8. Comparative Evaluation of Combinations of Sediment and Floodplain Remedial Alternatives

The selected remedy for the Rest of River will involve both a sediment remediation component and a floodplain remediation component. For this reason, the comparative evaluations of alternatives have been conducted for combinations of sediment and floodplain alternatives, rather than performing separate comparative evaluations for the sediment alternatives and for the floodplain alternatives. Since it is not be feasible to perform comparative analyses for all possible combinations of sediment and floodplain alternatives, EPA has approved the comparative evaluations of selected combinations of those alternatives. As noted in Section 1.8, those combinations (which span the full range of remedial alternatives in terms of removal volumes, affected areas, and assessment of the Permit criteria) are as follows:

- Combination of SED 2 and FP 1 (SED 2/FP 1);
- Combination of SED 3 and FP 3 (SED 3/FP 3);
- Combination of SED 5 and FP 4 (SED 5/FP 4);
- Combination of SED 6 and FP 4 (SED 6/FP 4);
- Combination of SED 8 and FP 7 (SED 8/FP 7);
- Combination of SED 9 and FP 8 (SED 9/FP 8); and
- Combination of SED 10 and FP 9 (SED 10/FP 9).

Section 8.1 provides a brief overview of each of these combinations. Section 8.2 presents comparative analyses of the relative performance of each of these combinations under each of the Permit criteria.

8.1 Overview of Selected Combinations

In several respects, the above-listed combinations of sediment and floodplain alternatives (which were described individually in Sections 6 and 7, respectively) differ from the sum of their sediment and floodplain components. For example, since the locations of access roads and staging areas for individual sediment and floodplain alternatives are redundant in some cases, locations for the access roads and staging areas for the above combinations have been selected without regard to the locations selected for their individual sediment and floodplain components.[446] Further, due to the differences in locations of the access roads and staging areas, the extent of ecological impacts of the combinations of the sediment and floodplain alternatives differs somewhat from those associated with the sum of their individual sediment and floodplain components. Additionally, the duration and costs of the combinations are less than the sum of their individual sediment and floodplain components (as a result of the efficiency of coordination of the sediment and floodplain work activities), and thus separate estimates have been developed for the duration and costs of the combinations.[447] Similarly, separate quantitative estimates of several types of short-term impacts – including GHG emissions, increased truck traffic, risks of traffic accidents from that increased truck traffic, and risks to remediation workers – have been developed for the combinations. Finally, the evaluation of IMPG attainment for insectivorous birds and piscivorous mammals under the sediment-floodplain combinations did not require use of pre-selected target levels (as were used for the individual sediment and floodplain evaluations), but was made directly using the process described in Section 4.2.3.5.

This section provides a description of each of the above-listed combinations of sediment and floodplain alternatives. Specifically, for each such combination, this section provides a brief summary of its elements (with references back to previous sections for additional details), as well as its estimated duration and the locations of access roads and staging areas. Other aspects of the combinations that differ from the sum of their components – including the types and extent of habitats that would be adversely impacted, achievement of certain IMPGs, quantitative estimates of certain impacts (i.e., GHG emissions, increased truck traffic, risks of traffic accidents, and risks to remediation workers), and costs – are presented and discussed under the relevant Permit criteria in the comparative analyses in Section 8.2.

8.1.1 Description of SED 2/FP 1

SED 2/FP 1 consists of a combination of MNR with institutional controls for all reaches of the River downstream of the Confluence and no action for the floodplain. This combination would rely on upstream source control and remediation measures, natural recovery

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[446] Consistent with the discussion in Sections 6 and 7, the locations of access roads and staging areas for the combinations were identified, considering site conditions (e.g., topography, habitat type, presence of residential areas, etc.) observed through site visits and aerial photographs, in an effort to minimize impacts on sensitive habitats and local communities to the extent practical (see Section 5.2.2). Access roads and staging areas were specifically selected based on accessibility, existing land use, habitat type, and location relative to the floodplain.

[447] The duration of the combinations was based on their sediment components, on the assumption that the associated floodplain remediation could be completed within the same timeframe.

processes in the River and floodplain, and institutional controls. The River monitoring program would include biota, water column, and sediment monitoring for a period of 100 years, as described for SED 2 in Section 6.2.1.

8.1.2 Description of SED 3/FP 3

As shown on Figure 8-1, SED 3/FP 3 includes the following elements:

- Removal (followed by capping) of 134,000 cy of sediment from the entire 42 acres of the River in Reach 5A;
- Stabilization of the riverbanks along both sides of the River in Reaches 5A and 5B (total of 14 linear miles covering both banks along 7 miles of River), including removal of approximately 35,000 cy of bank soil;
- Application of a thin-layer cap over 97 acres of the River in the downstream portion of Reach 5C and in the entirety of Woods Pond;
- MNR in the remaining portions of the River in the Rest of River area; and
- Removal of 74,000 cy of floodplain soil (followed by backfilling) from approximately 44 acres in various types of habitats in the floodplain.

The general remediation approach and associated assumptions for the sediment and floodplain components of this combination were described in Sections 6.3.1 and 7.3.1, respectively. It is estimated that SED 3/FP 3 would require approximately 10 years to complete. A construction timeline for implementation of SED 3/FP 3 is provided in Figure 8-2. As described in Section 3.1.6.4, this timeline presents a general representation of the main components of the reach-specific remedial activities (e.g., sediment and floodplain soil removal, capping or backfilling, bank stabilization, restoration, etc.), and illustrates the respective contributions of each activity to the overall estimated time to implement this combination of alternatives, as well as the activities that would be performed concurrently.

As indicated above, the locations of staging areas and access roads for SED 3/FP 3 have been modified from those identified for SED 3 and FP 3 individually. The conceptual plans developed for this Revised CMS Report indicate that 26 staging areas, occupying a total of 37 acres (10 acres of which would be within the floodplain), and 24 miles of temporary access roads covering 57 additional acres (18 miles and 44 acres of which would be within the floodplain) would be constructed to support implementation of SED 3/FP 3. The locations identified for these staging areas and access roads are shown on Figure 8-1.

8.1.3 Description of SED 5/FP 4

As shown on Figure 8-3, SED 5/FP 4 includes the following elements:

- Removal (followed by capping) of 377,000 cy of sediments from 126 acres of the River, including all of Reaches 5A (134,000 cy over 42 acres) and 5B (88,000 cy over 27 acres), and portions of Reach 5C (66,000 cy over 20 acres) and Woods Pond (89,000 cy over 37 acres);

- Stabilization of both riverbanks in Reaches 5A and 5B (total of 14 linear miles considering both banks), including removal of 35,000 cy of bank soil;

- Placement of a cap (without prior removal) over 37 acres in Reach 5C and 23 acres in the currently deeper portion of Woods Pond;

- Application of a thin-layer cap over 61 acres in certain Reach 5 backwaters and 41 acres in Rising Pond;

- MNR in the remaining portions of the River in the Rest of River area; and

- Removal of 121,000 cy of floodplain soil (followed by backfilling) from 72 acres in various types of habitats in the floodplain.

The general remediation approach and associated assumptions for the sediment and floodplain components of this combination were described in Sections 6.5.1 and 7.4.1, respectively. SED 5/FP 4 is estimated to require approximately 18 years to complete. A construction timeline for implementation of SED 5/FP 4 is provided in Figure 8-4. As described in Section 3.1.6.4, this timeline presents a general representation of the main components of the reach-specific remedial activities (e.g., sediment and floodplain soil removal, capping or backfilling, bank stabilization, restoration, etc.), and illustrates the respective contributions of each activity to the overall estimated time to implement this combination of alternatives, as well as the activities that would be performed concurrently.

As indicated above, the locations of staging areas and access roads for SED 5/FP 4 have been modified from those identified for SED 5 and FP 4 individually. The conceptual plans developed for this Revised CMS Report indicate that 30 staging areas, occupying a total of 43 acres (10 acres of which would be within the floodplain), and 22 miles of temporary access roads covering 54 additional acres (16 miles and 40 acres of which would be within the floodplain) would be constructed to support implementation of SED 5/FP 4. The locations identified for these staging areas and access roads are shown on Figure 8-3.

8.1.4 Description of SED 6/FP 4

As shown on Figure 8-5, SED 6/FP 4 includes the following elements:

- Removal (followed by capping) of 521,000 cy of sediments from 178 acres of the River including all of Reaches 5A (134,000 cy over 42 acres), 5B (88,000 cy over 27 acres), and 5C (186,000 cy over 57 acres), and portions of the Reach 5 backwaters (24,000 cy over 15 acres) and Woods Pond (89,000 cy over 37 acres);
- Stabilization of both riverbanks in Reaches 5A and 5B (total of 14 linear miles considering both banks), including removal of 35,000 cy of bank soil;
- Placement of a cap (without prior removal) over the deeper portions of Woods Pond (23 acres) and Rising Pond (22 acres);
- Application of a thin-layer cap over 112 acres of the River, including 55 acres in certain Reach 5 backwaters, 38 acres in the Reach 7 impoundments, and 19 acres in Rising Pond (in addition to capping the deeper portions of Rising Pond);
- MNR in the remaining portions of the River in the Rest of River area; and
- Removal of 121,000 cy of floodplain soil (followed by backfilling) from 72 acres in various types of habitats in the floodplain.

The general remediation approach and associated assumptions for the sediment and floodplain components of this combination were described in Sections 6.6.1 and 7.4.1, respectively. SED 6/FP 4 is estimated to require approximately 21 years to complete. A construction timeline for implementation of SED 6/FP 4 is provided in Figure 8-6. As described in Section 3.1.6.4, this timeline presents a general representation of the main components of the reach-specific remedial activities (e.g., sediment and floodplain soil removal, capping or backfilling, bank stabilization, restoration, etc.), and illustrates the respective contributions of each activity to the overall estimated time to implement this combination of alternatives, as well as the activities that would be performed concurrently.

As indicated above, the locations of staging areas and access roads for SED 6/FP 4 have been modified from those identified for SED 6 and FP 4 individually. The conceptual plans developed for this Revised CMS Report indicate that 31 staging areas, occupying a total of 51 acres (11 acres of which would be within the floodplain), and 23 miles of temporary access roads covering 55 additional acres (17 miles and 40 acres of which would be within the floodplain) would be constructed to support implementation of SED 6/FP 4. The locations identified for these staging areas and access roads are shown on Figure 8-5.

8.1.5 Description of SED 8/FP 7

As shown on Figure 8-7, SED 8/FP 7 includes the following elements:

- Removal of 2,252,000 cy of sediments (followed by backfilling) from 351 acres of the River, including all of Reaches 5A, 5B, and 5C, the Reach 5 backwaters, Woods Pond, the Reach 7 impoundments, and Rising Pond;
- Stabilization of both riverbanks in Reaches 5A and 5B (total of 14 linear miles considering both banks), including removal of 35,000 cy of bank soil;
- MNR in the remaining portions of the River in the Rest of River area; and
- Removal of 615,000 cy of floodplain soil (followed by backfilling) from 377 acres in various habitat types of the floodplain.[448]

The general remediation approach and associated assumptions for the sediment and floodplain components of this combination were described in Sections 6.8.1 and 7.7.1, respectively. SED 8/FP 7 is estimated to require approximately 52 years to complete. A construction timeline for implementation of SED 8/FP 7 is provided in Figure 8-8. As described in Section 3.1.6.4, this timeline presents a general representation of the main components of the reach-specific remedial activities (e.g., sediment and floodplain soil removal, backfilling, bank stabilization, restoration, etc.), and illustrates the respective contributions of each activity to the overall estimated time to implement this combination of alternatives, as well as the activities that would be performed concurrently.

As indicated above, the locations of staging areas and access roads for SED 8/FP 7 have been modified from those identified for SED 8 and FP 7 individually. The conceptual plans developed for this Revised CMS Report indicate that 49 staging areas, occupying a total of 61 acres (16 acres of which would be within the floodplain), and 15 miles of temporary access roads covering 36 additional acres (8 miles and 20 acres of which would be within the floodplain) would be constructed to support implementation of SED 8/FP 7. The locations identified for these staging areas and access roads are shown on Figure 8-7.

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[448] As described in Section 7.7.1, the floodplain soil removal volume and area for this combination of alternatives has been reduced by 16,000 cy and 10 acres (from the original 631,000 cy and 387 acres reported for FP 7) to account for overlap of floodplain waterfowl hunting areas with backwater areas that are included as part of sediment remediation under SED 8.

8.1.6 Description of SED 9/FP 8

As shown on Figure 8-9, SED 9/FP 8 includes the following elements:

- Removal of 886,000 cy of sediments from 333 acres of the River, including:
  - Sediment removal in all of Reaches 5A (134,000 cy over 42 acres), 5B (88,000 cy over 27 acres), and 5C (156,000 cy over 57 acres), followed by capping to the pre-removal grade;
  - Sediment removal in the Reach 5 backwaters (109,000 cy over 68 acres), all of Woods Pond (244,000 cy over 60 acres), the Reach 7 impoundments (84,000 cy over 38 acres), and all of Rising Pond (71,000 cy over 41 acres), followed by capping with a 6-inch active layer and a 6-inch habitat/bioturbation layer (and, in areas of high shear stress, a 6-inch armor stone layer);
- Stabilization of both riverbanks in Reaches 5A and 5B (total of 14 linear miles considering both banks), including removal of 35,000 cy of bank soil;
- Placement of a cap (without prior removal) over 3 acres of the Reach 5 backwaters;
- MNR in the remaining portions of the River in the Rest of River area; and
- Removal of 177,000 cy of floodplain soil (followed by backfilling) from 108 acres in various habitat types of the floodplain.

The general remediation approach and associated assumptions for the sediment and floodplain components of this combination were described in Sections 6.9.1 and 7.8.1, respectively. As described in Section 6.9.1, at EPA's direction, SED 9 includes certain operational aspects that are not an element of any other individual sediment alternative. Notably, EPA specified that, under SED 9, the sediment removal and capping work in Reaches 5A and 5B would be performed in the "wet" by equipment operating from the river bottom (or a road constructed on the river bottom) in Reach 5A and on barges in Reach 5B. In addition, EPA specified that the removal of sediments in the further downstream reaches (i.e., Reaches 6, 7, and 8, as well as the Reach 5 backwaters) would be performed concurrently with activities in the Reach 5 channel, but that capping in Reaches 6, 7, and 8 would be delayed until after all the removal/capping activities in Reach 5 have been completed. These assumptions have been incorporated into SED 9.

It is estimated, based on production rates and other inputs specified by EPA for SED 9 (some of which GE disputed), that SED 9/FP 8 would be completed within approximately 14 years. A construction timeline for implementation of SED 9/FP 8 is provided in Figure 8-10. As described in Section 3.1.6.4, this timeline presents a general representation of the main components of the reach-specific remedial activities (e.g., sediment and floodplain soil removal, capping or backfilling, bank stabilization, restoration, etc.), and illustrates the respective contributions of each activity to the overall estimated time to implement this combination of alternatives, as well as the activities that would be performed concurrently.

As indicated above, the locations of staging areas and access roads for SED 9/FP 8 are different from those identified for SED 9 and FP 8 individually. The conceptual plans developed for this Revised CMS Report indicate that 30 staging areas, occupying a total of 47 acres (6 acres of which would be within the floodplain), and 14 miles of temporary access roads covering 34 additional acres (8 miles and 19 acres of which would be within the floodplain) would be constructed to support implementation of SED 9/FP 8. The locations identified for these staging areas and access roads are shown on Figure 8-9.

8.1.7 Description of SED 10/FP 9

As shown on Figure 8-11, SED 10/FP 9 involves the following elements:

- Removal (followed by capping) of 66,000 cy of sediment in selected areas in Reach 5A;
- Stabilization of the riverbanks in selected areas in Reaches 5A and 5B (totaling approximately 1.6 linear miles, considering both banks), including removal of approximately 6,700 cy of bank soil;
- Sediment removal in Woods Pond (169,000 cy of sediments over 42 acres), without subsequent capping or backfilling;
- MNR in the remaining portions of the River in the Rest of River area; and
- Removal of 26,000 cy of floodplain soil (followed by backfilling) from approximately 14 acres in various habitat types of the floodplain.

The general remediation approach and associated assumptions for the sediment and floodplain components of this combination were described in Sections 6.10.1 and 7.9.1, respectively. SED 10/FP 9 is estimated to require approximately 5 years to complete. A construction timeline for implementation of SED 10/FP 9 is provided in Figure 8-12. As described in Section 3.1.6.4, this timeline presents a general representation of the main components of the reach-specific remedial activities (e.g., sediment and floodplain soil removal, capping or backfilling, bank stabilization, restoration, etc.), and illustrates the respective contributions of each activity to the overall estimated time to implement this combination of alternatives, as well as the activities that would be performed concurrently.

As indicated above, the locations of staging areas and access roads for SED 10/FP 9 are different from those identified for SED 10 and FP 9 individually. The conceptual plans developed for this Revised CMS Report indicate that 14 staging areas, occupying a total of 18 acres (4 acres of which would be within the floodplain), and 8 miles of temporary access roads covering 18 additional acres (5 miles and 11 acres of which would be within the floodplain) would be constructed to support implementation of SED 10/FP 9. The locations these staging areas and access roads are shown on Figure 8-11.

8.1.8 Summary of Combinations of Alternatives

The following table summarizes, for each of the seven combinations of alternatives evaluated, the volume of sediment, bank soil, and floodplain soil that would be removed, total areas that would be capped or backfilled following removal, the total area that would be subject to capping alone, the total area subject to thin-layer capping, the total surface area addressed, and the estimated construction duration.

Table 8-1 - Overview of Combinations of Alternatives

Remedial Components[1]	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Removal Volume (cubic yards)							
Sediment	---	134,000	377,000	521,000	2,252,000	886,000	235,000
Bank Soil	---	35,000	35,000	35,000	35,000	35,000	6,700
Floodplain Soil	---	74,000	121,000	121,000	615,000	177,000	26,000
Total	---	243,000	533,000	677,000	2,902,000	1,098,000	267,700
Area Subject to Sediment/Soil Removal (acres)[2]							
Sediment	---	42	126	178	351	333	62
Floodplain	---	44	72	72	377	108	14
Total	---	86	198	250	728	441	76
Riverbank Subject to Stabilization/Bank Soil Removal (linear miles, considering both banks)							
Riverbank	--	14	14	14	14	14	1.6
Capping Without Removal or Thin-Layer Capping (acres)							
Capping	---	---	60	45	---	3	---
Thin-Layer Capping	---	97	102	112	---	---	---
Total Surface Area Impacted (acres) and Construction Duration (years)							
Area Impacted by Remediation	---	183	360	407	728	444	76
Area Impacted by Access Roads/ Staging Areas[3]	---	94	97	106	97	80	36
Construction Duration	---	10	18	21	52	14	5

Notes:

1. MNR would also be a component of all combinations.
2. All areas subject to removal would be capped or backfilled following removal except for 42 acres of Woods Pond under SED 10/FP 9, where sediment would be removed without capping or backfilling.
3. Includes impacted areas outside the floodplain.

8.2 Comparative Analysis Based on Permit Criteria

The individual sediment and floodplain components of the seven combinations of alternatives were individually evaluated in detail in Sections 6 and 7 against the three General Standards and six Selection Decision Factors specified in the Permit. In this section, the seven combinations of sediment and floodplain alternatives are evaluated against the same General Standards and Selection Decision Factors.

In this comparative analysis, the relative performance of each combination of sediment and floodplain alternatives is evaluated against the nine Permit criteria. This comparative analysis also addresses the Permit requirement (Special Condition II.G.3) to reach a conclusion as to which alternative, in GE's opinion, is "best suited to meet the [General Standards] in consideration of the [Selection Decision Factors], including a balancing of those factors against one another." As this Permit language reflects, a comparison of alternatives necessarily involves balancing of advantages and disadvantages. As a result, the comparative analysis presented herein focuses primarily on differences among the alternatives with respect to each criterion. For criteria (or portions thereof) where there is no clear distinction among the alternatives, a brief statement is included to identify the similarities.

8.2.1 Overall Protection of Human Health and the Environment – Introduction

The evaluation of whether a particular combination of sediment and floodplain alternatives would provide overall human health and environmental protection relies heavily on the evaluations under several other Permit criteria – notably: (a) comparison to IMPGs; (b) compliance with ARARs; (c) long-term effectiveness and permanence (including long-term adverse impacts); and (d) short-term effectiveness. For that reason, the comparative evaluation of the combinations of sediment and floodplain alternatives in terms of overall protection of human health and the environment is presented at the end of Section 8.2 so that it can take account of the comparative evaluations under those other criteria, as well as other aspects of the alternatives and other factors relevant to the protection of human health and the environment.

8.2.2 Control of Sources of Releases

The extent to which each of the combinations of sediment and floodplain alternatives control sources of PCB releases has been evaluated in this subsection. This evaluation is driven by a comparison of the sediment components of the sediment-floodplain alternative combinations because the floodplain soils are not a significant source of PCBs releases to the River. As discussed in Section 6, the floodplain is generally flat, well vegetated, and depositional in nature, greatly reducing the potential for PCBs in floodplain soil to scour and be transported to the River.

The sediment components of the combinations would result in long-term control of sources of releases. Completed and ongoing source control and remediation upstream of the Confluence, along with natural recovery processes, have already resulted in significant reductions in PCBs entering the water column of the Rest of River, as shown in Section 6.1.1. Reduction in PCB transport into the Rest of River is expected to continue, especially considering the planned remediation activities upstream of the Confluence. Although such remediation will not eliminate PCBs in the water column from upstream, EPA's model predicts that, in 52 years, the reductions from this remediation along with natural recovery processes within the Rest of River (as reflected in SED 2) would result in reductions of 37% and 41% in the annual mass of PCBs passing Woods Pond and Rising Pond Dams, respectively, and a reduction of 50% in the annual mass of PCBs transported from the River to the floodplain in Reaches 5 and 6.[449]

In addition, the sediment components of the other combinations considered in this comparative evaluation (SED 3, SED 5, SED 6, SED 8, SED 9, and SED 10) would result in the control of additional sources of PCBs in the Rest of River by permanently removing and/or capping PCB-containing sediments, and would thus result in an additional reduction in PCB mass transport in the River and transport to the floodplain. The reductions relative to current conditions in the annual PCB mass transported within the River (as represented by the predicted PCB mass passing Woods Pond and Rising Pond Dams) and to the floodplain within Reaches 5 and 6 at the end of the model projection period are summarized in Table 8-2.

Table 8-2 – Percent Reduction in Annual PCB Mass Passing Woods Pond and Rising Pond Dams and Transported to the Reach 5/6 Floodplain for Combinations of Alternatives

Location	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Woods Pond Dam	37%	94%	97%	97%	98%	97%	62%
Rising Pond Dam	41%	87%	93%	95%	96%	96%	62%
Reach 5/6 Floodplain	50%	97%	98%	98%	99%	98%	68%

These model results show that the mass of PCBs passing Woods Pond and Rising Pond Dams would decrease by 62% (at each location) relative to current levels under SED 10, by 94% and 87% under SED 3, and by greater than 95% under the larger alternatives. Similarly, the model results show that the PCB mass transported to the Reach 5/6 floodplain would decrease by 68% under SED 10, by 97% under SED 3, and by slightly higher and essentially level percentages under the larger alternatives. Thus, alternatives

[449] The initial (i.e., current) annual PCB mass values used in the model are 20 kg/yr passing Woods Pond Dam, 19 kg/yr passing Rising Pond Dam, and 12 kg/yr transported from the River to the floodplain in Reaches 5 and 6.

greater than SED 3 would achieve little additional reduction in the PCB transport passing Woods Pond and Rising Pond Dams and to the Reach 5/6 floodplain despite the remediation of substantially more surface area and the consequent increase in adverse ecological impacts.[450]

To assess the extent to which the sediment components of these combinations of alternatives would mitigate the potential effects of a flood that could cause buried sediments to be exposed, model predictions of erosion and reach-average PCB concentrations in surface sediments following an extreme high flow event were compared. While the EPA model predicts varying responses to high flow events, including the extreme event (50- to 100-year flood) simulated in Year 26 of the projection, the results generally show that buried sediments containing PCBs would not be exposed to any significant extent during high flow events under any remediation alternative, as discussed further below.

- For areas that would be capped (either with or without prior removal), the model predicts that, with an appropriately sized armor stone layer, those areas would be stable (i.e., would not experience erosion) even under high flow events.[451]

- For areas that would receive a thin-layer cap, the model predicts that the cap would largely remain in place throughout all the high flow events simulated in the model projections. While, in some instances, the model predicts that certain areas would be eroded, the spatial extent of predicted erosion was small (typically on the order of a few model grid cells), and the resulting increases in reach-average surface sediment PCB concentrations were likewise small. For example, under all alternatives that involve thin-layer capping, the model predicts that erosion would occur over $< 7\%$ of the thin-layer cap areas in the Reach 5 channel and $\leq 5\%$ of such areas Woods Pond, with resulting concentration increases of < 0.5 and < 1 mg/kg, respectively. In the Reach 5 backwaters, the impacts were even less, with erosion predicted to occur in $\leq 1\%$ of the thin-layer cap area, resulting in concentration increases of ≤ 0.2 mg/kg. In Reaches 7 and 8, predicted erosion was limited, covering generally $< 20\%$ of the thin-layer capped areas in the Reach 7 impoundments and $< 7\%$ in Rising Pond (with

[450] In addition, all sediment components assume that the dams on the River would continue to limit the movement of PCB-containing sediments in the impoundments behind the dams, since all alternatives assume the continuation of the dam inspection, monitoring, and maintenance programs in place under other authorities to prevent or minimize the potential for failure of those dams. In the event of failure, regulatory requirements would ensure that any contaminated sediments behind the dams would be properly characterized, managed, and/or disposed of (see Section 3.8.2 above).

[451] As discussed in Section 6.9.1, under SED 9, the caps in higher shear stress areas of the Reach 7 impoundments and Rising Pond would consist of an "active" layer overlain by a habitat/bioturbation layer and an armor layer. These caps are also predicted to be stable during large flood events.

corresponding concentration increases of ≤ 1 mg/kg and ≤ 0.3 mg/kg, respectively). Moreover, even after the small concentration increases described above are taken into account, the concentrations following the high flow events still represent significant reductions relative to current PCB levels for all cases where a thin-layer cap would be placed (approximately 90% to 99% for Reaches 5, 6, and 8 and approximately 70% to 90% for the Reach 7 impoundments).

- Similarly, in cases where backfill would be placed following removal (under SED 7 and SED 8) and where "active caps" would be placed in low shear stress areas (under SED 9), the model predicts that 97% to 100% of those areas in the PSA and more than 70% of those areas in Reaches 7 and 8 would be stable during high flow events. The erosion of backfill material predicted in some limited areas of Reach 5A and the Reach 7 impoundments produced little or no change in predicted reach-average surface sediment PCB concentrations (i.e., 0.3 mg/kg or less). Likewise, the concentration increases resulting from the limited erosion of the "active caps" in low shear stress areas under SED 9 are minimal (0.2 mg/kg or less).

- The model predictions for Woods Pond under SED 10, in which sediment removal would be performed without subsequent capping or backfilling, demonstrate that the simulated large flood events would not result in any increases in reach-average surface PCB concentrations in the Pond, thus indicating that buried sediments with higher concentrations of PCBs would not become exposed in these areas during such events.

In short, the model predictions indicate that high flow events would result in minor or no increases in surface sediment PCB concentrations due to potential exposure of buried PCBs, and hence this factor does not represent a significant differentiator among the sediment alternatives evaluated.

Finally, there are differences among the combinations of sediment and floodplain alternatives in terms of the potential for releases during implementation, including both resuspension-related releases during sediment removal and potential releases from open excavations in the floodplain during an extreme weather event. Although engineering controls and/or best management practices would be applied to minimize such releases, they could not prevent such releases. The potential for such short-term releases would be a function of the duration of the remedy and the overall extent of open excavation/dredging areas. Apart from SED 2/FP 1 (which would have no potential for such releases) SED 10/FP 9 and SED 3/FP 3 would have the lowest potential for such releases because they would have the shortest duration (5 and 10 years, respectively) and the smallest amount of area subject to removal (62 acres of sediment and 14 acres of floodplain for SED 10/FP 9 and 42 acres of sediment and 44 acres of floodplain for SED 3/FP 3). SED 5/FP 4, SED 6/FP 4, and SED 9/FP 8 would take longer (14 to 21 years) and would involve considerably more area of sediment removal and floodplain excavations (total of approximately 200 to 440 acres; see Table 8-1 above). SED 8/FP 7 would take 52 years and involve the greatest area of excavation (over 700 acres); therefore, this alternative has the greatest potential for releases during remediation.

8.2.3 Compliance with Federal and State ARARs

The potential chemical-specific, location-specific, and action-specific ARARs identified by GE, in accordance with directions from EPA, for the sediment and floodplain components of the alternative combinations under evaluation are specified in tables in Appendix G for the pertinent sediment and floodplain alternatives, and have been summarized in the relevant subsections in Sections 6 and 7 for those individual alternatives. Review of those potential ARARs indicates the following regarding the extent to which the combinations of sediment and floodplain alternatives would met those ARARs and the need for waivers under CERCLA and the NCP.

Chemical-Specific ARARs

The potential chemical-specific ARARs include federal and state water quality criteria for PCBs. As previously discussed, these criteria consist of a freshwater chronic aquatic life criterion of 0.014 µg/L (based on a 4-day average not to be exceeded more than once every 3 years) and a human health criterion (based on consumption of water and/or organisms) of 0.000064 µg/L.[452] These criteria would apply only to the sediment component of the sediment-floodplain alternative combinations.

Model predictions of water column PCB concentrations indicate that SED 2 and SED 10 would not achieve the federal and state water quality criterion for freshwater aquatic life (0.014 µg/L) in Massachusetts (but would in Connecticut). They show further that (based upon a block averaging approach) the sediment components of the remaining combinations would achieve that criterion in all reaches by the end of the model period. The model predictions also show that none of these alternatives would achieve the federal and Massachusetts water quality criterion for human consumption of organisms (0.000064 µg/L) in any of the Massachusetts reaches. For the four Connecticut impoundments, the estimates using the CT 1-D Analysis, although highly uncertain, indicate that SEDs 2, 3, and 10 would not achieve that level in any impoundment, and

[452] As also noted above, Connecticut currently has a human health criterion for PCBs of 0.00017 µg/L, which does not constitute an ARAR since it is less stringent that the federal criterion. In December 2009, CDEP proposed to revise that standard to 0.00000056 µg/L, and that proposal remains pending.

that the other sediment components would do so in only two (SED 5 and SED 6) or three (SED 8 and SED 9) impoundments.[453]

As discussed in Section 6.1.4, the ARARs based on the human consumption criteria should be waived on the ground that achievement of those ARARs is technically impracticable, given that they could not be achieved by any sediment alternative in any reach in Massachusetts or in one or more of the Connecticut impoundments In addition, for SED 2 and SED 10, as discussed in Sections 6.1.4 and 6.10.4, the ARARs based on the water quality criterion for freshwater aquatic life should be waived on the ground that compliance with that requirement "will result in greater risk to human health and the environment" than other alternatives (CERCLA § 121(d)(4)(B); 40 CFR § 300.430(f)(1)(ii)(C*)(2)*). The remedial actions that would be necessary to attain that ARAR (i.e., the remedial actions involved in the larger sediment alternatives) would unavoidably cause substantial adverse short-term and long-term harm to the environment, as shown in prior sections evaluating those alternatives. Those adverse impacts would outweigh any risks to human health and the environment that would result from exceedances of this ARAR, as discussed further below. EPA's guidance on compliance with ARARs provides an example of the appropriateness of a waiver in this type of situation: "For example, attaining the ambient concentration level for PCBs spread throughout river sediment might require widespread dredging of the sediments, causing an unacceptable release of the pollutant to the water body and damaging or disrupting the ecosystem. Waiving the ARAR for ambient PCB concentrations in the sediment would eliminate the need to conduct such harmful dredging" (EPA, 1988, p. 1-72).

Location-Specific and Action-Specific ARARs

The tables in Appendix C identify a number of regulatory requirements as potential location-specific and action-specific ARARs for the sediment and floodplain alternatives that are part of the combinations under evaluation. As GE discussed in Section 2.1.3, some of those requirements – i.e., those that do not address on-site hazardous substances or the media containing them, but rather address impacts of the remedial construction work – do not constitute ARARs for the Rest of River remedy under CERCLA, but have nevertheless been identified as potential ARARs at EPA's direction. Review of the potential ARARs identified in those tables indicates that SED 2/FP 1 would achieve all the relevant ARARs (since SED 2 would meet the ARARs relating to MNR and

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[453] Application of the CT 1-D Analysis also indicates that CDEP's proposed revised standard of 0.00000056 µg/L would not be achieved in any of the Connecticut impoundments under any sediment alternatives, even the largest (SED 8). See also footnote 469 in Section 8.2.5.1 regarding the potential for removing the current fish consumption advisory in Connecticut.

there are no ARARs for FP 1), and that the other sediment-floodplain alternative combinations could be designed and implemented to achieve certain of the potential location-specific and action-specific ARARs,[454] but would not meet a number of other potential ARARs. For all of those other combinations except SED 10/FP 9, the requirements that would not be met include the following (see tables in Appendix C and Sections 6.3.4 and 7.3.4 for citations):

- The requirements of EPA's and the Corps of Engineers' regulations under Section 404 of the Clean Water Act that there be no practicable alternative with less adverse on the aquatic ecosystem or wetlands (since there are practicable alternatives with less adverse impact – e.g., SED 10/FP 9) and that a project involving the discharge of dredged or fill material not contribute to violation of state water quality standards (which are not currently met in the Housatonic River) and not cause significant adverse effects on aquatic life, aquatic ecosystems, wetlands, and recreational and aesthetic values;

- The requirements of the federal Executive Orders for Wetlands Protection and Floodplain Management that there be no practicable alternative with less adverse impacts on wetlands and floodplains, respectively;[455]

- Given that the PSA is in the Upper Housatonic ACEC, the prohibition on dredging in an ACEC under the Massachusetts Waterways Law and its regulations;

- The requirements of the Massachusetts water quality certification regulations that there be no practicable alternative with less adverse impact on the aquatic ecosystem and wetlands, that a project involving dredging and the discharge of dredged or fill material not affect the Estimated Habitat of state-listed rare wildlife species, and that such a project not cause substantial adverse impacts to conditions in surface waters;

- The requirements of the Massachusetts Wetlands Protection Act regulations that there be no practicable alternative with less adverse impact on resource areas, that

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[454] For some of these requirements, as discussed Sections 6.3.4 and 7.2.4, it is assumed that EPA would make necessary determinations authorized by the regulations. For example, it is assumed that the discharges of treated water from dewatering/treatment facilities would be in compliance with instructions from EPA's OSC (which would authorize such discharges even if they do not meet state water quality standards in the river water). Similarly, with respect to the compliance of the temporary staging areas with EPA's TSCA regulations, it is assumed that EPA would make any necessary risk-based determination for the temporary staging areas pursuant to 40 CFR § 761.61(c).

[455] Since these Executive Orders were not formally promulgated after notice-and-comment rulemaking, they are to be considered (TBC), rather than ARARs. However, as orders of the President, they are applicable to and binding on EPA.

implementation of the project not affect the Estimated Habitat of state-listed rare wildlife species, and, if this project does not constitute a "limited project" under those regulations, certain other requirements as well (e.g., the prohibition on work that would result in loss of more than 5000 square feet of bordering vegetated wetlands or would impair such wetlands within an ACEC, and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area, subject to certain exceptions); and

- The requirement of MESA and its implementing regulations that the project not result in a take of a state-listed species.[456]

Thus, to the extent that these requirements constitute ARARs, they would need to be waived by EPA as technically impracticable to meet (or on some other ground) under CERCLA and the NCP.

SED 10/FP 9 would likewise not meet some, but fewer, of the above-listed requirements. The requirements that would not be met by SED 10/FP 9 include:

- The requirement of EPA's and the Corps' regulations under Section 404 of the Clean Water Act that a project involving the discharge of dredged or fill material not contribute to violation of state water quality standards;

- The prohibition on dredging in an ACEC under the Massachusetts Waterways Law and its regulations;

- The requirement of the Massachusetts water quality certification regulations that a project involving dredging and the discharge of dredged or fill material not affect the Estimated Habitat of state-listed rare wildlife species;

- The requirements of the Massachusetts Wetlands Protection Act regulations that implementation of the project not affect the Estimated Habitat of state-listed rare wildlife species and, if this project does not constitute a "limited project," a few additional

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[456] The MESA evaluations in Appendix L indicate that all of the combinations of sediment and floodplain alternatives (other than SED 2/FP 1) would result in a take of a number of state-listed rare species. The MESA regulations contain a provision authorizing the Director of the MDFW to permit, or not permit, a take of a state-listed species if (a) the project proponent has adequately assessed alternatives, (b) the take would not affect a significant portion of the local population of the species, and (c) a long-term Net Benefit plan for the species is developed and agreed to (321 CMR 10.23). However, as discussed in Section 5.4, this provision does not constitute an ARAR for the Rest of River remedial action.

requirements (e.g., the prohibition on work that would result in loss of more than 5000 square feet of bordering vegetated wetlands or would impair such wetlands within an ACEC, and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area, subject to certain exceptions); and

- The requirement of MESA and its implementing regulations (310 CMR 10.23) that the project not result in a take of a state-listed species.

Therefore, to the extent that these requirements constitute ARARs, they would need to be waived by EPA in connection with the implementation of SED 10/FP 9. However, the need for such waivers for this combination of alternatives would be less than under the other combinations involving sediment and soil removal.

In addition, for all of the alternative combinations that involve removal, it is possible that, in the unlikely event that excavated sediments or soils should be found to constitute hazardous waste under RCRA or comparable state regulations (which is not anticipated) and that the temporary staging areas for the handling of those materials are subject to federal and/or state hazardous waste regulations, the staging areas may not meet certain locational and/or technical requirements for the storage of hazardous waste (see Sections 6.3.4 and 7.3.4 above). In that unlikely event, those requirements should be waived by EPA as technically impracticable to meet. This possibility applies equally to all alternative combinations involving sediment and floodplain soil removal and thus does not provide a basis for distinguishing among those combinations.

8.2.4 Long-Term Reliability and Effectiveness

The assessment of long-term reliability and effectiveness for the combinations of sediment and floodplain alternatives has included an evaluation of the magnitude of residual risk as defined by EPA, the adequacy and reliability of the alternatives, and potential long-term adverse impacts on human health or the environment.

8.2.4.1 Magnitude of Residual Risk

Magnitude of residual risk (as defined by EPA) for each of the sediment-floodplain alternative combinations is evaluated in this subsection considering the individual sediment and floodplain components separately, primarily because residual risks (as defined by EPA) differ between the in-river and floodplain environments.

Potential Residual Risks Associated with River Sediments, Water, and Fish

Upstream source control/remediation efforts, together with natural recovery processes, would by themselves result in a considerable reduction in PCB concentrations and potential human and ecological exposures to PCBs in sediments, surface water, and fish in the Rest of River area. SED 2/FP 1 would rely on and monitor this reduction in the River. Implementation of the sediment component of the other combined alternatives being evaluated (SED 3, SED 5, SED 6, SED 8, SED 9, and SED 10) would further reduce the potential for exposure to PCBs by humans and ecological receptors through a combination of removal, capping, thin-layer capping, and/or natural recovery processes. As discussed in Section 6, EPA's model has been used to predict the extent to which each sediment alternative would reduce PCBs in surface sediments, the water column, and fish. For purposes of comparison, fish PCB concentrations are presented here, since fish are representative of the trends and relative success of each alternative in reducing the potential for PCB exposure in the various pathways as they integrate the effects of changes in surface sediments and water column concentrations. Table 8-3 presents the subreach-average fish fillet PCB concentrations at the start of the model projection period and those at the end of that projection period, and shows the percent reduction in fish PCB concentrations for each of the sediment alternatives included in the combinations under evaluation. These results are also presented graphically (versus sediment surface area impacted) for all modeled subreaches within Reaches 5 through 8 and for the Connecticut impoundments on Figure 8-13.

Table 8-3 - Modeled Subreach-Average Fish (Fillet) PCB Concentrations at End of Projection Period and Percent Reductions for Combinations of Alternatives

Reach	*Initial Conc.*	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Fish PCB Concentration (mg/kg wet weight)								
Reach 5A	*18*	7.3	0.3	0.3	0.3	0.2	0.3	4.2
Reach 5B	*17*	9.3	3.0	0.2	0.2	0.2	0.3	6.6
Reach 5C	*14*	7.4	1.8	0.2	0.2	0.1	0.2	5.8
Reach 5D (Backwaters)	*22*	9.5	6.3	0.4	0.4	0.3	0.4	11
Reach 6	*15*	8.6	0.7	0.2	0.2	0.1	0.2	3.7
Reach 7	*6.4 - 13*	2.8 - 6.4	0.7 - 2.1	0.4 - 1.6	0.2 - 0.7	0.1 - 0.6	0.2 - 0.7	1.9 - 4.4
Reach 8	*6.3*	3.6	1.6	0.3	0.2	0.2	0.2	2.7
Connecticut (Bulls Bridge Dam Impoundment)	*0.4*	0.2	0.04	0.01	0.009	0.007	0.009	0.1
Percent Reduction in Fish PCB Concentration								
Reach 5A		60%	99%	99%	99%	99%	98%	77%
Reach 5B		47%	83%	99%	99%	99%	98%	62%
Reach 5C		48%	87%	99%	99%	99%	99%	59%
Reach 5D (Backwaters)		57%	72%	98%	98%	99%	98%	51%
Reach 6		44%	95%	99%	99%	99%	99%	76%
Reach 7		45 - 63%	80 - 91%	84 - 97%	94 - 98%	94 - 99%	93 - 98%	59 - 75%
Reach 8		43%	75%	95%	97%	97%	96%	57%
Connecticut (Bulls Bridge Dam Impoundment)		60%	91%	97%	98%	98%	98%	73%

Notes:

1. PCB concentrations shown (except for the initial concentrations) represent subreach-average values predicted by EPA's model at the end of the model projection period (52 years for SEDs 2, 3, 5, 6, 9, and 10, and 81 years for SED 8).
2. Values shown as ranges in Reach 7 represent the range of modeled PCB concentrations at the end of the projection within each of the Reach 7 subreaches.
3. Percent reduction represents the change in annual average PCB concentrations predicted by EPA's model between the beginning and the end of the projection period.

Review of these model predictions indicates the following: (All percent reductions specified below are relative to the initial PCB concentrations in the model.)

- Upstream source control/remediation and natural recovery processes contribute significantly to the overall reduction in PCBs in fish in the Rest of River. These processes, as represented by SED 2, are predicted to result in a 43% to 63% reduction in fish PCB levels.[457]

- SED 10 would achieve significant additional reductions in fish concentration (beyond those already achieved via upstream source control/remediation and natural recovery processes), leading to a total reduction in fish concentrations ranging from about 60% to 80% (except in the backwaters, where the reduction is closer to 50%).

- SED 3 would result in a total reduction in fish concentrations ranging from nearly 75% in the Reach 5D backwaters and Rising Pond to nearly 100% in Reach 5A. However this additional reduction in fish concentrations would require approximately 140 acres of sediment remediation compared to approximately 60 acres of sediment remediation under SED 10.

- SED 5 would result in total reductions in fish concentration that are generally greater than 90%, except for two subreaches in Reach 7 (7B and 7G, which have reductions of approximately 85%). For the sediment components of the remaining combinations (SED 6, SED 8, and SED 9), percent reductions in fish concentrations are generally greater than 95% in all subreaches. For all of these larger alternatives, Figure 8-13 illustrates that these modest additional reductions in fish PCB concentrations would require the disturbance of significantly more surface area than SED 10 and SED 3.

As evidenced by the above comparisons, SED 10 and SED 3 would achieve significant reductions in fish PCB concentrations by addressing the most upstream portion of the Rest of River to take advantage of natural recovery processes in the downstream reaches, while minimizing the amount of area disturbed.

Further, SED 10 and SED 3 would have the shortest implementation time and thus would achieve such reductions more quickly than the other removal alternatives. This is illustrated by the temporal profiles of model-predicted fish PCB concentrations (converted to a fillet basis) on Figures 8-14a-r. On these figures, model projections for all the sediment alternatives included in the combinations are plotted together by reach.

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[457] As discussed in Section 6.2.5.2, the most recent adult fish sampling data from Reach 5B/5C and Reach 6 (Woods Pond), which were collected in 2008, show lower PCB concentrations in those fish than the initial concentrations in EPA's model (with a more pronounced difference in fillets than in whole body concentrations). This suggests that SED 2 may actually achieve lower concentrations than predicted by EPA's model, although future long-term fish sampling would be needed to confirm such a result.

(Appendix K contains similar plots for surface sediments.) These plots show that the times to achieve the reductions in fish levels associated with remediation are generally shortest for SED 10 and SED 3, followed by SED 9, and greater for SED 5, SED 6, and SED 8 (increasing with the level of remediation). This trend is increasingly prominent with downstream distance. For example, in Woods Pond (Figure 8-14e), the 76% reduction achieved by SED 10 would be reached in approximately 10 years, the 95% reduction achieved by SED 3 would be reached in approximately 15 years, while the 99% reductions achieved by the remaining alternatives would be reached in 15 to 20 years for SED 9, 20 to 25 years for SED 5 and SED 6, and 45 years for SED 8.

The potential residual risks (as defined by EPA) to human and ecological receptors from the concentrations shown in Table 8-3 have been evaluated in the context of the extent to which they would achieve the IMPGs, as discussed in Section 8.2.5.[458] Since none of the alternatives would achieve the fish consumption IMPGs for both cancer and non-cancer based on unrestricted human consumption of fish within the model period (as shown in the evaluations of the individual sediment alternatives), residual risks from fish consumption (as estimated in EPA's HHRA) would be addressed under all alternatives through the continuation of fish consumption advisories.

Finally, PCBs would remain in the sediments beneath the depths of or outside the areas targeted for remediation. However, the caps (or backfill), where installed, would prevent direct contact with, and effectively reduce the mobility of, the underlying sediments; and the thin-layer caps would provide a cover layer over the underlying PCB-containing sediments, and reduce the surface sediment PCB concentrations in these areas, should scour/mixing of the thin-layer cap and the underlying sediments occur. As discussed in Section 8.2.2, EPA's model predicts that an extreme flood event would result in little increase in PCB concentrations for all these sediment alternatives. In any event, potential exposures to PCB-containing sediments in non-remediated areas must be considered in the context of the overall impact of the remediation in reducing PCB concentrations (as discussed above), and must be balanced against the other Selection Decision Factors in determining which remedial option is best suited overall to meet the General Standards.

Since SED 10 would involve intermittent riverbed remediation in Reach 5A (alternating between remediated and unremediated segments) and would not involve remediation in the river reaches immediately upstream of Woods Pond, EPA has raised a particular concern about potential recontamination of the remediated areas due to transport of PCBs from

[458] As discussed in Section 1.2, GE does not agree with many of the EPA assumptions and inputs on which the IMPGs are based and thus does not agree that exceedances of those IMPGs are indicative of a risk to human health or the environment.

unremediated areas. As shown in Section 6.10.5.2, the simulations using EPA's model implicitly account for any such recontamination and show that any such impact from upstream areas would not reverse or significantly impede the substantial reductions in reach-average surface sediment PCB concentration that would result from the implementation of SED 10.

Potential Residual Risks Associated with Floodplain Soil

Under SED 2/FP 1, floodplain soil PCB concentrations, as well as any potential risks (as determined by EPA in its HHRA and ERA), are assumed to remain generally similar to current conditions. Implementation of the floodplain component of the other combined alternatives (FP 3, FP 4, FP 7, FP 8, and FP 9) would reduce the potential risks (as defined by EPA) to humans and ecological receptors from exposure to PCBs in the floodplain by removing PCB-containing soil and backfilling those excavations with clean material. The reduction in potential exposure and associated risks (as defined by EPA) would occur upon the completion of remediation in a given area. As the removal volume among the alternatives increases, so does the area of the floodplain over which removal occurs, and correspondingly the time to implement and the extent of adverse habitat impacts. FP 7 would provide for the greatest reduction in potential exposures, removing the largest volume of PCB-containing soils, but would also impact the greatest area of the floodplain (377 acres) over the longest period (52 years when combined with SED 8) with the greatest extent of adverse habitat impacts.

Because the different parts of the floodplain are used by human and ecological receptors in different ways and with varying degrees of frequency and intensity, the extent to which each of the combinations evaluated in this section would reduce potential residual risks (as defined by EPA) from PCB exposure in the floodplain has been evaluated in terms of the extent to which they would achieve the IMPGs that have been based on EPA's human health and ecological risk assessments.[459] The comparative evaluation of the alternative combinations based on this factor is presented in Section 8.2.5.

PCBs would also remain below the depths considered in the IMPG evaluations. Exposure to this deeper soil is not anticipated under current uses. In the event that future exposure to such deeper soil were reasonably anticipated in particular areas, it would be addressed, under all floodplain alternatives except FP 1, by deed restrictions and/or Conditional Solutions. Additionally, under those alternatives, deed restrictions and/or

[459] As noted above, since GE does not agree with many of the EPA assumptions and inputs on which the IMPGs are based, it does not agree that exceedances of those IMPGs in the floodplain are indicative of a risk to human health or the environment.

Conditional Solutions would be implemented where necessary to address potential risks from reasonably anticipated future uses (based on realistic assumptions), as discussed in Section 4.6.

8.2.4.2 Adequacy and Reliability of Alternative

<u>Use of Technologies Under Similar Conditions</u>

SED 2/FP 1 involves MNR with institutional controls in the River and no action in the floodplain. MNR has been selected at other contaminated sediment sites as part of the overall remedy (see Section 6.2.5.2), and no action has been adopted as a remedy component at other sites, as well as upstream portions of the Pittsfield/Housatonic River Site, where cleanup goals are already met (see Section 7.1.5.2). The other six alternative combinations involve different combinations of remedial technologies and processes.

For the sediment components, the selected approaches include removal in the dry and/or wet (followed by capping or backfilling in most cases), capping without prior removal, thin-layer capping, riverbank stabilization (using a combination of bioengineering and hard stabilization techniques), and MNR. As EPA has recognized, a combination of technologies is often necessary and appropriate to achieve remedial objectives at contaminated sediment sites (EPA, 2005d, p. 3-2). As discussed in Section 6, all of the remedial technologies included in the sediment alternatives under evaluation have been used at other remediation sites, with the exception of the approach assumed (at EPA's instruction) for sediment/bank soil excavation and riverbed capping/bank stabilization in Reach 5A under SED 9 (see Section 6.9.5.2).

The floodplain components of the combinations involving remediation would rely primarily on removing floodplain soils from areas containing various types of habitats and backfilling the excavations. Excavation and replacement of soils have been performed at a number of sites across the country, using conventional equipment. (Restoration is discussed separately below.)

While most of the individual remedial technologies included in these combinations have been implemented at other portions of this Site and at other sites, there are no completed remedies that provide a precedent for the scope and scale of the remediation that would be involved in several of the combinations of alternatives considered here in a setting comparable to the Rest of River. For example, as discussed in Section 6.3.5.2, GE's review of publicly available information on environmental dredging/removal projects identified approximately 75 completed projects, including the 26 environmental dredging projects evaluated in the NRC (2007) report. That review showed that less than 25% of these projects involved removal of volumes equivalent to or greater than the sediment removal volume of SED 3/FP 3, less than 15% and 10% involved removal of volumes comparable to or greater than the sediment removal volumes of SED 5/FP 4 and SED 6/FP 4, respectively, and only one had a removal volume greater than the sediment removal volume of SED 9/FP 8 and comparable to that of SED 8/FP 7. None of these completed projects was conducted in a riverine setting like that in the Rest of River, where the area targeted for remediation is long and sinuous, includes numerous stretches with limited access, contains a largely undisturbed corridor of diverse and ecologically sensitive habitats (with numerous rare species), and is not navigable by large vessels.[460]

While remedies selected for some other large sediment sites include dredging of more than or close to 2,000,000 cy of sediment (e.g., Hudson River, Fox River, Onondaga Lake), these remedies have not been completed. In any event, the Hudson and Fox Rivers are significantly different from the Rest of River, as they are large, wide navigable rivers generally accessible throughout their course, and the majority of the dredging is to be done by working within the navigable river with transport to a single processing facility. Similarly, Onondaga Lake differs from the Rest of River as it is a 3,000-acre lake (4.5 miles by 1 mile) with an average water depth of 36 feet, surrounded by residential, urban, industrial, parklands, wetlands, and undeveloped areas. In contrast, operations in the Rest of River area would include substantial remedial construction activities in the relatively narrow and shallow riverine system, as well as on the shoreline and in the adjacent floodplain, including numerous access roads and staging areas.

Considering the magnitude and estimated time to complete the larger remedial combinations and the very different site characteristics of the Rest of River area relative to other environmental dredging/excavation sites, it is reasonable to assume that implementation of the large-scale combinations at the Rest of River would result in complications and uncertainties not encountered at other sites, which could compromise the long-term reliability and effectiveness of those alternatives.

<u>General Reliability and Effectiveness</u>

As noted above and discussed in the evaluations of individual remedial alternatives, the alternative combinations under evaluation generally use sediment remediation and

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[460] For example, only two of the projects identified by the NRC (2007) involved removal of more than 400,000 cy of sediment, and both were in large shipping channels in a highly industrial area (Commencement Bay, Washington). Other large completed dredging projects, such as at the Grand Calumet River in Indiana (786,000 cy) and the Ashtabula River in Ohio (630,000 cy), were carried out in industrial areas with conditions very different from those present in the Rest of River. The one completed project with a sediment removal volume greater than that of SED 9/FP 8 and comparable to that of SED 8/FP 7 was conducted at the Milltown Reservoir Site in Montana, where approximately 2.0 to 2.3 million cy of sediments were removed behind the dam, along with the dam itself.

floodplain soil removal technologies that have been shown to be reliable and effective in reducing exposure of humans and animals to PCBs in sediments and floodplain soil.

To further assess the reliability and effectiveness of the sediment components of these combinations, model predictions of erosion in areas receiving a cap, thin-layer cap, or backfill were evaluated to assess stability, as discussed in Section 8.2.2. While the model's erosion predictions vary depending on the remedial technology, they demonstrate that the caps, thin-layer caps, and backfill used in these alternatives would be generally effective and reliable. EPA's model indicates that areas subject to engineered capping would remain stable during high-flow events, and that areas with thin-layer capping, backfill, or capping with an active layer overlain by a habitat/bioturbation layer would likewise largely remain stable during such events, with only small areas of erosion that result in very small increases in surface sediment PCB concentrations on a reach-wide basis (see Section 8.2.2). Thus, the stability of these remedial components does not provide a significant basis for distinguishing among the alternatives.

For all of the active remedial combinations except SED 10/FP 9, the entire stretch of riverbanks in Reaches 5A and 5B would be stabilized using a combination of bioengineering techniques and hard engineering techniques. Those techniques would be similar for all of the sediment components of these remedial combinations, except that they would be modified in part under alternatives that would require construction in the wet (i.e., SED 3 in Reach 5B, SED 4 in the downstream portion of Reach 5B, and SED 9 in both Reaches 5A and 5B). As discussed in Section 6.3.5.2 and Appendix G, such combinations of techniques are expected to be reliable and effective in stabilizing the banks and controlling erosion. However, the stabilization would also have long-term adverse ecological impacts (as discussed in the next section). SED 10/FP 9 would apply such a combination of techniques to selected portions of the river banks in Reaches 5A and 5B. As discussed in Section 6.10.5.2 and Appendix G, this approach is also expected to be reliable and effective in the areas applied, would not exacerbate erosion in other areas, and would reduce the adverse ecological impacts from bank stabilization inherent in the other alternatives involving stabilization.

Finally, it has been assumed for this analysis that the areas affected by implementation of the combinations of alternatives would be subject to restoration. However, as discussed generally in Section 5.3 and specifically in the evaluations of individual alternatives, there are significant constraints on the ability to re-establish the pre-remediation conditions and functions of the affected habitats. Implementation of restoration methods would not re-establish pre-remediation conditions for some of these habitats for many decades and would likely never do so for other habitats. As such, these restoration methods would not be fully effective or reliable in returning these habitats to their pre-remediation state. For example, under combinations that would impact vernal pool habitat (i.e., SED 3/FP 3, SED 5/FP 4, SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8), it is highly likely that the full complement of characteristics that contribute to vernal pool functions would not be re-established in at least many of those pools despite the implementation of restoration measures (see Section 8.2.4.3 below). However, the constraints on restoration would have less influence on restoration success, or at least less overall impact on the ecosystem of the PSA, under SED 10/FP 9 than under the larger combinations due to the more limited areas selected for remediation under SED 10/FP 9. As a result, the likelihood of effective restoration is higher under SED 10/FP 9.

Reliability of Operation, Monitoring, and Maintenance Requirements and Technical Component Replacement Requirements

All alternative combinations would incorporate reliable long-term monitoring and/or maintenance techniques. For example, for the sediment components, activities would be conducted to inspect and repair or replace aspects of the caps or bank stabilization measures installed. However, as the area to be capped increases (progressively more from SED 10/FP 9 to SED 9/FP 8), there would be a greater probability that repairs or replacement would be needed.

Similarly, the backfilled/restored areas would be monitored through periodic inspections to verify that the planted vegetation is surviving and growing and to identify areas (if any) where the backfill is eroding or in need of repair. This is a reliable means of assessing the need for maintenance. However, monitoring and maintenance could be difficult to implement in certain areas of the floodplain, due to remoteness, the extent of standing water, and the extent of vegetation both in and around the remediated areas. Depending on the timing, location, and scale of any repairs, access roads and staging areas may need to be temporarily constructed in the floodplain. For those alternatives that involve more extensive floodplain remediation, a greater likelihood exists that maintenance would be required and that such difficulties would be encountered. As a result, this factor favors the combinations that involve fewer acres of removal, particularly in wetlands.

8.2.4.3 Long-Term Adverse Impacts on Human Health or Environment

The evaluation of potential long-term adverse impacts on human health or the environment has included evaluation of potentially affected populations, long-term adverse impacts on the various habitats that would be affected by the combinations of sediment and floodplain alternatives and the biota that inhabit those habitats (including impacts on state-listed species), impacts on the aesthetics and recreational use of the River and floodplain, impacts on banks and bedload movement (i.e., fluvial geomorphic processes), and potentially available measures that may be employed to mitigate these impacts.

Potentially Affected Populations

Implementation of all of the alternative combinations except SED 2/FP 1 (which would not involve remedial construction activities) would result in some level of long-term adverse impacts on ecological habitats, with the impacts being more widespread and severe as the combinations of alternatives grow larger and more extensive. These habitat alterations would affect the people, animals, and plants that use these areas. The long-term impacts of the combinations of alternatives on the affected habitats and the plants and animals that inhabit or use those habitats, as well as the long-term impacts on the aesthetics and recreational use of the affected habitats by people, are discussed and compared below.

Long-Term Adverse Impacts on Habitats and Biota

The extent and severity of long-term adverse impacts from remedial construction activities are dependent on the types of habitat affected, the size of the affected areas, the success of the restoration approach(es), and length of time needed for restoration if restoration is possible. Table 8-4 (below) identifies the habitat types and summarizes the areas of each habitat affected by the combinations of sediment and floodplain alternatives. As discussed in prior sections, long-term impacts would occur despite the implementation of restoration measures. Because restoration of affected habitats is dependent on several factors and processes, the length of time necessary to achieve successful restoration (if it occurs) is variable and often uncertain. In fact, as discussed in this section, it is expected that certain habitat areas would never recover fully.

Table 8-4 – Habitat Areas in PSA Affected by Combinations of Sediment and Floodplain Alternatives[1]

Habitat	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Aquatic Riverine Habitat (acres)	--	79	127	127	127	127	20
Riverbank (linear miles)	--	14	14	14	14	14	1.6
Impoundment Habitat (acres)	--	60	101	139	139	139	42
Backwater (acres)	--	0	61	70	86	66	0
Floodplain Wetland Forest (acres)	--	38	60	60	178	56	14
Shrub and Shallow Emergent Wetlands (acres)	--	19	22	22	70	31	3.7
Deep Marshes (acres)	--	1.9	0.3	0.3	4.7	3.1	0
Vernal Pools (acres) [2]	--	15 (58)	15 (58)	15 (58)	17 (61)	18 (61)	0
Disturbed Upland Habitats (acres)	--	14	15	15	25	11	7.5
Upland Forested Habitats (acres)	--	4.2	4.9	4.6	6.4	2.8	0.7
Total (acres)[3]	**--**	**231**	**406**	**453**	**653**	**454**	**88**

Notes:

1. Includes habitat areas within the boundaries of the Woodlot (2002) natural community mapping; includes remediation areas as well as areas impacted by access roads and staging areas.
2. Number of vernal pools affected are shown in parentheses.
3. Total habitat area affected does not include riverbanks, and can differ from total surface area affected since the total shown includes all habitats within the boundaries of the Woodlot (2002) mapping (see note 1).

Aquatic Riverine Habitat: The long-term post-restoration impacts of sediment removal/capping, as well as capping or thin-layer capping without removal, on aquatic riverine habitat were described generally in Section 5.3.1.4 and summarized in the relevant subsections of Section 6 for the individual sediment alternatives. In brief, those impacts include the following:

- The caps would cause a change in surface substrate type from its current condition (sand, sand and gravel, or silt) to armor stone, lasting until deposition of natural sediments from upstream changes the substrate surface back to a condition approximately its prior condition, which could take many years.

- There would be a loss of a continuing source of woody debris and shade in Reaches 5A and 5B of the River due to the permanent loss of mature trees on the riverbanks. This would alter the riverine habitat, because woody debris provides structure that is important to many aquatic and semi-aquatic species, and shading limits temperature increases in the river water, which could increase aquatic plant growth and change the suitability of the habitat for temperature-dependent species.

- The sediment removal and/or capping would remove or bury the existing aquatic vegetation and benthic invertebrates, and displace the fish. While recolonization would occur, the vegetation, invertebrates and fish that would recolonize these areas would differ from the existing species (e.g., would include species more tolerant of stress, including invasive species) due to the changed substrate. Over time, continued accumulation of sediments would increase the diversity of habitat, resulting in more complex communities than initially existed, but those communities are still unlikely to match the pre-remediation communities in terms of composition, species diversity and richness, and relative abundance of species, at least for many years. In particular, the return of certain sensitive species, such as state-listed species, destroyed by the sediment removal/capping is doubtful.

- There is a high potential that the disturbed areas would be colonized by invasive species, which are impractical to control in a flowing river and thus are likely to dominate over the native species.

- In shallow areas subject to capping or thin-layer capping without removal, the increase in substrate elevation due to the cap could change the vegetative characteristics of the areas and the biota dependent on them. In fact, if the thickness of the cap exceeds the depth of water and if consolidation of the underlying sediment does not occur, the elevation change could cause the emergent vegetation to be replaced by species more tolerant of less frequently inundated or drier conditions.

In summary, in the aquatic riverine habitat subject to remediation, it is expected that over time the physical substrate type in the River would approximate its prior condition and a biotic community consistent with that substrate type would be present. However, the length of time for that recolonization to occur and the abundance of organisms and richness of the mix of species in the re-established community are uncertain, the return of certain sensitive species (such as state-listed species whose local populations were adversely impacted) is doubtful, and colonization by invasive species is highly probable.

Under SED 3/FP 3, these long-term impacts would occur over 79 acres of aquatic riverine habitat, all in Reach 5A. Under SED 5/FP 4, SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8, these impacts would occur over 127 acres of such habitat throughout Reach 5. By contrast, under SED 10/FP 9, these impacts would occur in limited, intermittent portions of Reach 5A, affecting only 20 acres of such habitat. As a result, the significant stretches of Reach 5A that would remain undisturbed would serve as a source of native sediments for transport and deposition into the remediated segments, and as a source and refuge for aquatic species to aid in the recolonization process after remediation is completed. Further, while there would still be a threat of colonization by invasive species, it would be less than would be the case with more extensive stretches of disturbed aquatic habitat. Thus, over the long term, SED 10/FP 9 would involve a higher potential for recolonization and re-establishment of pre-remediation conditions and functions in Reach 5A compared to other combinations of alternatives, and it would not adversely impact the other aquatic riverine areas that would be impacted by other combinations of alternatives.

Riverbank Habitat: The long-term impacts of riverbank stabilization on riverbank habitat in Reaches 5A and 5B were described generally in Section 5.3.2.4 and summarized in Section 6.3.5.3. In brief, those impacts include the following:

- The implementation of stabilization measures that would prevent significant bank erosion and lateral channel movement would result in the permanent elimination of vertical and/or undercut banks and the consequent loss of critical habitat for birds and other animals that depend on such banks (e.g., kingfisher, bank swallow, and the state-listed wood turtle).

- The removal of mature trees overhanging the River as part of bank stabilization/remediation, together with the long-term prevention of the return of those trees due to their potentially destabilizing effect, would result in a permanent change in the vegetative character of the banks from their current wooded condition to a more open condition with dense shrub growth. This would produce a corresponding reduction in the quality of the habitat for birds, dragonflies, reptiles, and mammals that currently use the mature trees on the banks.

- The use of bank stabilization measures would produce a long-term reduction in slides and burrows of muskrat and beaver, and would also reduce access routes and movement of reptiles, amphibians, and smaller and less mobile mammals between the River and the wetland habitats which they use.

- As a result of the above changes, there would be a long-term reduction in species richness and diversity on the riverbanks.

- Due to the disturbances of the banks, there would be an increased potential for colonization by invasive plant species, which would not be practical to control over the long term.

As a result of these impacts, the stabilized riverbanks would not return to their current condition or level of function. Since all of the alternative combinations except SED 2/FP 1 and SED 10/FP 9 would involve stabilization of the entire 14 linear miles of banks in Reaches 5A and 5B (considering both banks), they would produce these severe impacts along the entirety of those banks. SED 2/FP 1 would have no such impacts. SED 10/FP 9 would involve stabilization of only a portion of the banks in Reaches 5A and 5B, totaling approximately 1.6 linear miles, and thus would minimize the long-term adverse impacts of stabilization on the riverbanks in Reaches 5A and 5B.

Impoundment Habitat: The long-term impacts from removal and/or capping or thin-layer capping on the habitat of impoundments were described generally in Section 5.3.3.4 and summarized in the relevant subsections of Section 6 for the individual sediment alternatives. Those impacts are similar to the above-described impacts on aquatic riverine habitat. In general, they would include a change in the surface substrate and a consequent alteration in the biological community in the affected impoundment. It is anticipated that, over time, as sand and organic sediments are deposited from upstream, a biological community typical of such impoundments would eventually develop. However, the length of time for such a community to develop is uncertain and would be affected by the extent of upstream remediation. The community that does develop may include changes in the mix of species, may not include certain specialized native species and would likely be dominated by invasive plant species, including those currently present in the Rest of River area (e.g., water chestnut, which is already present in large quantities in Woods Pond). Further, the alternatives that involve capping or thin-layer capping without removal in the impoundments would change the bottom elevation, potentially changing the vegetative characteristics in shallow portions of the impoundments and the biota dependent on them. By contrast, the placement of a cap or a thin-layer cap in the “deep hole” portion of Woods Pond is not expected to have any significant long-term adverse ecological impacts.

SED 8/FP 7 and SED 9/FP 8 would involve sediment removal followed by capping (or backfilling) in all the impoundments in the Massachusetts portion of the River – Woods Pond, the Reach 7 impoundments, and Rising Pond – affecting 139 acres within those impoundments. They would thus have the greatest potential for long-term adverse impacts on impoundment habitat.

The remaining alternative combinations (except for SED 2/FP 1) would involve sediment removal with capping, capping or thin-layer capping without removal, and/or removal without capping. SED 3/FP 3 would involve thin-layer capping in the entire 60 acres of Woods Pond. SED 5/FP 4 would involve sediment removal and capping in 37 acres of Woods Pond, capping without removal in the remaining 23 acres of Woods Pond, and thin-layer capping in 41 acres of Rising Pond (affecting a total of 101 acres). SED 6/FP 4 would involve the same approach as SED 5/FP 4 for the 60 acres of Woods Pond, with the addition of 38 acres of thin-layer capping in the Reach 7 impoundments and a combination of capping without removal (22 acres) and thin-layer capping (19 acres) in Rising Pond (affecting a total of 139 acres). Under all of these combinations, the remediation in the 23-acre deep portion of Woods Pond (through thin-layer capping or capping without removal) would not be expected to have any significant adverse long-term impacts due to the depth of that area. However, the long-term adverse impacts described previously for these remedial techniques would occur in the remainder of Woods Pond and in the other impoundments.

Finally, SED 10/FP 9 would involve removal without capping or backfilling in 42 acres of Woods Pond. As discussed in Section 6.10.5.3, this combination would be expected to have the fewest adverse long-term impacts on impoundment habitat (apart from SED 2/FP 1), since it would affect the smallest amount of such habitat, would not impose a new and different surface substrate over the existing substrate, and would leave the reaches upstream of Woods Pond (Reaches 5B and 5C) undisturbed to serve as a source for recolonization of the Pond by aquatic plants, invertebrates, fish, and other aquatic organisms. In disturbed areas within the photic zone in the Pond, there would be a high potential for the return of invasive species (especially water chestnut), but the sediment removal and the increase in water depth would aid in limiting the proliferation of such species, at least for several years.

Backwater Habitat: The long-term impacts of thin-layer capping or sediment removal/capping on backwaters were discussed generally in Section 5.3.6.4 and summarized in Sections 6.4.5.3 and 6.6.5.3. In brief, they include the following:

- Change in surface substrate type from silts or mucky organic material to sand, which would last until enough silt and organic material have been deposited through flood events to approximate current conditions – which is an uncertain time period, but could be a decade or more;

- Change in vegetative characteristics corresponding to the change in substrate type and elevation (including, in shallower areas where the thin-layer cap exceeds the depth of water, a potential change from emergent wetlands vegetation to species more tolerant of less frequently inundated or drier conditions);

- Proliferation of invasive plant species;
- Change in the wildlife communities using the backwaters until such time as the soil, hydrological, and vegetative conditions of the backwaters return to conditions comparable to pre-remediation conditions – which is uncertain; and
- High potential for the loss of certain sensitive (e.g., state-listed) species.

Since SED 2/FP 1, SED 3/FP 3, and SED 10/FP 9 would not involve any remediation work in the backwaters, these combinations would have no long-term adverse impacts in backwater habitat. The other combinations would affect the backwaters. SED 5/FP 4 would involve thin-layer capping in 61 acres of backwaters. SED 6/FP 4 would involve thin-layer capping in 55 acres of backwaters, but would also involve sediment removal and capping of 15 additional acres. SED 9/FP 8 would involve sediment removal and capping in 68 acres of backwater in addition to 3 acres of capping without removal. SED 8/FP 7 would involve sediment removal and capping in 86 acres of backwaters. All of these combinations would have the long-term impacts described above. Due to the spatial extent and duration of the backwater remediation under SED 8/FP 7, the long-term impacts of that combination would be the most widespread and severe, and it is likely that local populations of less mobile organisms such as reptiles and amphibians would be displaced from these backwater areas indefinitely or permanently.

Floodplain Wetland Forest Habitat: The long-term post-restoration impacts of floodplain soil removal, as well as the construction of access roads and staging areas, on floodplain wetland forest habitat were described generally in Section 5.3.4.4 and summarized in Section 7.3.5.3. In brief, these impacts include the following:

- The removal of mature trees from the forested floodplain areas subject to soil removal or the construction of access roads and staging areas would result in a long-term loss of mature forested habitat in those areas. Following replanting, the plant community succession in these areas would not progress to a mature forest for at least 50 years to 100 years. However, this vegetative progression could take even longer and is unreliable in large cleared areas due to cumulative stresses from floods, changes in microclimate, changes in hydrology, and colonization of invasive species. Moreover, even under optimum conditions, the developing forest would be an even-aged community for more than 25 years, with minimal structural profile diversity and an associated reduction in overall wildlife diversity.
- The tree removals would also cause a loss of the coarse woody debris that is used as structural wildlife habitat and of the annual leaf litter that provides cover habitat for numerous woodland species.

- The loss of woody vegetation and coarse woody debris, presence of sparsely vegetated areas, and altered microtopography would result in a decrease in floodplain roughness, which would reduce the floodplain's flood flow alteration function, with increased flood flow velocities, more erosion, and less infiltration, at least in some areas.

- Changes in soil composition, chemistry, and stratigraphy would result from the replacement of existing forested wetland soils with soils that would not match the characteristics of those existing soils and from the soil compaction that would result from the use of heavy equipment.

- There would be a long-term loss of the forest wildlife species (including rare species) that currently utilize the mature forested habitats that would be removed, and the return of some of those species, especially sensitive species, would be in doubt.

- In areas of substantial clearing, the existing largely undisturbed forested floodplain/riparian corridor in the PSA would be fragmented, disrupting the dispersal and migratory movements of wildlife species that depend on that corridor.

All of the combinations except SED 2/FP 1 and SED 10/FP 9 would produce these long-term adverse impacts across substantial portions of the floodplain. SED 3/FP 3 would have these impacts in 38 acres of floodplain forest; and SED 5/FP 4, SED 6/FP 4, and SED 9/FP 8 would do so in 56 to 60 acres of floodplain forest. SED 8/FP 7 would impact by far impact the largest amount of this habitat at 178 acres (36% of the total floodplain forest habitats in the PSA), resulting in the most widespread and severe impacts. As previously noted, it is likely that re-establishment of forested communities in those areas would take at least 50 to 100 years and, in areas with extensive clearing, would take longer and may not occur at all.

SED 2/FP 1 would have no impacts on this habitat type. Apart from that combination, SED 10/FP 9 would impact the smallest area of floodplain wetland forest (14 acres), affecting only a small percentage (1.7%) of the total forested floodplain in the PSA. As a result, that combination would result in the fewest long-term negative impacts and would not be expected to cause widespread harm to the overall forested floodplain habitat in the Rest of River.

Shrub and Shallow Emergent Wetlands and Deep Marshes: The long-term post-restoration impacts of floodplain soil removal, as well as the construction of access roads and staging areas, on shrub and emergent wetlands were described generally in Section 5.3.5.4 (for shrub and shallow emergent wetlands) and 5.3.6.4 (for deep marshes) and summarized in Section 7.3.5.3. These impacts include: changes in soil stratigraphy due to the soil compaction that would result from the use of heavy equipment; changes in soil composition and chemistry due to the replacement of existing wetland soils with soils that would not match the characteristics of those existing soils; changes in the hydrology of these wetlands due to impacts on the swales, drainage features, and microtopography that influence the hydrology; and changes in vegetative characteristics due to the changes in soil and hydrological conditions. These impacts would alter the characteristics of the wetlands and their wildlife communities and would last until soil and hydrological conditions similar to pre-remediation conditions return through flooding and the other natural processes that originally formed these habitats. This recovery time is uncertain and could take a decade or more. During this period, the wildlife that use these wetlands would be lost. In fact, even after the return of soil and hydrological conditions resembling prior conditions, the biotic communities that are re-established may not match the pre-remediation communities in certain respects. For example, there would be a high potential for proliferation of invasive plants, and the return of certain sensitive species, including state-listed wildlife species, would be doubtful.

Apart from SED 2/FP 1, all of the alternative combinations would have some impacts on these habitats. SED 3/FP 3 would impact about 20 acres, SED 5/FP 4 and SED 6/FP 4 would impact about 22 acres, SED 9/FP 8 would impact about 34 acres, and SED 8/FP 7 would again have by far the largest impact, affecting nearly 75 acres of these habitat types. All of these combinations would have the long-term adverse impacts on these habitat described above. Again, SED 10/FP 9 would impact the smallest area of these habitat types (less than 4 acres) and thus would not be expected to cause widespread damage to these overall habitats in the Rest of River area.

<u>Vernal Pools and Surrounding Habitat:</u> The long-term impacts of floodplain soil removal and associated facilities on vernal pools, as well as the surrounding non-breeding habitat for vernal pool amphibians, were described generally in Section 5.3.7.4 and summarized in Section 7.3.5.3. In brief, these impacts include the following:

- The excavation and replacement of the surface soil and vegetation within and around vernal pools would change the sediment types and stratigraphy, microtopography, and foliage cover of these pools, as well as the surface flow patterns into and out of the pools. These changes would alter the hydrology of these pools, and efforts to reproduce all of these characteristics are unlikely to re-establish the existing or comparable seasonal hydrology within the affected vernal pools.

- There is also likely to be a long-term change in the vegetative characteristics of the vernal pools, since the complex and mature organic vegetative composition (alive and dead) of these pools cannot be re-established in a predictable period of time, and numerous factors could derail the plant succession process and result in undesirable vegetative growth (e.g., invasive species). Moreover, mature trees around the periphery of the pools, if removed, would take at least 50 to 100 years to be re-established if not impeded by floods or invasive species encroachment.

- Long-term changes in soil composition in the vernal pools are also probable, since replacement soils would not match the characteristics of the existing vernal pool soils, and it would be extremely difficult, if not impossible, to maintain the necessary detrital base on a long-term basis.

- Habitats immediately adjacent to vernal pools are critical for maintaining water quality and providing shade and litter for the pool; and the proximate non-breeding terrestrial habitats, with features such as coarse woody debris and the burrows of small mammals, provide a variety of protective cover, temperature and moisture regulation, and overwintering habitat functions for the vernal pool amphibians. Even small impacts to these non-breeding habitats have the potential to disrupt important aspects of those areas' non-breeding functions for the vernal pool amphibians. In addition, impacts from soil removal and access roads and staging areas in areas around the vernal pools in the PSA could cause a long-term loss of connectivity among those vernal pools and between vernal pools and other habitats used by the vernal pool species, resulting in a long-term, if not permanent, adverse impact on the vernal pool animals.

- The disturbances within and around the vernal pools would create a high potential for predators (e.g., green frogs, bullfrogs) to invade individual vernal pools where they did not previously exist, and these predators could further undermine the re-establishment of the vernal pool functions.

- Due to the foregoing impacts, there would be a long-term or permanent loss of vernal pool functions and the sensitive vernal pool species (including wood frogs, spotted salamanders, and the state-listed Jefferson salamanders) in at least many of the vernal pools affected.

SED 2/FP 1 and SED 10/FP 9 would have no direct impact on any of the vernal pools in the PSA. The other combinations would directly affect at least portions of most of those pools and much of the overall vernal pool acreage in the PSA. SED 3/FP 3, SED 5/FP 4, and SED 6/FP 4 would involve excavation and replacement of the surface soils and vegetation in 58 of the 66 vernal pools in the PSA, impacting 15 acres of vernal pool habitat. SED 8/FP 7 and SED 9/FP 8 would both involve excavation in 61 of the 66 vernal pools, impacting 17 to 18 acres of vernal pool habitat. In addition, all these combinations would affect varying portions of the 100-foot and 100- to 750-foot zone around the vernal pools, as shown in the table below.

Table 8-5 – Impacts of Sediment-Floodplain Alternative Combinations on Amphibian Non-Breeding Habitats Around Vernal Pools in PSA[1]

Zone	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Total impact on 100-foot zones around vernal pools in PSA (acres)	--	12	16	16	48	22	3
Total impact on 100-700 foot zones around vernal pools in PSA (acres)	--	50	64	64	178	88	12

1. This table shows the total number of acres within the respective zones around vernal pools in the PSA that would be affected by each combination.

Due to the extensive direct impacts of all of these combinations except SED 2/FP 1 and SED 10/FP 9 on the vernal pools in the PSA, as well as their impacts on the surrounding non-breeding habitats, it is highly unlikely, under these combinations, that the full complement of characteristics that contribute to vernal pool functions would be re-established in at least many of those pools. As a result, there would be a long-term or permanent loss of the sensitive vernal pool species that rely on those pools for breeding. SED 10/FP 9 would not directly affect any of those pools; and while it would produce some disturbances that could disrupt non-breeding habitats around certain vernal pools, those disruptions would be limited relative to the other combinations involving removal.

Upland Habitats: The potential long-term impacts of floodplain soil removal, as well as the construction of access roads and staging areas, on upland habitats were described generally in Section 5.3.8.4 and summarized in Section 7.3.5.2. As discussed there, most of the affected upland areas consist of disturbed upland habitats, which include agricultural fields and cultural grasslands. As these areas support altered or early successional plant communities that have limited ecological value, no long-term adverse impacts would be expected from the remediation in these areas under any of the remedial combinations.

On the other hand, where the remediation or supporting activities would affect upland forested habitats, they would have long-term adverse impacts, since they would require the removal of mature trees in these areas, which could take at least 50 to 100 years to be re-established, as discussed above for floodplain forests. As shown above in Table 8-4, apart from SED 2/FP 1, all of the combinations of sediment and floodplain alternatives would have some, although relatively limited, impacts on these habitats, with SED 8/FP 7 affecting the largest area (over 6 acres), SED 10/FP 9 affecting the smallest area (less than 1 acre), and the other combinations having intermediate impacts (approximately 3 to 5 acres).

Long-Term Impacts on State-Listed Species

All of the sediment-floodplain alternative combinations except SED 2/FP 1 would affect the Priority Habitats of some state-listed rare species. As discussed previously, an evaluation has been conducted, for each potentially affected state-listed species, to assess whether each of the remedial combinations would result in a take of that species under MESA and, where there would be a take, to assess whether the combination would impact a significant portion of the local population(s) of the species. The results of those evaluations are presented in Appendix L and are summarized in the table below:

Table 8-6 – Impacts of Sediment/Floodplain Alternative Combinations on State-Listed Species[1]

Impact	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Number of species that would be taken	--	28	28	30	32	30	21
Number of species where take would impact or would likely impact a significant portion of a local population	--	17	21	21	22	21	2

1. This table does not include species where impact has been determined to be "possible" or "unlikely."

As shown in the above table, all combinations of sediment and floodplain alternatives (except for SED 2/FP 1) would result in a take of more than 20 state-listed species. SED 10/FP 9 would result in a take of 21 state-listed species, while the other combinations would result in a take of 28 to 32 such species. The number of state-listed species where these takes would or would likely impact a significant portion of the local population varies from 2 under SED 10/FP 9 to at least 17 to 22 under the other combinations. Thus, of the combinations of removal alternatives, SED 10/FP 9 would have the least impact on these rare state-listed species.

Long-Term Impacts on Aesthetics and Recreational Use

All combinations of sediment and floodplain alternatives except SED 2/FP 1 would have some long-term impacts on the aesthetic features of the Rest of River. Floodplain soil removal activities, as well as the construction of access roads and staging areas necessary to support sediment and soil removal, would require removal of trees and vegetation, including numerous forested areas, which would detract from the natural pre-remediation appearance of those areas until such time as restoration plantings have matured. The length of time that the appearance of the floodplain in these areas would remain altered depends on the length of time that the access roads and staging areas remain, as well as the time necessary for these areas to return to their prior appearance. As discussed above, where mature trees are cut down, it would take 50 to 100 years or more for a replanted forest community to develop an appearance comparable to its current appearance. In addition, bank stabilization activities would result in the permanent loss of mature overhanging trees on the banks, creating a permanent change in the vegetative community on those banks to a more open, exposed community. Further, sediment removal and capping activities would alter the appearance of the River over the course of construction activities and for some time thereafter.

These aesthetic impacts on the appearance of the Rest of River area would be substantial for all of the sediment-floodplain alternative combinations except SED 10/FP 9. SED 3/FP 3 would impact 139 acres of the River, 14 linear miles of riverbanks (7 miles on both sides of the River), and 42 acres of forested habitat (including floodplain and upland forests). SED 5/FP 4, SED 6/FP 4, and SED 9/FP 8 would impact 288 to 336 acres of the River, 14 linear miles of riverbank (7 miles on both sides of the River), and approximately 60 to 65 acres of forested habitat. SED 8/FP 7 would affect 351 acres of the River, 14 linear miles of riverbank (7 miles on both sides of the River), and approximately 185 acres of forested habitat.

SED 10/FP 9 would have the least impact of these combinations on the aesthetics of the floodplain, as it would impact 62 acres of the River, 1.6 linear miles of riverbank, and approximately 15 acres of forested habitat. These impacts would not be expected to be significantly detrimental to the overall aesthetics of the River and floodplain in the long term, although they would have long-term aesthetic effects in the relatively small areas affected.

Similarly, all of the alternative combinations except SED 2/FP 1 would disrupt recreational use of the River and floodplain not only during the remediation period, but until the areas have sufficiently recovered to support such uses. These affected uses include canoeing, fishing, waterfowl and other game hunting, hiking, dirt biking, and general recreation. Similar to other long-term impacts, the extent of these impacts is dependent on the size of the affected area and the length of time both for construction and for recovery. Thus, SED 8/FP 7 would have the greatest impacts on these uses based on the total extent of areas subject to remediation or the construction of support facilities, as well as the time required for construction (52 years). Conversely, SED 10/FP 9 would have the fewest impacts on these uses, as it would involve the smallest area subject to remediation and the shortest construction time of these combinations (5 years). The remaining alternative combinations would have impacts between these two extremes, but in all cases they would cause substantial disruptions of recreational activities for a considerable period of time.

Long-Term Impacts on Fluvial Geomorphic Processes

As previously discussed, all of the combinations of sediment and floodplain alternatives involving active remediation except SED 10/FP 9 would involve the stabilization of 14 linear miles of riverbanks (7 miles on both sides of the River) in Reaches 5A and 5B, and SED 10/FP 9 would involve stabilization of a total of 1.6 linear miles of riverbanks in those sub-reaches. As discussed above, these bank stabilization activities would prevent or permanently curtail the current processes of bank erosion and lateral channel migration, which have allowed for the current mix of riverbank types, including vertical and undercut banks.

In addition, the stabilization of the banks, as well as the capping and armoring of the riverbed in these subreaches, would reduce the supply of sediment to the River, which could affect such in-river processes as sediment transport (as bedload or suspended load), point bar development, and changes in channel dimension (i.e., width and/or depth), as determined by sediment deposition/erosion patterns. As discussed in Section 6.3.5.3, based on geomorphological considerations and modeling results, the reduction in sediment load associated with riverbank stabilization and riverbed armoring under any of the alternative combinations would not be expected to result in a large-scale, long-term impact on these river morphologic processes or on in-river hydrologic characteristics such as water depth and current velocity. Since this conclusion applies to all of the alternative combinations, this factor does not create a distinction among them.[461]

Potential Measures to Mitigate Long-Term Adverse Impacts

For all of the combinations of sediment and floodplain alternatives except SED 2/FP 1, a variety of restoration measures are available for use in an effort to mitigate long-term adverse impacts resulting from their implementation.[462] The restoration methods for the types of habitats that would be affected by these combinations are described in the restoration methods subsections in Section 5.3. However, as also discussed in Section 5.3 and summarized above, given the constraints on the ability of these methods to re-establish pre-remediation conditions and functions, implementation of these restoration methods

[461] The intermittent nature of sediment remediation in Reaches 5A and 5B under SED 10/FP 9 would have the potential for small-scale, localized changes in in-river geomorphic processes, but no significant changes in these processes are expected. Specifically, increases in near-bed and bank shear stress might arise in areas where the channel transitions between its natural state and engineered sections, depending upon differences in roughness. As discussed in Section 6.10.5.3 the stabilization would be designed to minimize abrupt changes, and small localized areas of erosion that could occur would be evaluated and repaired if necessary under the monitoring program.

[462] Potential measures to avoid or minimize the adverse impacts were discussed in Section 5.2.

would not prevent long-term negative impacts from the remediation, especially on the affected riverbanks, forested floodplain habitats, and vernal pools. For similar reasons to those discussed above, since SED 10/FP 9 would involve the least amount of affected areas and the shortest implementation period, the overall influence of these impacts on the ecosystem of the PSA would be less under that combination than under the larger combinations, and the likelihood of effective restoration would be higher.

8.2.5 Attainment of IMPGs

In the assessment of IMPG attainment for the combinations of sediment and floodplain alternatives, GE has compared the appropriate post-remediation average PCB concentrations to the relevant IMPGs for both the sediment and floodplain components of the combinations. For direct human contact with sediments and floodplain soils, the modeled surface sediment PCB concentrations and the estimated floodplain EPCs in each exposure area have been compared with the IMPGs for direct contact. In addition, the estimated post-remediation floodplain EPCs in each farm area evaluated for human consumption of agricultural products have been compared to the floodplain IMPGs based on such consumption. Further, the fish PCB concentrations predicted by the EPA model (or estimated by the CT 1-D Analysis) at the end of the model projection period, converted to fillet concentrations, have been compared to the fish consumption IMPGs. For ecological receptors, the modeled sediment or fish concentrations at the end of the projection period and/or the estimated floodplain soil concentrations for the appropriate averaging areas have been compared to the relevant IMPGs. (For insectivorous birds and piscivorous mammals, these comparisons have used the procedures described in Section 4.2.3.5, which consider both the sediment and the floodplain components of the alternative combinations.)

This comparative evaluation has focused, in particular, on a comparison of the total number of averaging areas with predicted PCB concentrations that achieve the applicable IMPG(s). In addition, for the sediment component of each combination, as required by the Permit, GE has estimated the time that it would take to achieve the IMPGs. For the floodplain component of each combination, the time frame to achieve IMPGs would be the same as that required to complete the remediation in a particular area (i.e., the reduction in soil concentrations would occur upon completion of backfill placement).

The results of these comparisons for the combinations of alternatives considered in this evaluation are presented in a series of tables throughout this section. Each of these tables corresponds to a different type of receptor and/or IMPG, as follows:

- Table 8-7: Human direct contact with floodplain soil or sediment;
- Table 8-9: Human consumption of floodplain agricultural products;

- Table 8-11: Human consumption of fish;
- Table 8-12: Benthic invertebrates;
- Table 8-14: Amphibians (represented by wood frog);
- Table 8-16: Protection of fish (warmwater and coldwater);
- Table 8-18: Insectivorous birds (represented by wood duck);
- Table 8-20: Piscivorous birds (represented by osprey), as well as threatened and endangered species (represented by bald eagle);
- Table 8-22: Piscivorous mammals (represented by mink); and
- Table 8-24: Omnivorous/carnivorous mammals (represented by short-tailed shrew).

IMPG attainment for each of these human exposure pathways and ecological receptor groups is described in the subsections below.

8.2.5.1 Comparison to Human Health IMPGs

<u>Human Direct Contact with Floodplain Soils and Sediments</u>

Tables 8-7a and 8-7b present, for all of the combinations of sediment and floodplain alternatives under evaluation, a detailed comparison of human direct contact IMPG attainment (RME and CTE IMPGs, respectively[463]) for the floodplain soil and sediment exposure areas (EAs). These tables indicate the following regarding IMPG attainment in the floodplain and sediment EAs:

<u>Floodplain Direct Contact EAs</u>: For direct contact with floodplain soil, the floodplain soil PCB concentrations under SED 2/FP 1 (which are assumed to be the same as current levels) are within or below the range of the cancer-based RME and CTE IMPGs (i.e., below the IMPGs associated with a 10^{-4} cancer risk) in all 120 floodplain EAs. However, they do not achieve the non-cancer-based RME IMPGs in 24 of those EAs. Further, 5 of the 12 Heavily Used Subareas do not achieve the non-cancer RME IMPGs (and one does not achieve the RME IMPG associated with a 10^{-4} cancer risk).

Under all the other combinations, the post-remediation floodplain soil PCB concentrations are within or below the range of the RME and CTE IMPGs for both cancer and non-cancer

[463] The RME IMPGs are those based on EPA's Reasonable Maximum Exposure (RME) assumptions (representing more highly exposed individuals), and the CTE IMPGs are those based on EPA's Central Tendency Exposure (CTE) assumptions (representing individuals with average exposure).

(i.e., below the cancer-based IMPGs associated with a 10^{-4} risk and below the non-cancer IMPGs) in all 120 floodplain EAs and all 12 of the Heavily Used Subareas.[464]

Sediment Direct Contact EAs: For direct contact with sediments, the average predicted surface sediment PCB concentrations at the end of the modeled period under all seven combinations of alternatives are within (or below) the range of the RME and CTE IMPGs for both cancer and non-cancer in all eight sediment EAs. In fact, levels within the IMPG range would be achieved prior to the remediation of any sediment in all but one of the sediment EAs.[465]

Combined Floodplain and Sediment Exposures: Combining the 120 floodplain EAs with the eight sediment EAs results in a total of 128 human direct contact exposure areas. Table 8-8 below provides a summary, for each combination of alternatives, of the percent of these 128 human direct contact EAs that would meet the IMPGs associated with the various risk levels evaluated. In this table, IMPG attainment in the 12 Heavily Used Subareas has been summarized separately.

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464 SED 10/FP 9 would also achieve the RME IMPGs based on a cancer 10^{-5} risk in 71 of the EAs and 8 of the Heavily Used Subareas; SED 3/FP 3 would do so in 83 of the EAs and all 12 of the Heavily Used Subareas; and the other combinations of removal alternatives would do so in all EAs and Heavily Used Subareas.

465 Further, all of the combinations except SED 2/FP 1 and SED 10/FP 9 would achieve the RME IMPGs based on a 10^{-5} cancer risk in all eight sediment EAs; SED 10/FP 9 would do so in 7 of those EAs and SED 2/FP 1 would do so in 6 of those EAs.

Table 8-8 – Summary of Percent of Floodplain and Sediment Exposure Areas Achieving IMPGs for Direct Human Contact

Exposure Assumptions	Risk Level	Percent of 128 Floodplain and Sediment Exposure Areas Achieving IMPGs						
		SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
RME	Cancer 10^{-4}	100	100	100	100	100	100	100
	Cancer 10^{-5}	56	71	100	100	100	100	61
	Cancer 10^{-6}	7	9	13	14	100	15	7
	Non-cancer	81	100	100	100	100	100	100
CTE	Cancer 10^{-4}	100	100	100	100	100	100	100
	Cancer 10^{-5}	100	100	100	100	100	100	100
	Cancer 10^{-6}	88	98	99	99	100	99	97
	Non-cancer	99	100	100	100	100	100	100
		Percent of 12 Floodplain Heavily Used Subareas Achieving IMPGs						
RME	Cancer 10^{-4}	92	100	100	100	100	100	100
	Cancer 10^{-5}	42	100	100	100	100	100	67
	Cancer 10^{-6}	17	42	42	42	100	42	17
	Non-cancer	58	100	100	100	100	100	100
CTE	Cancer 10^{-4}	100	100	100	100	100	100	100
	Cancer 10^{-5}	92	100	100	100	100	100	100
	Cancer 10^{-6}	67	100	100	100	100	100	92
	Non-cancer	67	100	100	100	100	100	100

As shown in the above table, under SED 2/FP 1, floodplain and sediment PCB concentrations are within the range of the direct-contact RME IMPGs that correspond to EPA's cancer risk range in all 128 EAs, but do not meet the non-cancer IMPGs in about 20% of those areas. Under all other combinations, the post-remediation floodplain soil and sediment concentrations are within the RME IMPG cancer risk range and meet the non-cancer IMPGs in all 128 floodplain and sediment EAs and in all 12 Heavily Used Subareas.[466]

Human Consumption of Floodplain Agricultural Products

Table 8-9 presents a detailed comparison of IMPG attainment (RME and CTE IMPGs) for the agricultural averaging areas evaluated for human consumption of agricultural products from the floodplain. This comparison is summarized in Table 8-10 below, which shows, for each combination, the percentage of the 14 agricultural averaging areas that meet the adjusted floodplain IMPG levels for agricultural products consumption at the various risk levels evaluated.

Table 8-10 – Summary of Percent of Farm Areas Achieving IMPGs for Human Consumption of Agricultural Products

Exposure Assumptions	Risk Range	Percent of Farm Areas Achieving IMPGs						
		SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
RME	Cancer 10^{-4}	100	100	100	100	100	100	100
	Cancer 10^{-5}	100	100	100	100	100	100	100
	Cancer 10^{-6}	36	36	36	36	100	36	36
	Non-cancer (child)	100	100	100	100	100	100	100
	Non-cancer (adult)	100	100	100	100	100	100	100
CTE	Cancer 10^{-4}	100	100	100	100	100	100	100
	Cancer 10^{-5}	100	100	100	100	100	100	100
	Cancer 10^{-6}	93	93	93	93	100	93	93
	Non-cancer (child)	100	100	100	100	100	100	100
	Non-cancer (adult)	100	100	100	100	100	100	100

As shown in this table, the post-remediation floodplain concentrations under all alternative combinations (including SED 2/FP 1) would achieve, at a minimum, the RME and CTE

466 The extent to which the combinations of alternatives would achieve the RME IMPGs based on 10^{-5} and 10^{-6} cancer risks is shown in Table 8-8.

IMPGs based on a 10^{-5} cancer risk, as well as the non-cancer IMPGs, in all farm areas evaluated for human consumption of agricultural products.

Human Consumption of Fish

Table 8-11 presents a detailed evaluation, for all of the combinations of sediment and floodplain alternatives, of whether the fish PCB concentrations predicted by the model for each river reach or sub-reach at the end of the modeled period, when converted to fillet concentrations, would achieve the various RME and CTE IMPGs for human consumption of fish. As shown in that table, none of the combinations of alternatives would achieve the RME IMPGs for both cancer and non-cancer – which were based on unrestricted consumption of fish from the Housatonic River – in any of the Massachusetts reaches (Reaches 5 through 8) within the modeled period.[467]

Results from extrapolation of the model results beyond the model period to estimate the times to achieve the RME IMPGs associated with cancer risks and non-cancer impacts in Reaches 5 through 8 are also shown in Table 8-11, although these are highly uncertain. In general, the time needed to achieve (at a minimum) the deterministic RME IMPGs based on a 10^{-4} cancer risk and those based on non-cancer impacts range from approximately 120 to over 250 years in various sub-reaches throughout Reaches 5 through 8, regardless of the alternative selected. Given the long times to achieve the IMPGs for unrestricted fish consumption, fish consumption advisories would be need to be continued (given EPA's HHRA) for the indefinite future under all alternative combinations.

In the four Connecticut impoundments, where fish PCB concentrations are already considerably lower than those in Massachusetts, estimates from the CT 1-D Analysis, although highly uncertain, present a different picture. Those estimates indicate that all of the sediment-floodplain alternative combinations would achieve very low PCB levels in fish – i.e., 0.1 mg/kg or lower (except 0.16 mg/kg in one impoundment under SED 2/FP 1) – by the end of the model period. These estimated concentrations would achieve the RME IMPGs based on a 10^{-4} cancer risk in all impoundments within that period. With respect to the non-cancer RME IMPGs, the estimates indicate that SED 2/FP 1, SED 10/FP 9, and SED 3/FP 3 would achieve some of those IMPGs in some impoundments, but not others,[468]

[467] While some of the larger alternatives would achieve the RME IMPGs based on a 10^{-4} cancer risk (particularly the probabilistic IMPGs) in some sub-reaches, none of them would achieve the associated non-cancer IMPGs for adults and children in those sub-reaches. Moreover, none of the alternatives would achieve the RME IMPGs based on a 10^{-5} cancer risk in any reach in Massachusetts.

[468] As shown in Table 8-11, SED 2/FP 1 would achieve the probabilistic non-cancer IMPG for adults in 3 impoundments (but no other non-cancer IMPGs), SED 10/FP 9 would achieve the probabilistic

and that the remaining combinations would achieve all of those IMPGs in all impoundments. However, given the uncertain nature of these extrapolations to Connecticut, such fine distinctions among alternatives at such low levels are not reliable. All that can be concluded is that, at some point, the fish PCB concentrations achieved in the Connecticut impoundments under all of the combinations of alternatives should allow the CDPH to remove the fish consumption advisories for PCBs,[469] and that in the meantime those advisories will need to remain in place.

8.2.5.2 Comparison to Ecological IMPGs

This section compares the extent to which the combinations of sediment and floodplain alternatives under evaluation would achieve the IMPGs for the various ecological receptors. In evaluating this information, it is also critical to consider the adverse impacts from implementation of these alternatives on the ecological receptors that the IMPGs are designed to protect, as discussed in Sections 8.2.4.3 and 8.2.7, and to balance those impacts against any residual risks of PCBs in determining overall environmental protectiveness, as discussed in Section 8.2.10.

Benthic Invertebrates

The IMPGs for benthic invertebrates apply to the sediments in 32 averaging areas in Reaches 5 through 8. Table 8-12 presents, for the combinations of sediment and floodplain alternatives, a detailed comparison of attainment of the benthic invertebrate IMPGs (and time to achieve those IMPGs) for the 32 averaging areas. Those results are summarized in Table 8-13 below, which shows, for each combination, the percentage of those averaging areas where the model-predicted sediment concentrations would achieve the upper-bound and lower-bound IMPGs.

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non-cancer IMPG for adults in all 4 impoundments and the probabilistic IMPG for children in 2 impoundments, and SED 3/FP 3 would achieve all of the non-cancer RME IMPGs except for the deterministic IMPG for children in 2 impoundments.

[469] As previously noted, it is our understanding that, in developing and revising its fish consumption advisory for PCB, the CDPH utilizes as guidance a risk-based protocol that specifies unlimited fish consumption at PCB levels < 0.1 mg/kg. As discussed in Section 6, use of the CT 1-D Analysis, while highly uncertain, indicates that all of the combinations of removal alternatives would meet (or reach the boundary of) that criterion in all Connecticut impoundments by the end of the EPA model's projection period. It should also be noted that the removal of the PCB advisory would not affect the continuation of the current fish consumption advisory based on mercury, which is unrelated to releases from the former GE plant.

Table 8-13 – Summary of Percent of Benthic Invertebrate Averaging Areas Achieving IMPGs for Benthic Invertebrates

IMPGs	Percent of Averaging Areas Achieving IMPGs in Surface Sediments						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Upper Bound (10 mg/kg in sediment)	72	100	100	100	100	100	84
Lower Bound (3 mg/kg in sediment)	22	63	91	100	100	100	34

Amphibians

The IMPGs for amphibians apply both to the 66 vernal pools in the PSA floodplain identified by Woodlot (2002) and to 29 separate backwater areas. Table 8-14 presents, for the combinations of sediment and floodplain alternatives, a detailed comparison of attainment of the amphibian IMPGs in the 66 vernal pools (based on the floodplain component of the combinations) and in the 29 backwater areas (based on the sediment component of the combinations). Table 8-14 also shows the time to achieve those IMPGs in the backwater areas.

Combining the 66 floodplain vernal pools with the 29 backwaters evaluated for amphibian IMPG attainment results in a total of 95 amphibian exposure/averaging areas. Table 8-15 below provides a summary, for each alternative combination, of the percentage of those averaging areas that would achieve the upper-bound and lower-bound IMPGs.

Table 8-15 – Summary of Percent of Amphibian Averaging Areas Achieving IMPGs for Amphibians

IMPGs	Percent of Averaging Areas Achieving IMPGs in Surface Soil/Sediment						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Upper Bound (5.6 mg/kg in soil/sediment)	18	85	98	100	100	100	21
Lower Bound (3.27 mg/kg in soil/sediment)	13	27	40	48	100	100	14

Warmwater and Coldwater Fish Protection

The IMPGs for fish protection apply to whole-body fish PCB concentrations. Table 8-16 presents, for the sediment-floodplain alternative combinations, a detailed comparison of IMPG attainment (and time to achieve those IMPGs) for warmwater fish protection within the 14 sub-reaches of Reaches 5 through 8 and coldwater fish protection within the 8 sub-reaches of Reach 7. The results are summarized in Table 8-17 below, which shows, for each combination, the percentage of these sub-reaches (considered as averaging areas) in which the model-predicted fish concentrations would achieve the IMPGs.

Table 8-17 –Summary of Percent of Averaging Areas Achieving Warmwater and Coldwater Fish Protection IMPGs

IMPGs	Percent of Averaging Areas Achieving IMPGs in Fish Tissue						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Warmwater Fish Protection (55 mg/kg in fish)	100	100	100	100	100	100	100
Coldwater Fish Protection (14 mg/kg in fish)	0	88	100	100	100	100	0

Insectivorous Birds

As described previously, the IMPG for insectivorous birds (represented by wood duck) applies to the prey of those birds, which consist of both aquatic and terrestrial insects; and it thus depends on both sediment and floodplain concentrations in the 12 designated averaging areas. As also described above (see Section 4.3.2.5), since each remedial alternative combination involves a specific sediment component and a specific floodplain component, an assessment of the achievement of the insectivorous bird IMPG has been made by using the model-predicted sediment endpoint concentration in each averaging area to determine the corresponding target floodplain soil level in that area that would result in achievement of the IMPG, and then comparing the estimated floodplain soil EPC in that area to the target level. Table 8-18 shows, for each combination of sediment and floodplain alternatives and each averaging area for insectivorous birds, the model-predicted sediment endpoint concentration and the calculated associated target floodplain soil level that would allow achievement of the insectivorous bird IMPG. That table also presents, for each combination, a comparison of the post-remediation floodplain EPC in each averaging area to the target floodplain soil level in that area, thus indicating whether the combination would achieve the insectivorous bird IMPG in each averaging area.

The results of these comparisons are summarized in Table 8-19 below, which shows, for each combination, the percentage of the 12 averaging areas that would achieve the IMPG for insectivorous birds.

Table 8-19 – Summary of Percent of Averaging Areas Achieving IMPG for Insectivorous Birds

IMPG	Percent of Averaging Areas Achieving IMPG						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Insectivorous Birds (4.4 mg/kg in prey)	33	83	100	100	100	100	58

Piscivorous Birds

The IMPG for piscivorous birds (represented by osprey) applies to whole-body fish tissue concentrations in the 14 sub-reaches in Reaches 5 through 8. Table 8-20 presents, for the sediment-floodplain alternative combinations, a detailed comparison of IMPG attainment (and time to achieve the IMPG) for piscivorous birds in those 14 sub-reaches. The results are summarized in Table 8-21 below, which shows, for each combination, the percentage of the 14 sub-reaches (considered the averaging areas) in which the model-predicted fish concentrations would achieve the IMPG.

Table 8-21 – Summary of Percent of Averaging Areas Achieving Piscivorous Bird IMPG

IMPG	Percent of Averaging Areas Achieving IMPG in Fish Tissue						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Piscivorous Birds (3.2 mg/kg in fish)	0	43	93	100	100	100	0

<u>Piscivorous Mammals</u>

Similar to insectivorous birds, the IMPGs for piscivorous mammals (represented by mink) apply to the prey of those mammals, which consist of both aquatic and terrestrial animals; and they thus depend on both sediment and floodplain PCB concentrations in the two designated averaging areas (Reaches 5A/5B and Reaches 5C/5D/6). As also described above (see Section 4.3.2.5), since each remedial combination involves a specific sediment component and a specific floodplain component, an assessment of the achievement of the piscivorous mammal IMPGs has been made by using the model-predicted sediment endpoint concentration in each averaging area to determine the corresponding target floodplain soil levels in that area that would result in achievement of the upper- and lower-bound IMPGs, and then comparing the estimated floodplain soil EPC in that area to those target levels. Table 8-22 shows, for each sediment-floodplain alternative combination and each averaging area for piscivorous mammals, the model-predicted sediment endpoint concentration and the calculated associated target floodplain soil levels that would allow achievement of the upper- and lower-bound IMPGs. That table also presents, for each combination, a comparison of the post-remediation floodplain EPC in each averaging area to the target floodplain soil levels in that area, thus indicating whether the combination would achieve the piscivorous mammal IMPGs in each averaging area.

The results of these comparisons are summarized in Table 8-23 below, which shows, for each combination, the percentage of the two averaging areas that would achieve the upper-bound and lower-bound IMPGs for piscivorous mammals.

Table 8-23 – Summary of Percent of Averaging Areas Achieving IMPGs for Piscivorous Mammals

IMPGs	Percent of Averaging Areas Achieving IMPGs						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Upper Bound (2.43 mg/kg in prey)	0	0	100	100	100	100	0
Lower Bound (0.984 mg/kg in prey)	0	0	0	0	100	0	0

Omnivorous/Carnivorous Mammals

The IMPGs for omnivorous/carnivorous mammals (represented by the short-tailed shrew) apply to floodplain soil in 7 averaging areas in the PSA. Table 8-24 presents, for the combinations of sediment and floodplain alternatives, a detailed comparison of IMPG attainment for omnivorous/carnivorous mammals in those 7 averaging areas. The results are summarized in Table 8-25 below, which shows, for each combination, the percentage of the 7 averaging areas in which the average floodplain soil concentration would achieve the upper-bound and lower-bound IMPGs for omnivorous/carnivorous mammals.

Table 8-25 – Summary of Percent of Averaging Areas Achieving IMPGs for Omnivorous/Carnivorous Mammals

IMPGs	Percent of Averaging Areas Achieving IMPGs in Floodplain Soil						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Upper Bound (34.3 mg/kg in floodplain soil)	86	100	100	100	100	100	100
Lower Bound (21.1 mg/kg in floodplain soil)	57	71	100	100	100	100	57

Threatened and Endangered Species

The IMPG for threatened and endangered species (represented by bald eagle) applies to whole-body fish PCB concentrations in the 14 sub-reaches in Reaches 5 through 8. The detailed comparison of IMPG attainment (and time to achieve the IMPG) for threatened and endangered species in those sub-reaches is included in Table 8-20. The results are summarized in Table 8-26 below, which shows, for each combination of sediment and floodplain alternatives, the percentage of the 14 sub-reaches (considered as averaging areas) in which the model-predicted fish concentrations would achieve the IMPG.

Table 8-26 – Summary of Percent of Averaging Areas Achieving IMPG for Threatened and Endangered Species

IMPG	Percent of Averaging Areas Achieving IMPG in Fish Tissue						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Threatened and Endangered Species (30.41 mg/kg in fish)	100	100	100	100	100	100	100

8.2.6 Reduction of Toxicity, Mobility, or Volume

The degree to which the combinations of sediment and floodplain alternatives under evaluation would reduce the toxicity, mobility, and volume of PCBs is discussed below.

Reduction of Toxicity: None of the sediment-floodplain alternative combinations includes any treatment processes that would reduce the toxicity of PCBs in the sediment or soils. However, as noted in Section 2.2.3, in the very unlikely event that any material removed during implementation of any alternative should contain free NAPL, drums of liquid waste, or the like, those wastes would be segregated and transported off-site for treatment and disposal, as appropriate. Accordingly, this factor does not provide a basis for distinguishing among the alternatives.

Reduction of Mobility: Under SED 2/FP 1, reduction of mobility of PCBs in the River would be achieved through upstream source control/remediation and naturally occurring processes. Under all other combinations, in addition to these factors, further reductions would be achieved through sediment removal, capping, backfilling, thin-layer capping, and/or bank stabilization activities. Reduction in PCB mobility can be viewed in terms of reduction in the annual mass of PCBs passing Woods Pond and Rising Pond Dams, as discussed in Section 8.2.2.[470]

Reduction of Volume: Implementation of each of the sediment-floodplain alternative combinations except SED 2/FP 1 would reduce the volume of PCB-containing sediment, bank soil, and floodplain soil in the Rest of River through permanent removal of the material. Table 8-27 below summarizes the approximate removal volume and corresponding PCB mass that would be removed under each such combination.

Table 8-27 – Removal Volume and Corresponding PCB Mass for Combinations of Alternatives

Alternative	Removal Volume - Sediment/Soil (cy)	Estimated PCB Mass (lbs)
SED 2/FP 1	---	---
SED 3/FP 3	243,000	21,700
SED 5/FP 4	533,000	33,300
SED 6/FP 4	677,000	37,300
SED 8/FP 7	2,902,000	94,100
SED 9/FP 8	1,098,000	53,100
SED 10/FP 9	267,700	13,900

8.2.7 Short-Term Effectiveness

Evaluation of the short-term effectiveness of the sediment-floodplain alternative combinations has included consideration of the short-term impacts of implementing these combinations on the environment (considering both ecological effects and increases in GHG emissions), on local communities (as well as communities along transport routes), and on the workers involved in the remedial activities. Short-term impacts are those that would occur during and immediately after the performance of the remedial activities in a given area. Since SED 2/FP 1 would involve no remedial construction activities, its implementation would not produce any adverse short-term impacts. All of the other combinations would have adverse short-term impacts. These impacts would be spread out over the overall remedial action period and area, and thus would not last for the entire duration of the project in all affected areas. However, the total implementation duration is relevant because it represents the overall time period over which short-term impacts would

[470] As previously noted, PCBs in floodplain soils do not represent a significant potential source for mobility and migration.

occur in the Rest of River area. The estimated durations of the combinations under evaluation here are summarized in Table 8-28. As indicated, they range from 5 years for SED 10/FP 9 to over 50 years for SED 8/FP 7.

Table 8-28 – Construction Duration for Alternative Combinations

	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Construction Duration	---	10	18	21	52	14	5

Impacts on the Environment – Effects Within Rest of River Area

Short-term adverse impacts on the Rest of River environment from remedial construction activities would include PCB releases to the water column and air during sediment removal and other in-river activities, as well as destruction or alteration of the various habitats where remediation work would be conducted or support facilities would be built, with the attendant impacts on the plants and animals that use those habitats. These impacts are described and compared among the combinations in the following subsections.[471]

PCB Releases: Sediment removal activities would result in increases in resuspension of PCB-containing sediment in the water column. This would likely result in a temporary increase in PCB levels in aquatic biota downstream of the removal operations. Under all of the active remediation combinations except SED 9/FP 8, sediment removal in Reach 5A and, where applicable, Reach 5B would be conducted in the dry using sheetpile containment, which would allow the greatest control of resuspension. However, the potential still exists for suspended or residual sediment containing PCBs to be released from the work area both during sheetpile installation and during a high flow event should overtopping of the sheeting occur. Under SED 9/FP 8, sediment removal in those sub-reaches would be conducted in the wet, using equipment operating from a road on the channel bottom with water flowing, which would increase the potential for resuspension of PCB-containing sediments due to bank soil disturbances in building access ramps as well as the need to use a long-reach excavator with an open bucket, which would increase the release of dredged materials into the water.[472] In addition, under combinations of remedial

[471] Long-term adverse environmental effects were discussed and compared in Section 8.2.4.3.

[472] As discussed in Section 6.9.8, use of a clamshell bucket that fully closes, such as can be used on barge-mounted dredges, would not be feasible under this approach since such equipment is limited with respect to the weight that can be effectively picked up when the bucket is fully extended and thus would not have a sufficient reach for use in Reach 5A under SED 9.

alternatives that would involve sediment remediation in more downstream reaches, removal activities would be conducted in the wet from barges. Even with use of silt curtains in an effort to address resuspension impacts, these dredging activities, as well as boat and barge traffic, would result in releases of sediment containing PCBs.

Apart from SED 2/FP 1, SED 3/FP 3 has the lowest potential for PCB resuspension because it would involve the smallest area of sediment removal, all of which would be conducted in the dry (42 acres in Reach 5A). SED 10/FP 9 would involve a smaller area of dry removal (20 acres in Reach 5A), but would also involve the removal of sediment in the wet from 42 acres in Woods Pond. The other alternatives would involve substantially more sediment removal, with much of it conducted in the wet, which would result in more resuspension than SED 3/FP 3 and SED 10/FP 9 over a longer time period.[473]

Similarly, sediment and soil removal and related processing activities have the potential to produce airborne PCB emissions that could impact downwind communities. This potential also increases with the scope and duration of the removal activities, which increase substantially from SED 3/FP 3 and SED 10/FP 9 through SED 8/FP 7.

<u>*Impacts on Aquatic Riverine Habitat*</u>*:* The short-term impacts of sediment remediation activities – including removal with capping or backfilling and capping or thin-layer capping without removal – on aquatic riverine habitat were described generally in Section 5.3.1.2 and summarized in Section 6.3.8. They include: removal of the habitat used by aquatic plants, benthic invertebrates, and fish; change in surface substrate from its current condition (sand, sand and gravel, or silt) to armor stone or backfill material; removal or burial of most, if not all, vegetation, benthic invertebrates and other organisms present in the sediments; disruption and displacement of fish; alteration of habitat for birds and mammals living adjacent to the River that feed in areas subject to remediation; and likely colonization by invasive species. In addition, capping or thin-layer capping without removal would raise the elevation of the river bottom, which, in shallower areas, could change the vegetative characteristics of those areas and the biota dependent on them.

As discussed above, under SED 3/FP 3, these impacts would occur over 79 acres of aquatic riverine habitat, all in Reach 5A. Under SED 5/FP 4, SED 6/FP 4, SED 8/FP 7, and

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[473] For capping, the potential for resuspension of PCB-containing sediment is anticipated to be much less than for removal activities, since capping would involve placing clean material on undisturbed native sediment. It is also assumed that silt curtains would be used as a further precaution in an effort to reduce transport of cap material and any resuspended sediments downstream. For thin-layer capping, which is anticipated to be conducted during low flow periods without the use of silt curtains, it appears, based on data collected during the Silver Lake capping pilot study, that there is little potential to resuspend PCB-containing sediments.

SED 9/FP 8, these impacts would occur over 127 acres of such habitat throughout Reach 5. Under SED 10/FP 9, these impacts would occur in only 20 acres of such habitat (in Reach 5A), which is the smallest area of adverse short-term impacts on aquatic riverine habitat among the active remediation combinations.

Impacts on Riverbank Habitat: The short-term impacts of bank stabilization activities in Reaches 5A and 5B on the riverbanks, which provide habitat that is unique to its position on the landscape, were described generally in Section 5.3.2.2 and summarized in Section 6.3.8. Those impacts include: removal of all trees, other vegetation, and woody debris from the riverbanks, with the resulting loss of shading for the River and the loss of the wildlife that use those features; elimination of vertical and undercut banks used by various species (including the state-listed wood turtle) for nesting; loss of slide and burrow habitat for muskrats and beavers; reduction in wildlife access routes and movement of various species between their aquatic and terrestrial habitats; disruption of the wildlife dispersal corridors up and down the river in these reaches; and likely colonization by invasive species.

All of the sediment-floodplain alternative combinations except SED 2/FP 1 and SED 10/FP 9 would result in such impacts on the 14 linear miles of riverbanks subject to stabilization. SED 2/FP 1 would not have any such impacts, and SED 10/FP 9 would limit these impacts to a total of 1.6 linear miles of riverbank in Reaches 5A and 5B.

Impacts on Impoundment Habitat: The short-term impacts of sediment remediation activities – including removal with capping (or backfilling), capping or thin-layer capping without removal, and removal without capping – on impoundment habitat were described generally in Section 5.3.3.2 and summarized in Section 6.3.8. Those impacts are similar to the short-term impacts on aquatic riverine habitat, as described above, except that placement of a cap or thin-layer cap in the deep hole portion of Woods Pond would not be expected to have any significant short-term ecological impacts.

Apart from SED 2/FP 1, all of the sediment-floodplain alternative combinations under evaluation would have some impacts on impoundment habitat. SED 8/FP 9 and SED 9/FP 8 would have the greatest negative impacts, as they would involve sediment removal in 139 acres of such habitat – in Woods Pond, the Reach 7 impoundments, and Rising Pond. SED 6/FP 4 would also affect the same 139 acres through a combination of removal, capping, and thin-layer capping. However, under all three of these combinations, 23 acres of the affected area would involve remediation in the deep portion of Woods Pond, where no significant effects would be expected. SED 5/FP 4 would impact 101 acres of impoundment habitat, in Woods Pond and Rising Pond, but again 23 acres would be in the deep portion of the Woods Pond. The combinations (other than SED 2/FP 1) with the least impact on impoundment habitats are: SED 3/FP 3, which would affect 60 acres of such habitat, all in Woods Pond, with 23 acres in the deep portion; and SED 10/FP 9, which would impact 42 acres of impoundment habitat through removal without capping in Woods Pond.

Impacts on Backwater Habitat: The short-term impacts of sediment remediation activities, including thin-layer capping and sediment removal with capping (or backfilling), on backwater habitat were described generally in Section 5.3.6.2. Those impacts would include: burial or removal of most, if not all, vegetation, benthic invertebrates, and other organisms in the sediments; change in the substrate type from silts and mucky organic material to sand or a mixture of sand and gravel; changes in hydrology; colonization by invasive species; and the consequent impacts of these changes on the water birds and other wildlife that utilize the backwaters.

Since SED 2/FP 1, SED 3/FP 3, and SED 10/FP 9 would not involve any remediation in the backwaters, they would result in no short-term impacts to backwater habitat. The other alternative combinations would all have such impacts, as they would affect 61 to 86 acres of such habitat (see Table 8-4 above).

Impacts on Floodplain Habitats: The short-term adverse impacts on the various floodplain habitats resulting from floodplain soil removal and the construction and use of access roads and staging areas were described generally in Sections 5.3.4.2 for floodplain wetland forests, 5.3.5.2 for shrub and shallow emergent wetlands, 5.3.6.2 for deep marshes, 5.3.7.2 for vernal pools (and surrounding non-breeding habitats), and 5.3.8.2 for upland habitats. These impacts were also summarized in Section 7.3.8. In brief, they include the following:

- For floodplain wetland forest habitats, the short-term adverse impacts would include: (a) removal of all living trees, shrubs, and other vegetation, as well as dead tree snags and downed woody debris, which would result in a loss of cover, nesting, and feeding habitat for wildlife species that rely on forested floodplains; (b) replacement of existing native soil and leaf litter with commercial backfill with different characteristics, affecting plant growth and hydraulic conductivity; (c) compaction of soil due to use of heavy machinery, with consequent impacts on the permeability of the soils; (d) increase in colonization by invasive plant species; and (e) increase in construction and equipment traffic, which could disrupt some forest animals or result in mortality to certain slow-moving smaller animals.

- For shrub and emergent wetlands (both shallow and deep), the short-term adverse impacts would include: (a) clearing of vegetation, with consequent impacts on nesting, burrowing, and/or escape habitat and food for birds, amphibians, reptiles, mammals, and invertebrates that use these wetland areas; (b) replacement of existing soil with imported soil, resulting in effects on plant growth and hydraulic conductivity; (c) effects on soil permeability due to compaction of the soils; (d) alteration of the hydrology of the wetlands; (e) colonization by invasive species; and (f) increase in construction and equipment traffic, with the resulting potential for disruption or mortality to slow-moving animals.

- For vernal pools and the biota that use them, the short-term adverse impacts would include: (a) removal of any amphibian and invertebrate eggs, larvae, or adults in the affected portions of the pools; (b) removal of physical components of the pools (organic surface soils, vegetation, and other organic materials) that are critical to their ecology, and their replacement by soils with different characteristics; (c) alteration of the hydrology of the pools; (d) compaction of the sediments/soils due to use of heavy machinery; (e) tree clearing within and adjacent to the pools, reducing the shade and infusion of biomass provided to the pools; (f) loss of obligate vernal pool breeding species from all or parts of these pools; (g) likely increase in colonization by invasive species; (h) negative impacts on the non-breeding terrestrial habitats surrounding the vernal pools; and (i) loss or fragmentation of landscape connectivity among networks of vernal pools and between vernal pools and non-breeding habitats.

- For upland habitats, the short-term adverse impacts in disturbed habitat types (agricultural fields and cultural grasslands) would be less severe than those that would occur in the habitats discussed above since these disturbed habitats have already been modified and have relatively lower ecological value. However, in upland forest habitats, the short-term adverse impacts would include loss of trees and associated vegetation and impacts to the wildlife that use such areas, which would contribute to the fragmentation of the overall wooded riparian/floodplain corridor of the Housatonic River.

- In all of these habitats, the short-term adverse impacts would include the direct removal or disruption of any state-listed species present in the affected areas, as well as alteration of their habitat.

- The short-term adverse impacts would also include impairment of a number of other functions provided by the floodplain. For example, by removing woody debris and vegetation and altering microtopography in disturbed areas, the floodplain remedial construction activities would reduce the floodplain roughness that produces flow resistance and thus contributes to the important flood flow alteration function of the floodplain. In addition, the construction activities could alter the floodplain's groundwater recharge/discharge function and its functions of water quality maintenance, nutrient process, and production export (described in Section 5.3.4.1).

All of the combinations of sediment and floodplain alternatives involving removal, except SED 10/FP 9, would have these adverse short-term impacts on the habitats outside the River to a substantial degree. Specifically:

- SED 3/FP 3 would impact a total of approximately 92 acres of non-River habitats, including 38 acres of floodplain forest habitats, 21 acres of shrub and shallow and deep emergent marshes, 15 acres of vernal pools, and 18 acres of upland habitats.

- SED 5/FP 4 and SED 6/FP 4 would impact a total of approximately 117 acres of such habitats, including 60 acres of floodplain forest habitats, 22 acres of shrub and shallow and deep emergent marshes, 15 acres of vernal pools, and 20 acres of upland habitats.

- SED 9/FP 8 would impact a total of approximately 122 acres of such habitats, including 56 acres of floodplain forest habitats, 34 acres of shrub and shallow and deep emergent marshes, 18 acres of vernal pools, and 14 acres of upland habitats.

- SED 8/FP 7 would impact a total of approximately 300 acres of such habitats, including 178 acres of floodplain forest habitats, 75 acres of shrub and shallow and deep emergent marshes, 17 acres of vernal pools, and 31 acres of upland habitats.

Apart from SED 2/FP 1, SED 10/FP 9 would have the fewest short-term impacts on these habitats. That combination would impact a total of only approximately 26 acres of these habitats, including 14 acres of floodplain forest habitats, 4 acres of shrub and shallow and deep emergent marshes, no vernal pools, and 8 acres of upland habitats.

With specific reference to vernal pools, SED 2/FP 1 and SED 10/ FP 9 would have no direct impact on any of the vernal pools in the PSA. All of the other alternative combinations would impact those vernal pools to a generally similar extent. SED 3/FP 3, SED 5/FP 4, and SED 6/FP 4 would involve excavation in 58 of the 66 vernal pools in the PSA, impacting 15 acres of vernal pool habitat. SED 8/FP 7 and SED 9/FP 8 would both involve such activities in 61 of the 66 vernal pools, impacting 17 to 18 acres of vernal pool habitat. The impacts of all combinations on the 100-foot and 100- to 750-foot zones around the vernal pools in the PSA were shown in Table 8-5 in Section 8.2.4.3 above.

Carbon Footprint – GHG Emissions

As described in Section 5.6 and Appendix M, an estimate has been developed of the carbon footprint (i.e., GHG emissions) anticipated to occur through sediment removal/capping, floodplain soil and tree removal, and related ancillary activities during the implementation of the sediment-floodplain alternative combinations under evaluation. Table 8-29 below summarizes the total carbon footprint associated with each combination, including a breakdown of direct, indirect, and off-site emission sources. To provide context regarding the emissions reported below, the number of passenger vehicles that would emit an equivalent quantity of CO_2-eq in one year is also presented in the table.

Table 8-29 – Calculated GHG Emissions Anticipated to Result from Combinations of Sediment and Floodplain Alternatives

Alternative	Total GHG Emissions (tonnes)	Direct Emissions (tonnes)	Indirect Emissions (tonnes)	Off-site Emissions (tonnes)	No. Vehicles w/ Equivalent Annual Emissions
SED 2/FP 1	---	---	---	---	---
SED 3/FP 3	47,000	26,000	1,200	20,000	9,000
SED 5/FP 4	100,000	46,000	2,300	53,000	19,100
SED 6/FP 4	140,000	65,000	3,500	72,000	26,800
SED 8/FP 7	520,000	220,000	10,300	290,000	99,400
SED 9/FP 8	190,000	79,000	3,800	110,000	36,300
SED 10/FP 9	40,000	12,000	900	27,000	7,600

As shown in this table, SED 10/FP 9 would have the lowest amount of total GHG emissions (40,000 tonnes); SED 3/FP 3 would have the next lowest amount (47,000 tonnes); SED 5/FP 4, SED 6/FP 4, and SED 9/FP 8 would have between 100,000 and 190,000 tonnes of such emissions; and SED 8/FP 7 would have by far the greatest amount of GHG emissions (520,000 tonnes).[474]

Impacts on Local Communities and Communities Along Truck Transport Routes

Implementation of all combinations of sediment and floodplain alternatives (except SED 2/FP 1) would result in short-term impacts to the local communities along the River. These short-term effects would include changes to the visual appearance of the River, riverbanks, and affected areas of the floodplain, as well as disruption of recreational activities in those areas, due to the remediation as well as the construction of access roads and staging areas. They would also include increased construction traffic, noise, and nuisance dust in those areas.

Construction activities would affect recreational activities along the River and in the floodplain. Depending on the particular combination of alternatives, these would include fishing, canoeing (including canoe launches), hiking, dirt biking, general recreation, and

[474] As described in Appendix M, comparison among the three emission categories indicates that, on average, off-site emissions account for more than half of the GHG emissions for each combination (the most significant off-site sources being steel sheeting manufacture [with the exception of SED 9] and production of cement to be used in sediment stabilization). Direct emissions sources (including those associated with construction and transportation activities) generally account for 40-50% of the total GHG emissions.

both waterfowl and other game hunting. During the period of active construction, restrictions on recreational uses of the River and floodplain would be imposed in the areas where remediation-related activities are taking place. Due to safety considerations, boaters, anglers, hikers, hunters, and other recreational users would not be able to use the River, floodplain, or riverbank in the construction and support areas. Aesthetically, the presence of heavy construction equipment and cleared or disturbed areas would detract from the visually undisturbed nature of the area.

The extent of these impacts on River and floodplain use would vary depending on the overall area affected by remediation and support facility construction, as well as the length of time required to complete the remediation. (As noted above, although these impacts would not last for the entire duration of the project in all affected areas, the total implementation duration represents the overall time period over which short-term impacts would occur in some portion of the Rest of River area.) These impacts would be least for SED 10/FP 9 (91 acres, 5 years). They would be substantially more extensive and disruptive for SED 3/FP 3 (237 acres, 10 years), SED 5/FP 4 (410 acres, 18 years), SED 6/FP 4 (447 acres, 21 years), and SED 9/FP 8 (469 acres, 14 years). The combination with the greatest impact on these uses of the River and floodplain is SED 8/FP 7 (774 acres, 52 years).

In addition, due to the need to deliver equipment to the work areas, remove excavated materials, and deliver capping, backfill, and bank stabilization materials to the site, truck traffic would increase substantially over current conditions. This additional traffic would increase the likelihood of accidents, noise levels, emissions of vehicle/equipment exhaust, and nuisance dust to the air, and would persist over the duration of remedial activities. Table 8-30 summarizes the number of truck trips associated with transporting excavated materials from the staging areas to the disposal or treatment facilities and delivering capping/backfill and bank stabilization materials to the remediation areas.

Table 8-30 – Estimated Truck Trips for Removal of Excavated Material and Delivery of Capping/Backfill Material for Combinations of Sediment and Floodplain Alternatives

Alternative	Truck Trips for Excavated Material	Truck Trips for Capping/Backfill Material	Total Truck Trips
SED 2/FP 1	---	---	---
SED 3/FP 3	20,100 (2,000)	29,600 (3,000)	49,700 (5,000)
SED 5/FP 4	44,300 (2,500)	71,200 (4,000)	115,500 (6,500)
SED 6/FP 4	56,100 (2,700)	80,500 (3,800)	136,600 (6,500)
SED 8/FP 7	242,000 (4,700)	273,300 (5,300)	515,300 (10,000)
SED 9/FP 8	90,800 (6,500)	97,600 (7,000)	188,400 (13,500)
SED 10/FP 9	22,200 (4,400)	9,400 (1,900)	31,600 (6,300)

Notes:

1. Truck trips estimated assuming 20-ton capacity trucks for hauling excavated material and 16-ton trucks for local hauling of capping/backfill material.
2. Capping material includes cap, thin-layer cap, backfill, and bank stabilization materials.
3. The number in parentheses represents average annual truck trips.

As shown in this table, apart from SED 2/FP 1, SED 10/FP 9 would involve the fewest number of total truck trips (31,600) and SED 3/FP 3 would involve the next fewest (49,700). SED 5/FP 4, SED 6/FP 4, and SED 9/FP 8 would involve between 115,500 and 188,400 truck trips; and SED 8/FP 7 would require by far the most total truck trips (approximately 515,000). However, on an annual basis, SED 9/FP 8 would involve the greatest number of truck trips per year (13,500).

The additional truck traffic would also increase the risk of traffic accidents along transport routes. Appendix N includes an estimate of the number of injuries or fatalities from the increased off-site truck traffic that would be associated with the combinations of sediment and floodplain alternatives under evaluation.[475] A summary of that analysis is presented in Table 8-31 below.

[475] This analysis quantified transport-related risks only for trucks used to import capping, backfill, and bank stabilization materials to the site over public roads, as well as to dispose of materials used for the staging areas and access roads following completion of remediation. The risks from transporting excavated materials to the staging areas are evaluated as part of risks to workers, discussed below; and the risks from transporting such materials from the staging areas to local or off-site disposal or treatment facilities are evaluated as either worker risks or traffic accident risks under the relevant treatment/disposition alternatives.

Table 8-31 - Incidence of Accident-Related Injuries/Fatalities Due to Increased Truck Traffic

Impacts	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Non-Fatal Injuries							
Number	---	1.98	3.29	4.03	11.0	5.43	1.09
Average Annual Number	---	0.21	0.18	0.19	0.21	0.40	0.21
Probability[1]	---	0.86	0.96	0.98	1.00	1.00	0.66
Fatalities							
Number	---	0.09	0.15	0.19	0.51	0.25	0.05
Average Annual Number	---	0.010	0.008	0.009	0.010	0.019	0.010
Probability[1]	---	0.09	0.14	0.17	0.40	0.22	0.05

Note:

1. Probability indicates the probability of at least one injury/fatality.

As shown in Table 8-31, the incidence of potential injuries from accidents associated with increased truck traffic would be lowest for SED 10/FP 9 (1.09 injuries), with estimated injuries for the other alternatives ranging from 1.98 (SED 3/FP 3) to 11.0 (SED 8/FP 7). Similarly, estimated fatalities due to increased truck traffic are lowest for SED 10/FP 9 (0.05), with estimated fatalities for the other alternatives ranging from 0.09 (SED 3/FP 3) to 0.51 (SED 8/FP 7).

Potential Measures to Avoid, Minimize or Mitigate Short-Term Community Impacts

A number of measures would be employed in an effort to avoid, minimize, and mitigate potential detrimental effects of construction activities on the affected communities.[476] These measures were identified in Section 5.7. Despite the implementation of these measures, however, detrimental effects of construction and short-term impacts and risks associated with implementation of each of the combinations of alternatives, except SED 2/FP 1, would be inevitable. As would be expected, the level of impact is related to the scale/scope of the alternative and the time period of construction. Therefore, SED 8/FP 7 would have the

[476] The measures considered to avoid or minimize adverse short-term ecological effects were described in Section 5.2.

most significant effect on local communities and would require the greatest degree of mitigation. SED 10/FP 9 would have the least such effect.

Risks to Remediation Workers

There would be health and safety risks to site workers implementing each of these combinations of sediment and floodplain alternatives. An estimate of the injuries or fatalities to workers from implementation of the alternative combinations is also provided in Appendix N. The results of that analysis are summarized in Table 8-32.

Table 8-32 – Incidence of Accident-Related Injuries/Fatalities Due to Implementation of Sediment-Floodplain Alternative Combinations

Impacts	SED 2/ FP 1[1]	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Labor-hours (hours)	---	597,504	1,071,053	1,154,960	3,281,738	1,179,703	285,106
Duration (yrs)	---	10	18	21	52	14	5
Non-Fatal Injuries							
Number	---	5.5	9.9	10.7	30.2	10.9	2.6
Average Annual Number	---	0.55	0.55	0.51	0.58	0.78	0.53
Probability[2]	---	1.00	1.00	1.00	1.00	1.00	0.93
Fatalities							
Number	---	0.05	0.11	0.11	0.34	0.13	0.03
Average Annual Number	---	0.005	0.006	0.005	0.007	0.009	0.005
Probability[2]	---	0.05	0.10	0.11	0.29	0.12	0.03

Notes:

1. While the monitoring activities under SED 2 would involve the potential for accidents to site workers involved in those activities, these risks would be minimal, and would be mitigated through implementation of health and safety measures similar to those successfully applied during such activities on the River in the past.
2. Probability indicates the probability of at least one injury/fatality.

Table 8-32 shows that risks to site workers would be lowest with SED 10/FP 9 (2.6 injuries), with the estimated injuries for all other alternatives at least twice that of SED 10/FP 9, ranging from 5.5 (SED 3/FP 3) to 30.2 (SED 8/FP 7). Similarly, estimated fatalities for site workers are lowest for SED 10/FP 9 (0.03), with estimated fatalities for the other alternatives ranging from 0.05 (SED 3/FP 3) to 0.34 (SED 8/FP 7).

8.2.8 Implementability

8.2.8.1 Technical Implementability

The equipment, materials, technology, procedures, and personnel necessary to implement and monitor the effectiveness of the combinations of sediment and floodplain alternatives are expected to be readily available.

All of these combinations except SED 9/FP 8 would be implemented using well-established and available in-river remediation and floodplain soil removal methods and equipment, available construction technologies to build land-based support facilities, and readily available methods to implement monitoring and institutional controls. As discussed under the individual alternatives, the specific technologies involved in these combinations are considered suitable for implementation in the areas where they would be applied. The remedial components selected (i.e., sediment removal in the dry or wet, sediment capping and thin-layer capping, floodplain soil removal and backfilling, and MNR) have been used in similar applications as part of previous work at the Pittsfield/Housatonic River Site and at other sites. However, as discussed in Section 6.9.9.1, there are several aspects of the removal/capping/bank remediation approach for Reach 5A under SED 9/FP 8 (using the techniques suggested by EPA) that make its feasibility and/or ability to achieve the production and resuspension rates directed by GE highly questionable.

As described in Section 8.2.4.2, while most of the individual components of these combinations are considered technically implementable, available information regarding remedies at other sediment sites indicates that there have been a limited number of dredging/removal projects of the magnitude of several of the combinations being considered here (i.e., SED 3/FP 3, SED 5/FP 4, SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8), and none of them was conducted in a setting comparable to the Rest of River. As a result, implementation of these combinations would involve complications and uncertainties that have not been encountered at other sites to date and that would not be faced (or would be less significant) for a smaller-scale alternative such as SED 10/FP 9. These include: difficulties associated with contracting over time periods of more than a decade; uncertainties in obtaining the large quantities of capping and backfill materials that would be needed for such large-scale projects (which would range from approximately 308,000 cy to approximately 2.9 million cy, as shown in Table 8-33 below); greater potential for impacts from releases during implementation; and uncertainties in the availability of landfill capacity or treatment capabilities (depending on the treatment/disposition alternative selected). Thus, the technical implementability factor favors alternatives with less remediation and a shorter duration, such as SED 10/FP 9.

Table 8-33 – Required Capping/Backfill/Stabilization Material Volumes for Combinations of Sediment and Floodplain Alternatives

Combination	Sand (cy)	Armor Stone/ Riprap (cy)	Soil Backfill (cy)	Total Material (cy)
SED 2/FP 1	---	---		---
SED 3/FP 3	150,800	76,100	81,000	307,900
SED 5/FP 4	372,800	246,100	133,000	751,900
SED 6/FP 4	438,800	279,100	133,000	850,900
SED 8/FP 7	1,976,800	255,100	677,000	2,908,900
SED 9/FP 8	446,800	221,400	195,000	863,200
SED 10/FP 9	33,500	34,900	29,000	97,400

Note: Sand and armor stone/riprap quantities include materials for caps, thin-layer caps, and backfill in the River, as well as bank stabilization. Soil backfill includes the backfill to be placed in floodplain excavations.

In addition, as discussed in Sections 5.3 and 8.2.4.2, while habitat restoration techniques are available, there are significant constraints on those techniques' ability to re-establish the prior conditions and functions of the affected habitats. As a result, restoration would not reliably re-establish pre-remediation conditions for some of these habitats for many decades, would likely never do so for some habitats, and would have considerable uncertainties for others. These problems are most severe for the combinations that would impact a substantial amount of these habitats (i.e., SED 3/FP 3, SED 5/FP 4, SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8). Under SED 10/FP 9, which would have more limited impacts, the likelihood of effective restoration is higher.

8.2.8.2 Administrative Implementability

In terms of administrative implementability, all alternative combinations would need to comply with the substantive requirements of regulations designated as ARARs for the performance of the remedial action (unless waived). An assessment of compliance with potential ARARs for all of the sediment-floodplain alternative combinations under evaluation was presented in Section 8.2.3.

Implementation of all combinations, except SED 2/FP 1, would also require GE to obtain permission for access to the properties where the work would be conducted or where the support facilities would be located. Although many of these properties are owned by the Commonwealth or the City of Pittsfield (which have agreed to allow access), it is anticipated that access agreements would be required from numerous other property owners – up to approximately 35 such landowners for SED 10/FP 9, 35 to 45 for SED 3/FP 3, 40 to 50 for SED 5/FP 4, 50 to 60 for SED 6/FP 4 and SED 9/FP 8, and 80 to 95 for SED 8/FP 7. Obtaining access to all these properties for the type of work and length of time that may be needed would likely be difficult and time-consuming. The more properties and owners involved, the greater the potential for problems and delays in obtaining access.

Finally, while all of the combinations would include coordination with EPA and/or state agencies in implementation of biota consumption advisories and other institutional controls (e.g., EREs and Conditional Solutions), obtaining access to state-owned lands, and public/community outreach programs, the alternatives with a greater extent of remediation and a longer implementation time would likely require more extensive and prolonged coordination activities.

8.2.9 Cost

The estimated costs for each of the combinations of sediment and floodplain alternatives under evaluation, including total capital costs, estimated annual OMM costs, and total estimated present worth costs, are summarized in Table 8-34 below. These estimates do not include costs associated with disposition/treatment of any removed sediments/soils.

Table 8-34 - Cost Summary for Combinations of Sediment & Floodplain Alternatives

Total Cost	SED 2/ FP 1	SED 3/ FP 3	SED 5/ FP 4	SED 6/ FP 4	SED 8/ FP 7	SED 9/ FP 8	SED 10/ FP 9
Capital ($ M)	0	166.4	307.5	384.6	899.7	380.8	83.5
OMM ($ M)	5.0	10.2	11.9	12.8	17.0	12.9	10.0
Total ($ M)	5.0	177	319	397	917	394	93.5
Present Worth ($ M)	1.8	133	193	219	300	251	78

Notes:

1. All costs are in 2010 dollars. $ M = million dollars.
2. Total capital costs are for engineering, labor, equipment, and materials associated with implementation.
3. Total OMM costs include costs for post-construction inspections and repair activities (if necessary) and for the maintenance of institutional controls.
4. Total present worth cost is based on using a discount factor of 7%, considering the length of the construction period and an OMM period of 100 years on a reach-specific basis.

As noted above, the total costs for these combinations of sediment and floodplain alternatives (without considering treatment/disposition costs) range from $5 M (for SED 2/FP 1) to $917 M (for SED 8/FP 7).

8.2.10 Overall Protection of Human Health and the Environment – Conclusions

As indicated in Section 8.2.1, the evaluation of whether a combination of remedial alternatives would provide overall human health and environmental protection relies on a number of other factors. These include long-term effectiveness, compliance with ARARs, attainment of IMPGs, existence of institutional controls for human health protection, likely impacts of PCBs on local populations and communities of ecological receptors, and long-term and short-term adverse impacts from implementation of the remediation work. A comparative evaluation of the alternative combinations considering these factors is presented below.

General Effectiveness: As discussed previously, completed and ongoing upstream source control and remediation measures and natural recovery processes (notably, silting-over with cleaner sediments) have significantly reduced, and will continue to reduce, PCB concentrations and potential human and ecological exposures to PCBs in sediments, surface water, and fish in the Rest of River. SED 2/FP 1 would rely on those processes. That combination is predicted by EPA's model to result in a permanent reduction in PCB concentrations in those media and a permanent reduction in PCB loading to the River and PCB transport to the floodplain. For example, based on the model results, SED 2/FP 1 would result in reductions of 40% to 60% in fish PCB concentrations relative to current levels (depending on the river reach). It would also result in reductions of 37% and 41% in the mass of PCBs passing Woods Pond and Rising Pond Dams, respectively, and a reduction of 50% in the mass of PCBs transported from the River to the floodplain in the PSA. While this combination would not involve floodplain remediation, the residual risks from exposure to floodplain soils under current conditions are limited, as shown in Section 8.2.5. Further, PCB concentrations in floodplain surface soils in certain areas may decrease over time due to deposition of cleaner sediments on top of them and other natural attenuation processes.

The other combinations of sediment and floodplain alternatives would result in additional reductions in PCB concentrations and potential exposures by permanently removing PCB-containing sediments, stabilizing and removing riverbank soils, capping certain areas of the River, and removing PCB-containing floodplain soils. For example, based on the model results, SED 10/FP 9 would result in total reductions of 60% to 80% in fish concentrations, a reduction of 62% in the PCB mass passing both Woods Pond and Rising Pond Dams, and a reduction of 68% in the PCB mass transported from the River to the PSA floodplain. SED 3/FP 3 would result in total reductions of 75% to nearly 100% in fish concentrations, reductions of 94% and 87% in the PCB mass passing Woods Pond and Rising Pond Dams, and a reduction of 97% in the PCB mass transported from the River to the PSA floodplain. The remaining combinations would result in only incrementally more reductions, resulting in total reductions in fish concentrations that are generally greater than 90% and reductions in PCB mass transport that are generally greater than 95% – despite the substantially greater extent of disturbances to the River.

For the floodplain, these combinations would involve removal of progressively more PCB-containing soil – from SED 10/FP 9 to SED 3/FP 3 to SED 5/FP 4 and SED 6/FP 4 to SED 9/FP 8 and finally to SED 8/FP 7. At the same time, while these combinations would reduce floodplain PCB concentrations over increasingly greater areas, they would also have increasingly greater adverse impacts on the diverse ecological habitats within the floodplain and the plants and animals that use them.

Compliance with ARARs: Section 8.2.3 shows the following with respect to the compliance of the combinations of remedial alternatives with requirements that have been identified as potential ARARs:

- Based on forecasts using EPA's model, SED 2/FP 1 and SED 10/FP 9 would not achieve the federal and state water quality criterion for freshwater aquatic life (0.014 µg/L) in Massachusetts (but would in Connecticut). According to the same model, the other sediment-floodplain alternative combinations would achieve that criterion. However, where it is not met, this criterion should be waived on the ground that the actions necessary to achieve it would result in a greater risk to the environment than alternatives that do not achieve that criterion.

- EPA's model indicates that none of the sediment-floodplain alternative combinations would achieve the federal and Massachusetts water quality criterion based on human consumption of organisms (0.000064 µg/L) in any of the Massachusetts reaches or in one or more of the four Connecticut impoundments.[477] For that reason, that criterion should be waived as technically impracticable to meet.

- SED 2/FP 1 would achieve all the relevant location-specific and action-specific ARARs (since SED 2 would meet the ARARs relating to MNR and there are no ARARs for FP 1). The other sediment-floodplain alternative combinations could be designed and implemented to achieve certain of the potential location-specific and action-specific ARARs, but there are a number of federal and state regulatory

[477] In addition, none of the combinations would achieve the CDEP's proposed revised health-based water quality criterion of 0.00000056 µg/L in any of the Connecticut impoundments.

requirements that would not be met (including those relating to the Upper Housatonic ACEC). To the extent that these requirements constitute ARARs, they would need to be waived by EPA as technically impracticable to meet (or on some other ground) under CERCLA and the NCP. The requirements that would not be met, and thus would require waivers, are fewer under SED 10/FP 9 than under the other combinations of alternatives.

- Under all of the sediment-floodplain removal combinations, it is possible that, in the unlikely event that excavated sediments or soils should be found to constitute hazardous waste under RCRA or comparable state regulations (which is not anticipated) and that the temporary staging areas for the handling of those materials are subject to federal and/or state hazardous waste regulations, those temporary staging areas may not meet certain requirements for the storage of hazardous waste. In that unlikely event, such requirements should be waived as technically impracticable. This possibility applies equally to all of these combinations.

Human Health Protection: As shown in Section 8.2.5.1, in terms of direct contact with sediments and floodplain soils, all of the combinations of sediment and floodplain alternatives under evaluation would achieve RME direct contact IMPGs within or below EPA's cancer risk range in all sediment and floodplain exposure areas. In addition, all of these combinations would achieve the RME IMPGs based on non-cancer impacts in all such exposure areas, except that SED 2/FP 1 would not achieve those IMPGs in 24 of the 120 floodplain exposure areas. Thus, even if governed by EPA's HHRA, all of these combinations would provide protection of human health from direct contact with sediments and soils, with the exception of potential non-cancer effects in a few floodplain areas under SED 2/FP 1. For human consumption of agricultural products from the floodplain, all of the sediment-floodplain alternative combinations would achieve IMPGs within or below EPA's cancer risk range, as well as the non-cancer IMPGs, in all farm areas evaluated for such consumption.

For human consumption of fish, the fish PCB concentrations predicted to result in Reaches 5 through 8 from all sediment-floodplain alternative combinations at the end of the modeled period, when converted to fillet concentrations, would not achieve both the cancer- and the non-cancer-based IMPGs based on unrestricted fish consumption in those reaches. As a result, under all combinations, institutional controls (fish consumption advisories) would continue to be utilized for the foreseeable future in Massachusetts to provide human health protection from fish consumption. In the four Connecticut impoundments, where fish PCB concentrations are already much lower, estimates from the CT 1-D Analysis indicate that all of the combinations would achieve very low PCB levels in fish – i.e., 0.1 mg/kg or lower (except in one impoundment under SED 2/FP 1) – by the end of the model period.[478] Given the uncertain nature of the specific numbers estimated by this extrapolation procedure, all that can be concluded is that, at some point, the fish PCB concentrations achieved in the Connecticut impoundments under all of the combinations of alternatives should allow the CDPH to remove the fish consumption advisories for PCBs, and that in the meantime those advisories will need to remain in place to provide human health protection.

In addition, in considering overall protection of human health, it should be noted that the larger combinations of sediment and floodplain alternatives would result in a greater risk of fatalities and injuries, both to on-site workers as a result of workplace accidents and to the public as a result of traffic accidents, as discussed in Section 8.2.7. SED 10/FP 9 would involve the least such risk.

Environmental Protection: As EPA guidance makes clear, the standard of "overall protection" of the environment requires a balancing of the short-term and long-term adverse ecological impacts of the alternatives with the residual risks (EPA, 1990a, 1997a, 1999, 2005d). Thus, in assessing achievement of that standard, it is essential that any asserted risks of PCBs be weighed against the adverse ecological impacts from implementation of the remedial alternatives.

The application of the ecological IMPGs to the sediment-floodplain alternative combinations under evaluation was described in Section 8.2.5.2. As shown there, SED 2/FP 1, SED 10/FP 9, SED 3/FP 3, and SED 5/FP 4 would achieve the IMPGs for some ecological receptor groups in all areas and would achieve the IMPGs for other receptor groups in some areas. Specifically:

- SED 2/FP 1 would achieve the IMPGs for warmwater fish protection and for threatened and endangered species in all averaging areas and would achieve levels within the IMPGs range for other receptors (benthic invertebrates, amphibians, insectivorous birds, and omnivorous/carnivorous mammals) in some areas. It would not achieve the IMPGs in any area for coldwater fish, piscivorous birds, or piscivorous mammals.

- SED 10/FP 9 would achieve the IMPGs for warmwater fish and threatened and endangered species, as well as levels within the range of the IMPGs for

[478] These estimates indicate that all of the combinations would achieve the RME IMPGs based on a 10^{-4} cancer risk in all impoundments within that period, and that SED 2/FP 1, SED 10/FP 9, and SED 3/FP 3 would achieve some of the non-cancer RME IMPGs in some impoundments, while the remaining combinations would achieve all of those IMPGs in all impoundments. However, given the highly uncertain nature of these extrapolations, such fine distinctions among alternatives at such low PCB levels are not reliable.

omnivorous/carnivorous mammals, in all averaging areas. In addition, it would achieve levels within the range of the IMPGs for benthic invertebrates in 84% of the averaging areas, for amphibians in 21% of the averaging areas, and for insectivorous birds in 58% of the areas. It would not achieve such levels in any area for coldwater fish, piscivorous birds, or piscivorous mammals.

- SED 3/FP 3 would achieve the IMPGs for warmwater fish and threatened and endangered species, as well as levels within the range of the IMPGs for benthic invertebrates and omnivorous/carnivorous mammals, in all averaging areas. In addition, it would achieve levels within the IMPG range for amphibians in 85% of the averaging areas, for coldwater fish in 88% of the areas, for insectivorous birds in 83% of the areas, and for piscivorous birds in 43% of the areas. It would not achieve such levels in any area for piscivorous mammals.

- SED 5/FP 4 would achieve the IMPGs for warmwater and coldwater fish, insectivorous birds, and threatened and endangered species – as well as levels within the IMPG range for benthic invertebrates, piscivorous mammals, and omnivorous/ carnivorous mammals – in all averaging areas. In addition, it would achieve levels within the IMPG range for amphibians in 98% of the averaging areas and for piscivorous birds in 93% of the areas.

The remaining combinations – SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8 – would achieve the ecological IMPGs or levels within the ranges of those IMPGs for all receptor groups in all averaging areas.

However, as discussed in Section 2.1.1, attainment of IMPGs, as only one of the Selection Decision Factors under the Permit, is not determinative of whether an alternative would provide overall protection of the environment, but rather is a consideration to be balanced against the other Selection Decision Factors. The fact that there are exceedances of the IMPGs for certain receptors does not translate into adverse impacts on the local populations of those receptors, let alone adverse impacts on the overall wildlife community in the Rest of River area. This is true, first, because of the highly conservative nature of the averaging areas and the fact that the local populations of these receptors extend beyond the individual averaging areas.[479] Furthermore, field surveys conducted by both EPA and GE, as well as other existing ecological information identified in Section 5.1.1, have

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[479] For example, as discussed in Section 4.2.3. the local populations of wood frogs, wood ducks, and shrews (as representative of amphibians, insectivorous birds, and omnivorous/carnivorous mammals) extend throughout the PSA; and the local population of mink (as representative of piscivorous mammals) extends beyond the PSA to areas near the shoreline but outside the defined floodplain, as well as to tributaries of the River and to other riverine areas in the vicinity.

documented the presence in the PSA of numerous and diverse plant and animal species, including state-listed rare species, that continue to reproduce and inhabit the River and floodplain despite the fact that PCBs have been present in this area for over 70 years. Thus, even accepting the IMPGs based on EPA's ERA, the impact of the IMPG exceedances on the maintenance of healthy local populations of these receptors is at best uncertain.

Moreover, as noted above, the standard of "overall protection" of the environment requires a balancing of the short-term and long-term adverse ecological impacts of the alternatives with the residual risks. In particular, "it is important to determine whether the loss of a contaminated habitat is a greater impact than the benefit of providing a new, modified but less contaminated habitat" (EPA, 2005d, p. 6-6). Thus, it is critical that any uncertain risks that may be evidenced by IMPG exceedances be weighed against the certain adverse impacts of further efforts to achieve the ecological IMPGs. As shown in Section 8.2.7, implementation of any of the sediment-floodplain alternative combinations except SED 2/FP 1 and SED 10/FP 9 would cause substantial and widespread adverse short-term impacts on the environment. Even more significantly, as shown in Section 8.2.4.7, despite the implementation of restoration measures, implementation of those combinations would result in devastating and widespread long-term and, in some cases, permanent adverse impacts on the ecosystem of the PSA and the plants and animals that use it. For example, those combinations would result in extensive fragmentation of the contiguous, largely undisturbed forested riparian/floodplain corridor in the PSA and the diverse riverine and wetland/floodplain habitats and wildlife that it contains. These impacts would cause severe harm to the animals that the IMPGs were designed to protect and thus result in a net negative ecological impact on the PSA.

Implementation of SED 2/FP 1 would not produce any of these adverse impacts. While SED 10/FP 9 would have some short-term and long-term adverse ecological effects, it would minimize those impacts relative to the larger combinations and would not be expected to produce widespread long-term impacts on the overall environment of the PSA. Based on balancing adverse impacts with uncertain risks, SED 10/FP 9 would provide overall protection of the environment, since it would (a) reduce the PCB exposure levels of ecological receptors and provide additional protection from the perceived PCB effects reported in EPA's ERA, while at the same time (b) causing the least amount of environmental damage of any of the combinations involving removal.

Summary: Based on EPA's conclusions in the HHRA and ERA (which GE has been directed to follow by EPA), SED 2/FP 1 would not be fully protective of human health and the environment due to the exceedances of the non-cancer RME IMPGs for direct contact in a number of floodplain exposure areas and due to the number and extent of exceedances of the ecological IMPGs (although the impact of these exceedances on the maintenance of healthy local populations of the wildlife receptors is still uncertain). However, GE does not accept EPA's conclusions in the HHRA and ERA or the IMPGs based thereon.

All of the other combinations of sediment and floodplain alternatives would meet the standard of providing overall protection of human health for the reasons given above. However, all of those combinations other than SED 10/FP 9 would not meet the standard of providing overall protection of the environment due to the extensive long-term harm to the environment that would result from their implementation. SED 10/FP 9 would meet that standard based on the balancing described above.

8.3 Conclusions

For the reasons given above, the combination of SED 10/FP 9 would meet the General Standards of the Permit, since it would provide overall protection of human health and the environment, would control sources of releases, and would meet pertinent ARARs or qualify for a waiver of those requirements. Based on EPA's conclusions in the HHRA and ERA (which GE does not accept), SED 2/FP 1 would not be fully protective of human health and the environment. The remaining combinations under evaluation (SED 3/FP 3, SED 5/FP 4, SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8), while providing protection of human health, would not provide overall protection of the environment due to their severe adverse impacts on the Rest of River ecosystem.

Further, consideration and balancing of the Selection Decision Factors in the Permit show that SED 10/FP 9 is "best suited" to meet those General Standards in light of the Selection Decision Factors. The principal reasons are that, among the combinations of alternatives involving removal, SED 10/FP 9 would cause the fewest long-term and short-term adverse ecological impacts and the least disruption to the local communities, and would have the fewest implementability problems and the lowest cost.

Table 8-7a. Evaluation of attainment of RME IMPGs for human direct contact exposure areas for combined SED/FP scenarios.

Exposure Area ID[1]	Area of Exposure Area (acre)[2]	Exposure Scenario	Floodplain Pre-Remediation EPC (mg/kg)[3]	Floodplain Post-Remediation EPC (mg/kg) / Projected Sediment Concentrations (mg/kg)							10^{-6} Cancer Risk (RME)								10^{-5} Cancer Risk (RME)								10^{-4} Cancer Risk (RME)								Non-cancer (RME)							
				SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4,5]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Floodplain Human Direct Contact Areas																																										
1	15	Medium-use general recreation, adult / older child	32	32	23	21	21	1.6	6.3	32	2.1								21								215								40							
2	27	High-use general recreation, adult / older child	25	25	20	14	14	1.9	14	25	2.0								14								143								27							
2a	2.3	Low-use general recreation, older child	52	52	42	21	21	1.5	21	51	12								116								1165								80							
2b	2.0	High-use general recreation, older child	31	31	27	27	27	3.8	27	27	3.9								39								388								27							
3	0.38	High-use general recreation, adult	7.8	7.8	7.8	7.8	7.8	2.0	7.8	7.8	2.0								14								143								38							
4	3.2	High-use general recreation, adult / older child / young child (low use)	27	27	14	14	14	1.6	14	26	2.0								14								143								27							
5	2.5	High-use general recreation, adult / older child	58	58	25	14	14	2.0	14	27	2.0								14								143								27							
6	3.8	Low-use general recreation, adult	75	75	28	28	28	1.3	25	75	4.3								43								429								115							
7	5.9	High-use general recreation, adult / older child	25	25	25	14	14	2.0	14	25	2.0								14								143								27							
8	0.60	Recreational canoeist	40	40	28	12	12	2.0	12	28	2.0								12								121								28							
9	0.042	Low-use general recreation, older child	27	27	27	27	27	12	27	27	12								116								1165								80							
10	59	High-use general recreation, adult / young child (high use)	10	10	4.6	4.6	4.6	2.0	4.6	4.6	2.0								13								134								4.6							
10a	8.0	High-use general recreation, adult / young child (high use)	22	22	4.5	4.5	4.5	2.0	4.5	4.5	2.0								13								134								4.6							
11	2.5	High-use general recreation, adult	18	18	18	14	14	2.0	14	18	2.0								14								143								38							
12	4.8	High-use general recreation, adult / older child / young child (low use)	14	14	14	5.3	5.3	1.6	5.3	14	2.0								14								143								27							
13	5.9	High-use general recreation, adult	28	28	27	13	13	2.0	13	28	2.0								14								143								38							
14	4.1	High-use general recreation, adult	2.7	2.7	2.6	2.6	2.6	1.6	2.6	2.7	2.0								14								143								38							
15	0.87	High-use general recreation, adult	2.2	2.2	2.2	2.2	2.2	2.0	2.2	2.2	2.0								14								143								38							
16	2.5	High-use general recreation, adult	41	41	38	14	14	2.0	14	38	2.0								14								143								38							
17	8.5	High-use general recreation, adult	15	15	15	14	14	2.0	14	15	2.0								14								143								38							
18	17	Medium-use general recreation, adult	46	46	46	21	21	2.1	19	46	2.1								21								215								58							
19	36	High-use general recreation, adult	83	83	20	14	14	1.6	14	38	2.0								14								143								38							
20	9.1	High-use general recreation, adult	34	34	22	14	14	2.0	9.0	34	2.0								14								143								38							
21	2.9	High-use general recreation, adult / older child	5.7	5.7	5.1	5.7	5.7	2.0	5.0	5.7	2.0								14								143								27							
22	19	High-use general recreation, adult / older child	28	28	23	14	14	1.5	13	26	2.0								14								143								27							
22a	1.8	Dirt biking/ATVing	93	93	8.2	8.2	8.2	2.0	8.2	8.2	2.0								20								205								14							
23	0.28	Medium-use general recreation, older child	11	11	11	11	11	5.8	10	11	5.8								58								582								40							
24	10	High-use general recreation, adult	31	31	26	13	13	1.3	12	31	2.0								14								143								38							
25	0.51	High-use general recreation, older child	30	30	27	27	27	3.9	16	27	3.9								39								388								27							
26a	48	High-use general recreation, adult / older child	7.0	7.0	6.9	6.9	6.9	1.9	6.9	7.0	2.0								14								143								27							
26b	7.6	Agricultural use (based on direct contact by farmer)	1.3	1.3	1.3	1.3	1.3	0.68	1.3	1.3	2.0								12								118								43							
26_F	55	High-use general recreation, adult / older child	6.1	6.1	6.0	6.0	6.0	1.7	6.0	6.1	2.0								14								143								27							
27	6.3	High-use general recreation, adult / older child	2.5	2.5	2.5	2.5	2.5	2.0	2.5	2.5	2.0								14								143								27							
27a	0.38	Dirt biking/ATVing	4.3	4.3	4.3	4.3	4.3	2.0	4.3	4.3	2.0								20								205								14							
28	0.21	High-use general recreation, adult / older child / young child (low use)	21	21	21	13	13	2.0	13	21	2.0								14								143								27							
28a	0.071	Dirt biking/ATVing	21	21	4.3	4.3	4.3	2.0	4.3	4.3	2.0								20								205								14							
29	0.34	Low-use general recreation, adult / older child	21	21	21	21	21	4.3	21	21	4.3								43								429								80							
30	0.19	High-use general recreation, adult / older child	18	18	18	14	14	2.0	14	18	2.0								14								143								27							
31	5.0	High-use general recreation, adult / older child	18	18	17	14	14	2.0	14	17	2.0								14								143								27							
31a	0.61	High-use general recreation, adult / older child	42	42	25	3.9	3.9	2.0	3.9	25	2.0								14								143								27							
32	6.8	High-use general recreation, adult	50	50	38	14	14	2.0	14	38	2.0								14								143								38							
33	30	High-use general recreation, adult	21	21	19	14	14	2.0	14	21	2.0								14								143								38							
34	7.8	Medium-use general recreation, adult	27	27	27	21	21	2.1	18	27	2.1								21								215								58							
35	25	High-use general recreation, adult / older child	22	22	22	14	14	2.0	14	22	2.0								14								143								27							
35a	1.2	High-use general recreation, adult / older child	44	44	13	4.4	4.4	2.0	4.4	27	2.0								14								143								27							
36a	16	Low-use commercial (groundskeeper scenario)	25	25	24	24	24	8.0	24	25	8.9								89								885								126							
36b	2.2	Agricultural use (based on direct contact by farmer)	15	15	15	12	12	2.0	12	15	2.0								12								118								43							
37	20	High-use general recreation, adult / older child	18	18	16	13	13	1.7	12	18	2.0								14								143								27							

Table 8-7a. Evaluation of attainment of RME IMPGs for human direct contact exposure areas for combined SED/FP scenarios.

Exposure Area ID[1]	Area of Exposure Area (acre)[2]	Exposure Scenario	Floodplain Pre-Remediation EPC (mg/kg)[3]	Floodplain Post-Remediation EPC (mg/kg) / Projected Sediment Concentrations (mg/kg)							10^{-6} Cancer Risk (RME)								10^{-5} Cancer Risk (RME)								10^{-4} Cancer Risk (RME)								Non-cancer (RME)							
				SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4,5]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
37a	1.4	Bank fishing	61	61	26	26	26	2.6	26	42	2.6								26								256								42							
37b	2.3	High-use general recreation, adult / older child	27	27	4.3	6.7	6.7	2.0	4.3	24	2.0								14								143								27							
38	13	High-use general recreation, adult	23	23	22	14	14	1.6	14	22	2.0								14								143								38							
38a	1.4	Bank fishing	71	71	42	18	18	2.6	18	42	2.6								26								256								42							
39	3.5	Marathon canoeist	30	30	6.8	6.8	6.8	2.0	6.3	13	2.0								7.8								78								13							
40	98	High-use general recreation, adult / young child (low use)	19	19	13	13	13	1.5	4.9	19	2.0								14								143								27							
40a	4.6	Bank fishing	120	120	42	25	25	2.6	22	42	2.6								26								256								42							
40b	1.1	High-use general recreation, adult / young child (low use)	11	11	11	11	11	2.0	11	11	2.0								14								143								27							
41	20	Medium-use general recreation, adult	27	27	24	21	21	1.8	20	26	2.1								21								215								58							
41a	2.4	Bank fishing	53	53	39	26	26	2.6	25	42	2.6								26								256								42							
42	14	Medium-use general recreation, adult	32	32	32	21	21	2.1	21	32	2.1								21								215								58							
42a	0.94	Bank fishing	25	25	25	25	25	2.6	25	25	2.6								26								256								42							
43	1.5	Medium-use general recreation, adult	27	27	27	14	14	2.1	6.3	27	2.1								21								215								58							
43a	0.24	Bank fishing	69	69	32	25	25	2.6	6.7	32	2.6								26								256								42							
44	2.2	High-use general recreation, adult	27	27	27	14	14	2.0	14	27	2.0								14								143								38							
45	17	High-use general recreation, adult	40	40	38	14	14	2.0	11	38	2.0								14								143								38							
46	7.2	High-use general recreation, adult	9.2	9.2	9.1	9.1	9.1	2.0	8.7	9.2	2.0								14								143								38							
47	1.0	Recreational canoeist	18	18	12	12	12	2.0	12	18	2.0								12								121								28							
47_F	0.12	Recreational canoeist	8.0	8.0	8.0	8.0	8.0	2.0	8.0	8.0	2.0								12								121								28							
48	6.5	High-use general recreation, adult	3.4	3.4	3.4	3.4	3.4	2.0	3.4	3.4	2.0								14								143								38							
49	7.7	Low-use general recreation, adult	63	63	63	43	43	4.3	33	63	4.3								43								429								115							
50	69	Low-use general recreation, adult	7.4	7.4	7.4	7.4	7.4	4.3	5.9	7.4	4.3								43								429								115							
50a	11	Waterfowl hunting	21	21	17	17	17	7.5	15	21	9.0								90								904								140							
51	87	Low-use general recreation, adult	7.1	7.1	7.1	7.1	7.1	4.3	6.7	7.1	4.3								43								429								115							
51a	32	Waterfowl hunting	23	23	23	23	23	8.4	20	23	9.0								90								904								140							
52	0.9	Recreational canoeist	6.5	6.5	5.9	5.9	5.9	2.0	5.9	6.5	2.0								12								121								28							
53	0.7	Recreational canoeist	18	18	11	11	11	2.0	6.1	15	2.0								12								121								28							
54	13	High-use general recreation, adult	6.5	6.5	6.3	6.3	6.3	1.9	5.0	6.5	2.0								14								143								38							
55	18	High-use general recreation, adult / young child (low use)	11	11	11	11	11	2.0	11	11	2.0								14								143								27							
55a	5.0	Waterfowl hunting	42	42	42	42	42	8.6	42	42	9.0								90								904								140							
56	32	Medium-use general recreation, adult / older child	37	37	37	21	21	2.1	21	37	2.1								21								215								40							
56a	10	Waterfowl hunting	51	51	51	45	45	9.0	45	51	9.0								90								904								140							
57	13	High-use general recreation, adult / young child (low use)	5.8	5.8	5.7	5.7	5.7	2.0	5.6	5.8	2.0								14								143								27							
58	1.3	High-use general recreation, adult	65	65	12	12	12	2.0	3.6	37	2.0								14								143								38							
59	1.9	High-use general recreation, adult / young child (low use)	18	18	14	14	14	2.0	14	18	2.0								14								143								27							
59a	0.83	Bank fishing	23	23	18	18	18	2.6	18	23	2.6								26								256								42							
60	0.84	High-use general recreation, adult / young child (low use)	7.4	7.4	7.4	7.4	7.4	2.0	7.4	7.4	2.0								14								143								27							
60a	0.16	Recreational canoeist	13	13	12	12	12	0.95	12	13	2.0								12								121								28							
61	3.3	Utility worker	42	42	27	23	23	0.77	23	42	17								169								1694								242							
62	1.6	Utility worker	280	280	68	37	37	5.4	37	68	17								169								1694								242							
63	0.67	Utility worker	84	84	65	24	24	8.6	24	84	17								169								1694								242							
64	0.61	Utility worker	42	42	25	3.9	3.9	1.5	3.9	25	17								169								1694								242							
65	3.9	Utility worker	18	18	17	17	17	17	17	18	17								169								1694								242							
66	1.7	Utility worker	25	25	12	11	11	5.6	11	24	17								169								1694								242							
67	0.31	High-use general recreation, adult	11	11	11	11	11	2.0	11	11	2.0								14								143								38							
68	0.090	High-use general recreation, adult	9.1	9.1	9.1	9.1	9.1	2.0	9.1	9.1	2.0								14								143								38							
69	1.9	High-use general recreation, adult	9.9	9.9	9.9	9.9	9.9	2.0	9.9	9.9	2.0								14								143								38							
70	19	High-use general recreation, adult / young child (high use)	3.1	3.1	3.1	3.1	3.1	2.0	2.9	3.1	2.0								13								134								4.6							
70a	1.2	Bank fishing	5.8	5.8	5.8	5.8	5.8	2.6	5.8	5.8	2.6								26								256								42							

Table 8-7a. Evaluation of attainment of RME IMPGs for human direct contact exposure areas for combined SED/FP scenarios.

Exposure Area ID[1]	Area of Exposure Area (acre)[2]	Exposure Scenario	Floodplain Pre-Remediation EPC (mg/kg)[3]	Floodplain Post-Remediation EPC (mg/kg) / Projected Sediment Concentrations (mg/kg)							10^{-6} Cancer Risk (RME)								10^{-5} Cancer Risk (RME)								10^{-4} Cancer Risk (RME)								Non-cancer (RME)							
				SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4,5]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
71	1.8	Bank fishing	5.5	5.5	5.5	5.5	5.5	2.6	5.5	5.5	2.6								26								256								42							
72	2.3	Bank fishing	11	11	11	11	11	2.6	11	11	2.6								26								256								42							
73	3.9	High-use general recreation, adult	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	2.0								14								143								38							
74	5.3	High-use general recreation, adult	5.4	5.4	5.4	5.4	5.4	2.0	5.4	5.4	2.0								14								143								38							
75	3.4	High-use general recreation, adult	15	15	15	14	14	2.0	14	15	2.0								14								143								38							
76	1.1	High-use general recreation, adult	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	2.0								14								143								38							
77	4.2	High-use general recreation, adult	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.0								14								143								38							
78	6.2	High-use general recreation, older child	3.9	3.9	3.9	3.9	3.9	3.8	3.9	3.9	3.9								39								388								27							
79	17	High-use general recreation, adult	3.1	3.1	3.1	3.1	3.1	2.0	3.1	3.1	2.0								14								143								38							
80a	9.5	Low-use general recreation, adult	7.7	7.7	7.7	7.7	7.7	3.9	7.7	7.7	4.3								43								429								115							
80b	20	Agricultural use (based on direct contact by farmer)	0.77	0.77	0.77	0.77	0.77	0.12	0.77	0.77	2.0								12								118								43							
81	33	Low-use general recreation, adult	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	4.3								43								429								115							
82	15	Low-use general recreation, adult	7.7	7.7	7.7	7.7	7.7	4.3	7.7	7.7	4.3								43								429								115							
83	22	High-use commercial (groundskeeper scenario)	6.5	6.5	6.5	6.5	6.5	2.0	6.5	6.5	2.0								18								177								25							
84	8.5	Low-use general recreation, adult	4.7	4.7	4.7	4.7	4.7	4.3	4.7	4.7	4.3								43								429								115							
85a	0.25	Recreational canoeist	8.5	8.5	8.5	8.5	8.5	2.0	8.5	8.5	2.0								12								121								28							
85b	10	High-use general recreation, older child	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	3.9								39								388								27							
86	118	High-use commercial (groundskeeper scenario)	2.5	2.5	2.5	2.5	2.5	2.0	2.5	2.5	2.0								18								177								25							
87	10	High-use general recreation, adult / young child (high use)	15	15	4.6	4.6	4.6	2.0	4.6	4.6	2.0								13								134								4.6							
87a	0.88	Bank fishing	9.1	9.1	6.6	6.6	6.6	2.6	6.6	6.6	2.6								26								256								42							
88	1.1	Medium-use general recreation, older child	13	13	13	13	13	5.8	13	13	5.8								58								582								40							
89	4.3	High-use general recreation, adult	6.3	6.3	6.3	6.3	6.3	2.0	6.3	6.3	2.0								14								143								38							
90	8.9	High-use general recreation, adult / older child	6.1	6.1	6.1	6.1	6.1	2.0	6.1	6.1	2.0								14								143								27							
Floodplain Direct Contact (Heavily Used Subareas)																																										
4	0.71	High-use general recreation, adult / older child / young child (low use)	67	67	9.3	9.3	9.3	0.64	9.3	21	2.0								14								143								27							
12	1.5	High-use general recreation, adult / older child / young child (low use)	15	15	11	11	11	1.3	11	11	2.0								14								143								27							
26a	2.2	High-use general recreation, adult / older child	1.9	1.9	1.9	1.9	1.9	0.27	1.9	1.9	2.0								14								143								27							
37b	0.31	High-use general recreation, adult / older child	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	2.0								14								143								27							
39	0.15	Marathon canoeist	52	52	4.9	4.9	4.9	2.0	4.9	8.6	2.0								7.8								78								13							
40	5.2	High-use general recreation, adult / young child (low use)	90	90	3.5	3.5	3.5	1.4	3.5	27	2.0								14								143								27							
47	0.18	Recreational canoeist	6.4	6.4	0.62	0.62	0.62	0.62	0.61	6.4	2.0								12								121								28							
52	0.25	Recreational canoeist	6.6	6.6	4.4	4.4	4.4	2.0	4.4	6.6	2.0								12								121								28							
53	0.35	Recreational canoeist	408	408	5.3	5.3	5.3	0.80	5.2	8.3	2.0								12								121								28							
58	0.16	High-use general recreation, adult	22	22	0.59	0.59	0.59	0.59	0.59	22	2.0								14								143								38							
59	0.15	High-use general recreation, adult / young child (low use)	28	28	1.8	1.8	1.8	0.70	1.8	8.1	2.0								14								143								27							
60a	0.16	Recreational canoeist	7.4	7.4	7.2	7.2	7.2	0.84	7.2	7.4	2.0								12								121								28							

Table 8-7a. Evaluation of attainment of RME IMPGs for human direct contact exposure areas for combined SED/FP scenarios.

Sediment Human Direct Contact

Exposure Area ID[1]	Area of Exposure Area (acre)[2]	Exposure Scenario	Floodplain Pre-Remediation EPC (mg/kg)[3]	Floodplain Post-Remediation EPC (mg/kg) / Projected Sediment Concentrations (mg/kg): SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
SA 1	57	Sediment exposure, adult / older child	---	12	1.6	0.057	0.054	0.076	0.16	7.0
SA 2	133	Sediment exposure, adult / older child	---	16	8.7	0.20	0.17	0.10	0.16	16
SA 3	11	Sediment exposure, adult / older child	---	23	1.7	0.21	0.24	0.17	0.15	11
SA 4	2.0	Sediment exposure, adult / older child	---	3.4	3.2	3.2	1.2	0.038	0.18	3.4
SA 5	3.2	Sediment exposure, adult / older child	---	4.2	4.1	4.1	0.10	0.044	0.021	4.1
SA 6	4.3	Sediment exposure, adult / older child	---	1.2	1.2	1.3	0.44	0.014	0.013	1.2
SA 7	2.4	Sediment exposure, adult / older child	---	7.6	7.0	7.5	2.1	0.055	0.35	7.6
SA 8	8.0	Sediment exposure, adult / older child	---	3.0	2.9	0.29	0.095	0.072	0.17	3.0

Exposure Area ID	10^{-6} Cancer Risk (RME): IMPG (mg/kg)[4,5]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
SA 1	1.3	>250	96	*9*	*9*	*13*	*5*	>250
SA 2	1.3	>250	>250	*15*	*16*	*27*	*10*	>250
SA 3	1.3	>250	92	*18*	*19*	*38*	*12*	>250
SA 4	1.3	>250	>250	>250	*19*	*40*	*12*	>250
SA 5	1.3	>250	>250	>250	*19*	*41*	*12*	>250
SA 6	1.3	*34*	*34*	*26*	*20*	*34*	*13*	*37*
SA 7	1.3	>250	>250	>250	>250	*42*	*13*	>250
SA 8	1.3	>250	>250	*18*	*21*	*48*	*14*	>250

Exposure Area ID	10^{-5} Cancer Risk (RME): IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
SA 1	13	*35*	*2*	*2*	*2*	*3*	*2*	*2*
SA 2	13	86	*11*	*14*	*14*	*23*	*8*	83
SA 3	13	120	*10*	*17*	*17*	*29*	*10*	*37*
SA 4	13	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 5	13	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 6	13	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 7	13	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 8	13	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Exposure Area ID	10^{-4} Cancer Risk (RME): IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
SA 1	135	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 2	135	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 3	135	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 4	135	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 5	135	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 6	135	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 7	135	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 8	135	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Exposure Area ID	Non-cancer (RME): IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
SA 1	31	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 2	31	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 3	31	*22*	*9*	*15*	*16*	*21*	*7*	*5*
SA 4	31	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 5	31	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 6	31	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 7	31	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 8	31	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Key:

(white box) = *post-remediation EPC is higher than IMPG*

(blue box) = *post-remediation EPC is lower than IMPG*

<value> = time to achieve predicted by the model

<value> = time to achieve based on highly uncertain extrapolation of the model results as described in Section 3.2.1 of the CMS Report

Notes:

1 *See Revised CMS Report Figures 4-1 and 4-2 for direct contact exposure areas in Reaches 5 through 8, and Heavily Used Subareas, respectively.*

2 *Area only includes the portion of the exposure area within the 1 mg/kg PCB isopleth (Reaches 5/6) or the 100-year floodplain (Reaches 7/8).*

3 *EPC is calculated for top 1-ft floodplain soil, except in Heavily Used Subareas where it is calculated for top 3-ft floodplain soil.*

4 *For scenarios that contain more than one receptor (e.g., adult plus older child and/or young child), the lowest IMPG was utilized in the comparison to the post-remediation EPC.*

5 *IMPGs less than 2 mg/kg were set to 2 mg/kg, because that concentration is fully protective for direct contact with soil under an unrestricted use scenario.*

Table 8-7b. Evaluation of attainment of CTE IMPGs for human direct contact exposure areas for combined SED/FP scenarios.

Exposure Area ID[1]	Area of Exposure Area (acre)[2]	Exposure Scenario	Floodplain Pre-Remediation EPC (mg/kg)[3]	Floodplain Post-Remediation EPC (mg/kg) / Projected Sediment Concentrations (mg/kg)							10^{-6} Cancer Risk (CTE)								10^{-5} Cancer Risk (CTE)								10^{-4} Cancer Risk (CTE)								Non-cancer (CTE)							
				SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4,5]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Floodplain Human Direct Contact Areas																																										
1	15	Medium-use general recreation, adult / older child	32	32	23	21	21	1.6	6.3	32	51								514								5143								176							
2	27	High-use general recreation, adult / older child	25	25	20	14	14	1.9	14	25	51								514								5143								176							
2a	2.3	Low-use general recreation, older child	52	52	42	21	21	1.5	21	51	103								1029								10286								353							
2b	2.0	High-use general recreation, older child	31	31	27	27	27	3.8	27	27	51								514								5143								176							
3	0.38	High-use general recreation, adult	7.8	7.8	7.8	7.8	7.8	2.0	7.8	7.8	63								630								6305								234							
4	3.2	High-use general recreation, adult / older child / young child (low use)	27	27	14	14	14	1.6	14	26	37								368								3684								63							
5	2.5	High-use general recreation, adult / older child	58	58	25	14	14	2.0	14	27	51								514								5143								176							
6	3.8	Low-use general recreation, adult	75	75	28	28	28	1.3	25	75	126								1261								12610								468							
7	5.9	High-use general recreation, adult / older child	25	25	25	14	14	2.0	14	25	51								514								5143								176							
8	0.60	Recreational canoeist	40	40	28	12	12	2.0	12	28	13								129								1286								73							
9	0.042	Low-use general recreation, older child	27	27	27	27	27	12	27	27	103								1029								10286								353							
10	59	High-use general recreation, adult / young child (high use)	10	10	4.6	4.6	4.6	2.0	4.6	4.6	18								184								1842								32							
10a	8.0	High-use general recreation, adult / young child (high use)	22	22	4.5	4.5	4.5	2.0	4.5	4.5	18								184								1842								32							
11	2.5	High-use general recreation, adult	18	18	18	14	14	2.0	14	18	63								630								6305								234							
12	4.8	High-use general recreation, adult / older child / young child (low use)	14	14	14	5.3	5.3	1.6	5.3	14	37								368								3684								63							
13	5.9	High-use general recreation, adult	28	28	27	13	13	2.0	13	28	63								630								6305								234							
14	4.1	High-use general recreation, adult	2.7	2.7	2.6	2.6	2.6	1.6	2.6	2.7	63								630								6305								234							
15	0.87	High-use general recreation, adult	2.2	2.2	2.2	2.2	2.2	2.0	2.2	2.2	63								630								6305								234							
16	2.5	High-use general recreation, adult	41	41	38	14	14	2.0	14	38	63								630								6305								234							
17	8.5	High-use general recreation, adult	15	15	15	14	14	2.0	14	15	63								630								6305								234							
18	17	Medium-use general recreation, adult	46	46	46	21	21	2.1	19	46	63								630								6305								234							
19	36	High-use general recreation, adult	83	83	20	14	14	1.6	14	38	63								630								6305								234							
20	9.1	High-use general recreation, adult	34	34	22	14	14	2.0	9.0	34	63								630								6305								234							
21	2.9	High-use general recreation, adult / older child	5.7	5.7	5.1	5.7	5.7	2.0	5.0	5.7	51								514								5143								176							
22	19	High-use general recreation, adult / older child	28	28	23	14	14	1.5	13	26	51								514								5143								176							
22a	1.8	Dirt biking/ATVing	93	93	8.2	8.2	8.2	2.0	8.2	8.2	29								290								2901								99							
23	0.28	Medium-use general recreation, older child	11	11	11	11	11	5.8	10	11	51								514								5143								176							
24	10	High-use general recreation, adult	31	31	26	13	13	1.3	12	31	63								630								6305								234							
25	0.51	High-use general recreation, older child	30	30	27	27	27	3.9	16	27	51								514								5143								176							
26a	48	High-use general recreation, adult / older child	7.0	7.0	6.9	6.9	6.9	1.9	6.9	7.0	51								514								5143								176							
26b	7.6	Agricultural use (based on direct contact by farmer)	1.3	1.3	1.3	1.3	1.3	0.68	1.3	1.3	42								419								4195								348							
26_F	55	High-use general recreation, adult / older child	6.1	6.1	6.0	6.0	6.0	1.7	6.0	6.1	51								514								5143								176							
27	6.3	High-use general recreation, adult / older child	2.5	2.5	2.5	2.5	2.5	2.0	2.5	2.5	51								514								5143								176							
27a	0.38	Dirt biking/ATVing	4.3	4.3	4.3	4.3	4.3	2.0	4.3	4.3	29								290								2901								99							
28	0.21	High-use general recreation, adult / older child / young child (low use)	21	21	21	13	13	2.0	13	21	37								368								3684								63							
28a	0.071	Dirt biking/ATVing	21	21	4.3	4.3	4.3	2.0	4.3	4.3	29								290								2901								99							
29	0.34	Low-use general recreation, adult / older child	21	21	21	21	21	4.3	21	21	103								1029								10286								353							
30	0.19	High-use general recreation, adult / older child	18	18	18	14	14	2.0	14	18	51								514								5143								176							
31	5.0	High-use general recreation, adult / older child	18	18	17	14	14	2.0	14	17	51								514								5143								176							
31a	0.61	High-use general recreation, adult / older child	42	42	25	3.9	3.9	2.0	3.9	25	51								514								5143								176							
32	6.8	High-use general recreation, adult	50	50	38	14	14	2.0	14	38	63								630								6305								234							
33	30	High-use general recreation, adult	21	21	19	14	14	2.0	14	21	63								630								6305								234							
34	7.8	Medium-use general recreation, adult	27	27	27	21	21	2.1	18	27	63								630								6305								234							
35	25	High-use general recreation, adult / older child	22	22	22	14	14	2.0	14	22	51								514								5143								176							
35a	1.2	High-use general recreation, adult / older child	44	44	13	4.4	4.4	2.0	4.4	27	51								514								5143								176							
36a	16	Low-use commercial (groundskeeper scenario)	25	25	24	24	24	8.0	24	25	166								1664								16642								571							
36b	2.2	Agricultural use (based on direct contact by farmer)	15	15	15	12	12	2.0	12	15	42								419								4195								348							
37	20	High-use general recreation, adult / older child	18	18	16	13	13	1.7	12	18	51								514								5143								176							

Table 8-7b. Evaluation of attainment of CTE IMPGs for human direct contact exposure areas for combined SED/FP scenarios.

Exposure Area ID[1]	Area of Exposure Area (acre)[2]	Exposure Scenario	Floodplain Pre-Remediation EPC (mg/kg)[3]	Floodplain Post-Remediation EPC (mg/kg) / Projected Sediment Concentrations (mg/kg)							10^{-6} Cancer Risk (CTE)								10^{-5} Cancer Risk (CTE)								10^{-4} Cancer Risk (CTE)								Non-cancer (CTE)							
				SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4,5]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
37a	1.4	Bank fishing	61	61	26	26	26	2.6	26	42	52								524								5237								180							
37b	2.3	High-use general recreation, adult / older child	27	27	4.3	6.7	6.7	2.0	4.3	24	51								514								5143								176							
38	13	High-use general recreation, adult	23	23	22	14	14	1.6	14	22	63								630								6305								234							
38a	1.4	Bank fishing	71	71	42	18	18	2.6	18	42	52								524								5237								180							
39	3.5	Marathon canoeist	30	30	6.8	6.8	6.8	2.0	6.3	13	5.8								58								575								25							
40	98	High-use general recreation, adult / young child (low use)	19	19	13	13	13	1.5	4.9	19	37								368								3684								63							
40a	4.6	Bank fishing	120	120	42	25	25	2.6	22	42	52								524								5237								180							
40b	1.1	High-use general recreation, adult / young child (low use)	11	11	11	11	11	2.0	11	11	37								368								3684								63							
41	20	Medium-use general recreation, adult	27	27	24	21	21	1.8	20	26	63								630								6305								234							
41a	2.4	Bank fishing	53	53	39	26	26	2.6	25	42	52								524								5237								180							
42	14	Medium-use general recreation, adult	32	32	32	21	21	2.1	21	32	63								630								6305								234							
42a	0.94	Bank fishing	25	25	25	25	25	2.6	25	25	52								524								5237								180							
43	1.5	Medium-use general recreation, adult	27	27	27	14	14	2.1	6.3	27	63								630								6305								234							
43a	0.24	Bank fishing	69	69	32	25	25	2.6	6.7	32	52								524								5237								180							
44	2.2	High-use general recreation, adult	27	27	27	14	14	2.0	14	27	63								630								6305								234							
45	17	High-use general recreation, adult	40	40	38	14	14	2.0	11	38	63								630								6305								234							
46	7.2	High-use general recreation, adult	9.2	9.2	9.1	9.1	9.1	2.0	8.7	9.2	63								630								6305								234							
47	1.0	Recreational canoeist	18	18	12	12	12	2.0	12	18	13								129								1286								73							
47_F	0.12	Recreational canoeist	8.0	8.0	8.0	8.0	8.0	2.0	8.0	8.0	13								129								1286								73							
48	6.5	High-use general recreation, adult	3.4	3.4	3.4	3.4	3.4	2.0	3.4	3.4	63								630								6305								234							
49	7.7	Low-use general recreation, adult	63	63	63	43	43	4.3	33	63	126								1261								12610								468							
50	69	Low-use general recreation, adult	7.4	7.4	7.4	7.4	7.4	4.3	5.9	7.4	126								1261								12610								468							
50a	11	Waterfowl hunting	21	21	17	17	17	7.5	15	21	75								752								7518								399							
51	87	Low-use general recreation, adult	7.1	7.1	7.1	7.1	7.1	4.3	6.7	7.1	126								1261								12610								468							
51a	32	Waterfowl hunting	23	23	23	23	23	8.4	20	23	75								752								7518								399							
52	0.9	Recreational canoeist	6.5	6.5	5.9	5.9	5.9	2.0	5.9	6.5	13								129								1286								73							
53	0.7	Recreational canoeist	18	18	11	11	11	2.0	6.1	15	13								129								1286								73							
54	13	High-use general recreation, adult	6.5	6.5	6.3	6.3	6.3	1.9	5.0	6.5	63								630								6305								234							
55	18	High-use general recreation, adult / young child (low use)	11	11	11	11	11	2.0	11	11	37								368								3684								63							
55a	5.0	Waterfowl hunting	42	42	42	42	42	8.6	42	42	75								752								7518								399							
56	32	Medium-use general recreation, adult / older child	37	37	37	21	21	2.1	21	37	51								514								5143								176							
56a	10	Waterfowl hunting	51	51	51	45	45	9.0	45	51	75								752								7518								399							
57	13	High-use general recreation, adult / young child (low use)	5.8	5.8	5.7	5.7	5.7	2.0	5.6	5.8	37								368								3684								63							
58	1.3	High-use general recreation, adult	65	65	12	12	12	2.0	3.6	37	63								630								6305								234							
59	1.9	High-use general recreation, adult / young child (low use)	18	18	14	14	14	2.0	14	18	37								368								3684								63							
59a	0.83	Bank fishing	23	23	18	18	18	2.6	18	23	52								524								5237								180							
60	0.84	High-use general recreation, adult / young child (low use)	7.4	7.4	7.4	7.4	7.4	2.0	7.4	7.4	37								368								3684								63							
60a	0.16	Recreational canoeist	13	13	12	12	12	0.95	12	13	13								129								1286								73							
61	3.3	Utility worker	42	42	27	23	23	0.77	23	42	209								2093								20933								718							
62	1.6	Utility worker	280	280	68	37	37	5.4	37	68	209								2093								20933								718							
63	0.67	Utility worker	84	84	65	24	24	8.6	24	84	209								2093								20933								718							
64	0.61	Utility worker	42	42	25	3.9	3.9	1.5	3.9	25	209								2093								20933								718							
65	3.9	Utility worker	18	18	17	17	17	17	17	18	209								2093								20933								718							
66	1.7	Utility worker	25	25	12	11	11	5.6	11	24	209								2093								20933								718							
67	0.31	High-use general recreation, adult	11	11	11	11	11	2.0	11	11	63								630								6305								234							
68	0.090	High-use general recreation, adult	9.1	9.1	9.1	9.1	9.1	2.0	9.1	9.1	63								630								6305								234							
69	1.9	High-use general recreation, adult	9.9	9.9	9.9	9.9	9.9	2.0	9.9	9.9	63								630								6305								234							
70	19	High-use general recreation, adult / young child (high use)	3.1	3.1	3.1	3.1	3.1	2.0	2.9	3.1	18								184								1842								32							
70a	1.2	Bank fishing	5.8	5.8	5.8	5.8	5.8	2.6	5.8	5.8	52								524								5237								180							

Table 8-7b. Evaluation of attainment of CTE IMPGs for human direct contact exposure areas for combined SED/FP scenarios.

Exposure Area ID[1]	Area of Exposure Area (acre)[2]	Exposure Scenario	Floodplain Pre-Remediation EPC (mg/kg)[3]	Floodplain Post-Remediation EPC (mg/kg) / Projected Sediment Concentrations (mg/kg)							10^{-6} Cancer Risk (CTE)								10^{-5} Cancer Risk (CTE)								10^{-4} Cancer Risk (CTE)								Non-cancer (CTE)							
				SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4,5]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
71	1.8	Bank fishing	5.5	5.5	5.5	5.5	5.5	2.6	5.5	5.5	52								524								5237								180							
72	2.3	Bank fishing	11	11	11	11	11	2.6	11	11	52								524								5237								180							
73	3.9	High-use general recreation, adult	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	63								630								6305								234							
74	5.3	High-use general recreation, adult	5.4	5.4	5.4	5.4	5.4	2.0	5.4	5.4	63								630								6305								234							
75	3.4	High-use general recreation, adult	15	15	15	14	14	2.0	14	15	63								630								6305								234							
76	1.1	High-use general recreation, adult	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	63								630								6305								234							
77	4.2	High-use general recreation, adult	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	63								630								6305								234							
78	6.2	High-use general recreation, older child	3.9	3.9	3.9	3.9	3.9	3.8	3.9	3.9	51								514								5143								176							
79	17	High-use general recreation, adult	3.1	3.1	3.1	3.1	3.1	2.0	3.1	3.1	63								630								6305								234							
80a	9.5	Low-use general recreation, adult	7.7	7.7	7.7	7.7	7.7	3.9	7.7	7.7	126								1261								12610								468							
80b	20	Agricultural use (based on direct contact by farmer)	0.77	0.77	0.77	0.77	0.77	0.12	0.77	0.77	42								419								4195								348							
81	33	Low-use general recreation, adult	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	126								1261								12610								468							
82	15	Low-use general recreation, adult	7.7	7.7	7.7	7.7	7.7	4.3	7.7	7.7	126								1261								12610								468							
83	22	High-use commercial (groundskeeper scenario)	6.5	6.5	6.5	6.5	6.5	2.0	6.5	6.5	17								166								1664								57							
84	8.5	Low-use general recreation, adult	4.7	4.7	4.7	4.7	4.7	4.3	4.7	4.7	126								1261								12610								468							
85a	0.25	Recreational canoeist	8.5	8.5	8.5	8.5	8.5	2.0	8.5	8.5	13								129								1286								73							
85b	10	High-use general recreation, older child	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	51								514								5143								176							
86	118	High-use commercial (groundskeeper scenario)	2.5	2.5	2.5	2.5	2.5	2.0	2.5	2.5	17								166								1664								57							
87	10	High-use general recreation, adult / young child (high use)	15	15	4.6	4.6	4.6	2.0	4.6	4.6	18								184								1842								32							
87a	0.88	Bank fishing	9.1	9.1	6.6	6.6	6.6	2.6	6.6	6.6	52								524								5237								180							
88	1.1	Medium-use general recreation, older child	13	13	13	13	13	5.8	13	13	51								514								5143								176							
89	4.3	High-use general recreation, adult	6.3	6.3	6.3	6.3	6.3	2.0	6.3	6.3	63								630								6305								234							
90	8.9	High-use general recreation, adult / older child	6.1	6.1	6.1	6.1	6.1	2.0	6.1	6.1	51								514								5143								176							
Floodplain Direct Contact (Heavily Used Subareas)																																										
4	0.71	High-use general recreation, adult / older child / young child (low use)	67	67	9.3	9.3	9.3	0.64	9.3	21	37								368								3684								63							
12	1.5	High-use general recreation, adult / older child / young child (low use)	15	15	11	11	11	1.3	11	11	37								368								3684								63							
26a	2.2	High-use general recreation, adult / older child	1.9	1.9	1.9	1.9	1.9	0.27	1.9	1.9	51								514								5143								176							
37b	0.31	High-use general recreation, adult / older child	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	51								514								5143								176							
39	0.15	Marathon canoeist	52	52	4.9	4.9	4.9	2.0	4.9	8.6	5.8								58.0								575								25							
40	5.2	High-use general recreation, adult / young child (low use)	90	90	3.5	3.5	3.5	1.4	3.5	27	37								368								3684								63							
47	0.18	Recreational canoeist	6.4	6.4	0.62	0.62	0.62	0.62	0.61	6.4	13								129								1286								73							
52	0.25	Recreational canoeist	6.6	6.6	4.4	4.4	4.4	2.0	4.4	6.6	13								129								1286								73							
53	0.35	Recreational canoeist	408	408	5.3	5.3	5.3	0.80	5.2	8.3	13								129								1286								73							
58	0.16	High-use general recreation, adult	22	22	0.59	0.59	0.59	0.59	0.59	22	63								630								6305								234							
59	0.15	High-use general recreation, adult / young child (low use)	28	28	1.8	1.8	1.8	0.70	1.8	8.1	37								368								3684								63							
60a	0.16	Recreational canoeist	7.4	7.4	7.2	7.2	7.2	0.84	7.2	7.4	13								129								1286								73							

Table 8-7b. Evaluation of attainment of CTE IMPGs for human direct contact exposure areas for combined SED/FP scenarios.

Exposure Area ID[1]	Area of Exposure Area (acre) [2]	Exposure Scenario	Floodplain Pre-Remediation EPC (mg/kg) [3]	Floodplain Post-Remediation EPC (mg/kg) / Projected Sediment Concentrations (mg/kg)							10^{-6} Cancer Risk (CTE)							
				SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg) [4,5]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Sediment Human Direct Contact (Older Child)																		
SA 1	57	Sediment exposure, adult / older child	---	12	1.6	0.057	0.054	0.076	0.16	7.0	28	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 2	133	Sediment exposure, adult / older child	---	16	8.7	0.20	0.17	0.10	0.16	16	28	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 3	11	Sediment exposure, adult / older child	---	23	1.7	0.21	0.24	0.17	0.15	11	28	*30*	*9*	*15*	*16*	*27*	*8*	*5*
SA 4	2.0	Sediment exposure, adult / older child	---	3.4	3.2	3.2	1.2	0.038	0.18	3.4	28	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 5	3.2	Sediment exposure, adult / older child	---	4.2	4.1	4.1	0.10	0.044	0.021	4.1	28	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 6	4.3	Sediment exposure, adult / older child	---	1.2	1.2	1.3	0.44	0.014	0.013	1.2	28	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 7	2.4	Sediment exposure, adult / older child	---	7.6	7.0	7.5	2.1	0.055	0.35	7.6	28	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 8	8.0	Sediment exposure, adult / older child	---	3.0	2.9	0.29	0.095	0.072	0.17	3.0	28	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Exposure Area ID[1]	10^{-5} Cancer Risk (CTE)								10^{-4} Cancer Risk (CTE)								Non-cancer (CTE)							
	IMPG (mg/kg) [4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg) [4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg) [4]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Sediment Human Direct Contact (Older Child)																								
SA 1	280	*0*	*0*	*0*	*0*	*0*	*0*	*0*	2800	*0*	*0*	*0*	*0*	*0*	*0*	*0*	125	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 2	280	*0*	*0*	*0*	*0*	*0*	*0*	*0*	2800	*0*	*0*	*0*	*0*	*0*	*0*	*0*	125	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 3	280	*0*	*0*	*0*	*0*	*0*	*0*	*0*	2800	*0*	*0*	*0*	*0*	*0*	*0*	*0*	125	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 4	280	*0*	*0*	*0*	*0*	*0*	*0*	*0*	2800	*0*	*0*	*0*	*0*	*0*	*0*	*0*	125	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 5	280	*0*	*0*	*0*	*0*	*0*	*0*	*0*	2800	*0*	*0*	*0*	*0*	*0*	*0*	*0*	125	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 6	280	*0*	*0*	*0*	*0*	*0*	*0*	*0*	2800	*0*	*0*	*0*	*0*	*0*	*0*	*0*	125	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 7	280	*0*	*0*	*0*	*0*	*0*	*0*	*0*	2800	*0*	*0*	*0*	*0*	*0*	*0*	*0*	125	*0*	*0*	*0*	*0*	*0*	*0*	*0*
SA 8	280	*0*	*0*	*0*	*0*	*0*	*0*	*0*	2800	*0*	*0*	*0*	*0*	*0*	*0*	*0*	125	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Key:

[white box] = *post-remediation EPC is higher than IMPG*

[blue box] = *post-remediation EPC is lower than IMPG*

<value> = time to achieve predicted by the model

<value> = time to achieve based on highly uncertain extrapolation of the model results as described in Section 3.2.1 of the CMS Report

Notes:

[1] *See Revised CMS Report Figures 4-1 and 4-2 for direct contact exposure areas in Reaches 5 through 8, and Heavily Used Subareas, respectively.*

[2] *Area only includes the portion of the exposure area within the 1 mg/kg PCB isopleth (Reaches 5/6) or the 100-year floodplain (Reaches 7/8).*

[3] *EPC is calculated for top 1-ft floodplain soil, except in Heavily Used Subareas where it is calculated for top 3-ft floodplain soil.*

[4] *For scenarios that contain more than one receptor (e.g., adult plus older child and/or young child), the lowest IMPG was utilized in the comparison to the post-remediation EPC.*

[5] *IMPGs less than 2 mg/kg were set to 2 mg/kg, because that concentration is fully protective for direct contact with soil under an unrestricted use scenario.*

Table 8-9. Evaluation of IMPG attainment for human consumption of floodplain agricultural products for combined SED/FP scenarios.

Floodplain Farm ID[1]	Floodplain Pre-Remediation EPC (mg/kg)[2]	Floodplain Post-Remediation EPC (mg/kg)[2]							10^{-6} Cancer Risk								10^{-5} Cancer Risk								10^{-4} Cancer Risk								Non-Cancer: Child								Non-Cancer: Adult							
		SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[3]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[3]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[3]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[3]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)[3]	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
									Floodplain Agricultural Products Consumption - Commercial Dairy (RME)																																											
FA 1	0.78	0.78	0.78	0.78	0.78	0.65	0.78	0.78	0.68								6.8								68								7.7								36							
FA 2	14	14	14	13	13	2.6	13	14	2.6								26								259								29								138							
FA 3	0.34	0.34	0.34	0.34	0.34	0.22	0.34	0.34	0.29								2.9								29								3.2								15							
FA 4	0.38	0.38	0.38	0.38	0.38	0.24	0.38	0.38	0.24								2.4								24								2.7								13							
FA 5	0.25	0.25	0.25	0.25	0.25	0.020	0.25	0.25	0.24								2.4								24								2.7								13							
FA 6	0.25	0.25	0.25	0.25	0.25	0.13	0.25	0.25	0.24								2.4								24								2.7								13							
FA 7	0.25	0.25	0.25	0.25	0.25	0.13	0.25	0.25	0.24								2.4								24								2.7								13							
FA 8	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.34								3.4								34								3.8								18							
FA 9	0.91	0.91	0.91	0.91	0.91	0.31	0.91	0.91	0.31								3.1								31								3.5								17							
FA 10	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	2.1								21								206								23								110							
FA 11	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	6.1								61								610								69								325							
FA 12	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.38								3.8								38								4.3								20							
FA 13	0.25	0.25	0.25	0.25	0.25	0.020	0.25	0.25	0.24								2.4								24								2.7								13							
FA 14	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.55								5.5								55								6.2								29							
									Floodplain Agricultural Products Consumption - Commercial Dairy (CTE)																																											
FA 1	0.78	0.78	0.78	0.78	0.78	0.65	0.78	0.78	3.1								31								312								12								44							
FA 2	14	14	14	13	13	2.6	13	14	12								119								1187								46								168							
FA 3	0.34	0.34	0.34	0.34	0.34	0.22	0.34	0.34	1.3								13								132								5.2								19							
FA 4	0.38	0.38	0.38	0.38	0.38	0.24	0.38	0.38	1.1								11								110								4.3								16							
FA 5	0.25	0.25	0.25	0.25	0.25	0.020	0.25	0.25	1.1								11								110								4.3								16							
FA 6	0.25	0.25	0.25	0.25	0.25	0.13	0.25	0.25	1.1								11								110								4.3								16							
FA 7	0.25	0.25	0.25	0.25	0.25	0.13	0.25	0.25	1.1								11								110								4.3								16							
FA 8	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	1.5								15								154								6.0								22							
FA 9	0.91	0.91	0.91	0.91	0.91	0.31	0.91	0.91	1.4								14								143								5.6								20							
FA 10	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	9.5								95								946								37								134							
FA 11	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	28								279								2794								109								396							
FA 12	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.8								18								176								6.9								25							
FA 13	0.25	0.25	0.25	0.25	0.25	0.020	0.25	0.25	1.1								11								110								4.3								16							
FA 14	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	2.5								25								253								9.9								36							

Key:

(white box) *= post-remediation EPC is higher than IMPG*

(blue box) *= post-remediation EPC is lower than IMPG*

Notes:

[1] *See Revised CMS Figure 4-4 for farm areas in Reaches 5 through 8.*

[2] *EPC is calculated for top 1 ft floodplain soil.*

[3] *IMPG values for agricultural products consumption include an adjustment to account for the areas outside the 1 mg/kg PCB isopleth/100-year floodplain (see Revised CMS Report Table 4-2).*

Table 8-11. Evaluation of IMPG attainment for human consumption of fish for combined SED/FP scenarios.

Human Consumption of Fish (Bass Fillets, Deterministic RME)

Average Fish (fillet) Concentrations (mg/kg)[1,2]

River Reach	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A	7.3	0.25	0.26	0.26	0.17	0.31	4.2
5B	9.3	3.0	0.23	0.22	0.15	0.27	6.6
5C	7.4	1.8	0.17	0.16	0.11	0.18	5.8
5D	9.5	6.3	0.36	0.35	0.29	0.41	11
6 (WP)	8.6	0.71	0.18	0.17	0.13	0.16	3.7
7A	6.4	1.3	0.42	0.40	0.34	0.42	4.2
7B	5.7	2.1	1.6	0.41	0.10	0.21	4.2
7C	6.3	1.8	1.0	0.20	0.12	0.20	4.4
7D	5.5	1.4	0.79	0.70	0.63	0.75	3.7
7E	4.1	1.0	0.57	0.34	0.18	0.22	2.8
7F	3.2	0.82	0.49	0.45	0.38	0.45	2.2
7G	3.5	1.3	1.0	0.40	0.15	0.22	2.6
7H	2.8	0.72	0.43	0.39	0.35	0.39	1.9
8 (RP)	3.6	1.6	0.34	0.22	0.17	0.24	2.7
BBD	0.16	0.04	0.01	0.009	0.006	0.009	0.1
LL	0.11	0.03	0.009	0.006	0.005	0.006	0.08
LZ	0.08	0.02	0.006	0.005	0.004	0.004	0.05
LH	0.08	0.02	0.006	0.004	0.003	0.004	0.05

10^{-6} Cancer Risk

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	237	249	230	>250	234	>250
5B		>250	>250	>250	235	>250	232	>250
5C		>250	>250	>250	242	>250	229	>250
5D		>250	>250	>250	>250	>250	IT	>250
6 (WP)		>250	>250	>250	>250	>250	231	>250
7A		>250	>250	>250	>250	>250	>250	>250
7B		>250	>250	>250	>250	>250	>250	>250
7C		>250	>250	>250	>250	>250	>250	>250
7D	0.0019	>250	>250	>250	>250	>250	>250	>250
7E		>250	>250	>250	>250	>250	>250	>250
7F		>250	>250	>250	>250	>250	>250	>250
7G		>250	>250	>250	>250	>250	>250	>250
7H		>250	>250	>250	>250	>250	>250	>250
8 (RP)		>250	>250	>250	>250	>250	>250	>250
BBD		>250	244	126	91	116	101	>250
LL		>250	222	113	82	106	90	>250
LZ		>250	199	99	73	96	78	>250
LH		>250	197	97	72	94	77	>250

10^{-5} Cancer Risk

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	149	156	146	188	151	>250
5B		>250	>250	159	145	186	148	>250
5C		>250	>250	159	143	179	139	>250
5D		>250	195	>250	>250	>250	IT	>250
6 (WP)		>250	>250	187	170	193	138	>250
7A		>250	>250	>250	>250	>250	>250	>250
7B		>250	>250	>250	>250	205	>250	>250
7C		>250	>250	>250	181	200	171	>250
7D	0.019	>250	>250	>250	>250	>250	>250	>250
7E		>250	>250	>250	213	>250	209	>250
7F		>250	>250	>250	>250	>250	>250	>250
7G		>250	>250	>250	>250	>250	>250	>250
7H		>250	>250	>250	>250	>250	>250	>250
8 (RP)		>250	>250	>250	>250	>250	>250	>250
BBD		230	94	40	36	60	34	246
LL		200	72	33	31	57	26	207
LZ		170	49	25	26	56	23	167
LH		167	46	25	26	56	22	162

10^{-4} Cancer Risk

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	62	64	62	74	68	>250
5B		>250	>250	59	56	70	63	>250
5C		>250	207	44	44	48	51	>250
5D		>250	138	>250	>250	117	IT	>250
6 (WP)		>250	>250	50	48	51	44	>250
7A		>250	233	138	112	166	120	>250
7B		>250	>250	>250	>250	46	60	>250
7C		>250	>250	>250	53	52	52	>250
7D	0.19	>250	>250	>250	210	>250	>250	>250
7E		>250	154	173	83	64	61	>250
7F		>250	195	165	128	182	140	>250
7G		>250	>250	>250	154	52	63	>250
7H		>250	219	174	139	226	147	>250
8 (RP)		>250	>250	>250	65	63	72	>250
BBD		31	11	11	18	15	13	17
LL		26	9	8	9	11	11	9
LZ		6	6	4	6	7	9	6
LH		5	5	4	5	6	8	4

Non-Cancer: Child

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	137	144	134	172	140	>250
5B		>250	>250	146	133	170	136	>250
5C		>250	>250	143	129	161	127	>250
5D		>250	187	>250	>250	>250	IT	>250
6 (WP)		>250	>250	168	153	174	125	>250
7A		>250	>250	>250	>250	>250	>250	>250
7B		>250	>250	>250	>250	181	245	>250
7C		>250	>250	>250	164	180	155	>250
7D	0.026	>250	>250	>250	>250	>250	>250	>250
7E		>250	>250	>250	195	>250	189	>250
7F		>250	>250	>250	>250	>250	>250	>250
7G		>250	>250	>250	>250	>250	232	>250
7H		>250	>250	>250	>250	>250	>250	>250
8 (RP)		>250	>250	>250	>250	>250	>250	>250
BBD		203	74	27	28	56	25	210
LL		173	52	24	25	55	21	171
LZ		143	34	22	23	54	18	131
LH		140	27	22	23	41	18	126

Non-Cancer: Adult

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	105	109	103	129	109	>250
5B		>250	>250	108	99	125	104	>250
5C		>250	>250	100	92	111	93	>250
5D		>250	165	>250	>250	>250	IT	>250
6 (WP)		>250	>250	116	106	122	89	>250
7A		>250	>250	>250	207	>250	219	>250
7B		>250	>250	>250	>250	116	164	>250
7C		>250	>250	>250	116	123	110	>250
7D	0.062	>250	>250	>250	>250	>250	>250	>250
7E		>250	224	>250	146	174	133	>250
7F		>250	>250	>250	228	>250	>250	>250
7G		>250	>250	>250	>250	176	158	>250
7H		>250	>250	>250	>250	>250	>250	>250
8 (RP)		>250	>250	>250	177	204	182	>250
BBD		128	22	21	22	34	16	111
LL		98	17	19	20	31	15	72
LZ		68	12	15	19	17	13	27
LH		65	12	11	19	17	13	26

Human Consumption of Fish (Bass Fillets, Probabilistic RME (5th percentile))

Average Fish (fillet) Concentrations (mg/kg)[1,2]

River Reach	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A	7.3	0.25	0.26	0.26	0.17	0.31	4.2
5B	9.3	3.0	0.23	0.22	0.15	0.27	6.6
5C	7.4	1.8	0.17	0.16	0.11	0.18	5.8
5D	9.5	6.3	0.36	0.35	0.29	0.41	11
6 (WP)	8.6	0.71	0.18	0.17	0.13	0.16	3.7
7A	6.4	1.3	0.42	0.40	0.34	0.42	4.2
7B	5.7	2.1	1.6	0.41	0.10	0.21	4.2
7C	6.3	1.8	1.0	0.20	0.12	0.20	4.4
7D	5.5	1.4	0.79	0.70	0.63	0.75	3.7
7E	4.1	1.0	0.57	0.34	0.18	0.22	2.8
7F	3.2	0.82	0.49	0.45	0.38	0.45	2.2
7G	3.5	1.3	1.0	0.40	0.15	0.22	2.6
7H	2.8	0.72	0.43	0.39	0.35	0.39	1.9
8 (RP)	3.6	1.6	0.34	0.22	0.17	0.24	2.7
BBD	0.16	0.04	0.01	0.009	0.006	0.009	0.1
LL	0.11	0.03	0.009	0.006	0.005	0.006	0.08
LZ	0.08	0.02	0.006	0.005	0.004	0.004	0.05
LH	0.08	0.02	0.006	0.004	0.003	0.004	0.05

10^{-6} Cancer Risk

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	191	200	186	242	190	>250
5B		>250	>250	207	188	242	188	>250
5C		>250	>250	213	190	241	181	>250
5D		>250	221	>250	>250	>250	IT	>250
6 (WP)		>250	>250	>250	229	>250	182	>250
7A		>250	>250	>250	>250	>250	>250	>250
7B		>250	>250	>250	>250	>250	>250	>250
7C		>250	>250	>250	242	>250	228	>250
7D	0.0064	>250	>250	>250	>250	>250	>250	>250
7E		>250	>250	>250	>250	>250	>250	>250
7F		>250	>250	>250	>250	>250	>250	>250
7G		>250	>250	>250	>250	>250	>250	>250
7H		>250	>250	>250	>250	>250	>250	>250
8 (RP)		>250	>250	>250	>250	>250	>250	>250
BBD		>250	165	>250	59	79	60	>250
LL		>250	143	64	51	68	50	>250
LZ		>250	120	51	38	62	36	>250
LH		>250	117	50	37	62	35	>250

10^{-5} Cancer Risk

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	103	108	102	127	108	>250
5B		>250	>250	106	98	123	103	>250
5C		>250	>250	98	91	110	91	>250
5D		>250	165	>250	>250	>250	IT	>250
6 (WP)		>250	>250	114	105	120	88	>250
7A		>250	>250	>250	205	>250	216	>250
7B		>250	>250	>250	>250	114	162	>250
7C		>250	>250	>250	114	121	108	>250
7D	0.064	>250	>250	>250	>250	>250	>250	>250
7E		>250	222	>250	144	171	131	>250
7F		>250	>250	>250	225	>250	251	>250
7G		>250	>250	>250	>250	172	155	>250
7H		>250	>250	>250	>250	>250	>250	>250
8 (RP)		>250	>250	>250	173	200	179	>250
BBD		125	22	21	22	34	16	107
LL		96	17	19	20	31	15	68
LZ		66	12	15	19	17	13	27
LH		62	12	11	19	17	13	26

10^{-4} Cancer Risk

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		240	15	15	15	17	19	186
5B		>250	213	16	16	20	15	>250
5C		>250	123	19	20	31	14	>250
5D		>250	108	21	21	31	15	239
6 (WP)		>250	79	22	23	41	16	189
7A		>250	117	24	24	43	120	235
7B		>250	232	>250	23	43	15	>250
7C		>250	197	166	23	44	16	>250
7D	0.64	>250	142	83	62	76	74	>250
7E		232	79	38	23	44	16	224
7F		205	75	25	26	45	21	>250
7G		243	156	142	23	45	16	>250
7H		188	66	23	23	46	16	>250
8 (RP)		233	190	22	24	53	18	>250
BBD		0	0	0	0	0	0	0
LL		0	0	0	0	0	0	0
LZ		0	0	0	0	0	0	0
LH		0	0	0	0	0	0	0

Non-Cancer: Child

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	106	111	105	131	111	>250
5B		>250	>250	110	101	128	106	>250
5C		>250	>250	102	94	114	94	>250
5D		>250	167	>250	>250	>250	IT	>250
6 (WP)		>250	>250	119	109	125	91	>250
7A		>250	>250	>250	211	>250	223	>250
7B		>250	>250	>250	>250	120	169	>250
7C		>250	>250	>250	118	126	112	>250
7D	0.059	>250	>250	>250	>250	>250	>250	>250
7E		>250	227	>250	149	179	136	>250
7F		>250	>250	>250	232	>250	>250	>250
7G		>250	>250	>250	>250	182	162	>250
7H		>250	>250	>250	>250	>250	>250	>250
8 (RP)		>250	>250	>250	181	210	187	>250
BBD		132	26	21	22	39	17	116
LL		103	19	20	21	32	16	77
LZ		73	14	18	20	26	14	41
LH		69	13	18	19	22	14	37

Non-Cancer: Adult

River Reach	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A		>250	80	82	79	96	85	>250
5B		>250	>250	79	74	91	80	>250
5C		>250	239	67	63	76	67	500
5D		>250	149	>250	>250	173	IT	>250
6 (WP)		>250	>250	75	71	82	62	>250
7A		>250	>250	188	151	234	161	>250
7B		>250	>250	>250	>250	70	103	>250
7C		>250	>250	>250	79	82	76	>250
7D	0.12	>250	>250	>250	>250	>250	>250	>250
7E		>250	183	223	109	110	91	>250
7F		>250	240	219	169	>250	187	>250
7G		>250	>250	>250	218	101	102	>250
7H		>250	>250	242	196	>250	210	>250
8 (RP)		>250	>250	>250	111	120	117	>250
BBD		71	11	11	18	15	13	17
LL		26	9	8	9	11	11	9
LZ		6	6	4	6	7	9	6
LH		5	5	4	5	6	8	4

Table 8-11. Evaluation of IMPG attainment for human consumption of fish for combined SED/FP scenarios.

River Reach	Average Fish (fillet) Concentrations (mg/kg)[1,2]							10^-6 Cancer Risk								10^-5 Cancer Risk								10^-4 Cancer Risk								Non-Cancer: Child								Non-Cancer: Adult							
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Human Consumption of Fish (Bass Fillets, Deterministic CTE)																																															
5A	7.3	0.25	0.26	0.26	0.17	0.31	4.2		>250	113	118	111	141	117	>250		>250	22	22	22	23	35	205		82	8	8	8	10	8	36		>250	62	64	62	74	68	>250		>250	26	26	26	39	38	214
5B	9.3	3.0	0.23	0.22	0.15	0.27	6.6		>250	>250	118	109	137	113	>250		>250	241	18	18	21	22	>250		123	12	10	10	14	9	81		>250	>250	59	56	70	63	>250		>250	>250	21	20	23	34	>250
5C	7.4	1.8	0.17	0.16	0.11	0.18	5.8		>250	>250	111	102	125	102	>250		>250	142	20	20	32	15	>250		98	10	14	14	17	10	69		>250	207	44	44	48	51	>250		>250	151	20	21	32	16	>250
5D	9.5	6.3	0.36	0.35	0.29	0.41	11		>250	171	>250	>250	>250	IT	>250		>250	115	21	21	31	16	>250		136	58	17	17	27	12	108		>250	138	>250	>250	117	IT	>250		>250	118	22	22	32	24	>250
6 (WP)	8.6	0.71	0.18	0.17	0.13	0.16	3.7		>250	>250	130	119	136	99	>250		>250	134	22	23	42	16	209		132	11	18	19	37	12	25		>250	>250	50	48	51	44	>250		>250	161	23	24	42	17	219
7A	6.4	1.3	0.42	0.40	0.34	0.42	4.2		>250	>250	>250	227	>250	240	>250		>250	142	36	33	44	37	>250		78	9	10	10	12	11	26		>250	233	138	112	166	120	>250		>250	155	48	41	48	48	>250
7B	5.7	2.1	1.6	0.41	0.10	0.21	4.2		>250	>250	>250	>250	134	186	>250		>250	>250	>250	23	43	16	>250		69	9	10	10	12	11	26		>250	>250	>250	>250	46	60	>250		>250	>250	>250	23	43	16	>250
7C	6.3	1.8	1.0	0.20	0.12	0.20	4.4		>250	>250	>250	129	138	122	>250		>250	234	227	24	45	17	>250		78	10	10	10	13	12	36		>250	>250	>250	53	52	52	>250		>250	>250	>250	24	45	18	>250
7D	5.5	1.4	0.79	0.70	0.63	0.75	3.7	0.049	>250	>250	>250	>250	>250	>250	>250	0.49	>250	174	124	94	127	114	>250	4.9	64	9	9	10	12	11	11	0.19	>250	>250	>250	210	>250	>250	>250	0.43	>250	189	144	110	153	134	>250
7E	4.1	1.0	0.57	0.34	0.18	0.22	2.8		>250	239	>250	159	197	148	>250		>250	96	69	24	45	17	>250		34	9	7	9	11	11	9		>250	154	173	83	64	61	>250		>250	104	84	24	45	17	>250
7F	3.2	0.82	0.49	0.45	0.38	0.45	2.2		>250	>250	>250	249	>250	>250	>250		231	102	51	41	48	39	>250		9	8	6	8	10	10	8		>250	195	165	128	182	140	>250		244	114	68	55	61	56	>250
7G	3.5	1.3	1.0	0.40	0.15	0.22	2.6		>250	>250	>250	>250	203	178	>250		>250	196	193	24	46	17	>250		10	8	6	8	11	10	8		>250	>250	>250	154	52	63	>250		>250	216	218	24	47	18	>250
7H	2.8	0.72	0.43	0.39	0.35	0.39	1.9		>250	>250	>250	>250	>250	>250	>250		214	99	34	26	47	22	>250		7	7	5	7	8	9	6		>250	219	174	139	226	147	>250		226	116	51	37	48	35	>250
8 (RP)	3.6	1.6	0.34	0.22	0.17	0.24	2.7		>250	>250	>250	200	234	205	>250		>250	231	23	25	53	19	>250		10	8	6	8	11	11	8		>250	>250	>250	65	63	72	>250		>250	>250	24	25	54	19	>250
BBD	0.16	0.04	0.01	0.009	0.006	0.009	0.1		148	37	22	23	54	19	138		0	0	0	0	0	0	0		0	0	0	0	0	0	0		31	11	11	18	15	13	17		0	0	0	0	0	0	0
LL	0.11	0.03	0.009	0.006	0.005	0.006	0.08		119	23	21	22	36	17	99		0	0	0	0	0	0	0		0	0	0	0	0	0	0		26	9	8	9	11	11	9		0	0	0	0	0	0	0
LZ	0.08	0.02	0.006	0.005	0.004	0.004	0.05		89	17	19	20	31	15	58		0	0	0	0	0	0	0		0	0	0	0	0	0	0		6	6	4	6	7	9	6		0	0	0	0	0	0	0
LH	0.08	0.02	0.006	0.004	0.003	0.004	0.05		85	17	19	20	31	15	54		0	0	0	0	0	0	0		0	0	0	0	0	0	0		5	5	4	5	6	8	4		0	0	0	0	0	0	0
Human Consumption of Fish (Bass Fillets, Probabilistic CTE (50th percentile))																																															
5A	7.3	0.25	0.26	0.26	0.17	0.31	4.2		>250	108	112	106	133	112	>250		249	18	18	18	18	23	194		71	7	7	7	9	7	26		232	14	14	14	16	16	179		174	11	11	11	13	10	125
5B	9.3	3.0	0.23	0.22	0.15	0.27	6.6		>250	>250	111	103	129	107	>250		>250	225	17	17	21	18	>250		107	11	10	10	13	9	65		>250	202	16	16	20	14	>250		>250	124	14	14	18	11	203
5C	7.4	1.8	0.17	0.16	0.11	0.18	5.8		>250	>250	104	96	116	96	>250		>250	131	19	20	31	14	>250		81	10	11	11	14	9	54		>250	116	19	19	31	14	>250		226	65	18	18	28	12	193
5D	9.5	6.3	0.36	0.35	0.29	0.41	11		>250	167	>250	>250	>250	IT	>250		>250	111	21	21	31	15	341		122	54	17	17	27	11	122		>250	105	20	21	31	15	320		249	87	19	19	29	13	249
6 (WP)	8.6	0.71	0.18	0.17	0.13	0.16	3.7		>250	>250	121	111	127	93	198		>250	103	22	23	41	16	52		113	11	17	19	37	11	10		>250	53	22	23	41	15	180		>250	14	20	21	40	14	122
7A	6.4	1.3	0.42	0.40	0.34	0.42	4.2		>250	>250	>250	214	>250	226	>250		>250	128	25	25	43	25	246		63	9	9	9	11	11	11		>250	107	24	24	42	17	225		192	26	21	22	39	14	152
7B	5.7	2.1	1.6	0.41	0.10	0.21	4.2		>250	>250	>250	>250	122	172	>250		>250	250	>250	23	43	16	>250		52	9	9	9	11	11	11		>250	217	238	22	42	15	>250		201	103	63	21	41	14	193
7C	6.3	1.8	1.0	0.20	0.12	0.20	4.4		>250	>250	>250	120	128	114	>250		>250	213	192	24	44	17	>250		62	9	9	9	12	11	12		>250	182	141	23	44	16	>250		202	76	23	22	42	14	177
7D	5.5	1.4	0.79	0.70	0.63	0.75	3.7	0.057	>250	>250	>250	>250	>250	>250	>250	0.57	>250	155	101	76	98	91	>250	5.7	38	9	8	9	11	11	9	0.71	>250	129	68	51	60	58	>250	1.5	206	38	22	22	42	15	180
7E	4.1	1.0	0.57	0.34	0.18	0.22	2.8		>250	229	>250	151	182	138	>250		243	86	52	23	44	16	>250		11	8	6	8	10	10	8		222	73	27	23	44	15	212		149	23	21	21	40	14	124
7F	3.2	0.82	0.49	0.45	0.38	0.45	2.2		>250	>250	>250	235	>250	>250	>250		216	87	36	32	46	30	>250		7	7	5	7	8	9	7		195	65	24	24	44	17	236		122	19	20	21	33	14	113
7G	3.5	1.3	1.0	0.40	0.15	0.22	2.6		>250	>250	>250	>250	186	165	>250		>250	173	164	24	46	17	>250		8	7	5	7	9	9	7		231	140	122	23	45	16	>250		145	34	21	21	42	14	158
7H	2.8	0.72	0.43	0.39	0.35	0.39	1.9		>250	>250	>250	>250	>250	>250	>250		199	80	24	24	46	17	>250		4	5	3	5	7	8	3		178	52	22	23	45	16	>250		106	15	19	20	32	13	99
8 (RP)	3.6	1.6	0.34	0.22	0.17	0.24	2.7		>250	>250	>250	185	215	190	>250		246	208	23	24	53	18	>250		7	7	5	7	9	10	6		222	174	22	24	52	18	>250		141	58	20	22	50	16	182
BBD	0.16	0.04	0.01	0.009	0.006	0.009	0.1		135	26	21	22	39	17	120		0	0	0	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0
LL	0.11	0.03	0.009	0.006	0.005	0.006	0.08		106	19	20	21	32	16	81		0	0	0	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0
LZ	0.08	0.02	0.006	0.005	0.004	0.004	0.05		75	14	18	20	26	14	41		0	0	0	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0
LH	0.08	0.02	0.006	0.004	0.003	0.004	0.05		72	13	18	19	22	14	37		0	0	0	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0

Key:

(white) = *post-remediation EPC is higher than IMPG*

(blue) = *post-remediation EPC is lower than IMPG*

<value> = time to achieve predicted by the model

<value> = time to achieve based on highly uncertain extrapolation of the model results as described in Section 3.2.1 of the Revised CMS Report

Notes:

[1] *Model endpoint concentrations after projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis*

[2] *Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.*

CTE = central tendency exposure

RME = reasonable maximum exposure

BBD: Bulls Bridge Dam Impoundment; LL: Lake Lillinonah; LZ: Lake Zoar; LH: Lake Housatonic

Table 8-12. Evaluation of attainment of IMPGs for benthic invertebrates for combined SED/FP alternatives.

Reach	Exposure Area[1]	Average 0-6" Sediment PCB Concentration (mg/kg)[2]							IMPG Attainment								
		SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	Lower Bound IMPG (mg/kg)	Upper Bound IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A	R5A_01	1.9	0.33	0.33	0.33	0.11	0.31	3.3	3	10	46 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	IT / 2
	R5A_02	3.7	0.18	0.17	0.17	0.084	0.20	0.92	3	10	63 / 20	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
	R5A_03	6.4	0.12	0.13	0.14	0.23	0.21	4.8	3	10	67 / 40	2 / 2	2 / 2	2 / 2	2 / 2	1 / 1	59 / 36
	R5A_04	29	0.071	0.071	0.070	0.37	0.29	27	3	10	>250 / >250	2 / 2	2 / 2	2 / 2	3 / 3	1 / 1	>250 / >250
	R5A_05	13	0.032	0.033	0.032	0.067	0.26	1.1	3	10	199 / 78	2 / 2	2 / 2	2 / 2	3 / 3	1 / 1	1 / 1
	R5A_06	7.7	0.043	0.044	0.045	0.28	0.13	2.3	3	10	IT / 12	3 / 2	3 / 2	3 / 2	4 / 3	2 / 1	2 / 1
	R5A_07	15	0.062	0.075	0.063	0.070	0.22	0.77	3	10	244 / 98	3 / 3	3 / 3	3 / 3	6 / 5	2 / 2	2 / 2
	R5A_08	17	0.028	0.024	0.023	0.021	0.18	14	3	10	>250 / 133	4 / 4	4 / 4	4 / 4	6 / 6	2 / 2	245 / 98
	R5A_09	9.9	0.022	0.021	0.021	0.027	0.11	9.9	3	10	>250 / 39	4 / 4	4 / 4	4 / 4	7 / 7	3 / 2	>250 / 51
	R5A_10	16	0.020	0.020	0.020	0.022	0.19	17	3	10	>250 / >250	6 / 5	6 / 5	6 / 5	9 / 8	3 / 3	IT / IT
	R5A_11	18	0.023	0.026	0.022	0.026	0.15	0.95	3	10	>250 / >250	7 / 7	7 / 7	7 / 7	11 / 10	4 / 4	4 / 3
5B	R5B_01	9.6	9.1	0.043	0.035	0.030	0.083	9.8	3	10	>250 / 28	>250 / 21	9 / 8	9 / 8	13 / 12	5 / 4	>250 / 45
	R5B_02	8.5	5.3	0.055	0.042	0.038	0.073	6.9	3	10	IT / 0	125 / 0	10 / 0	10 / 0	14 / 0	5 / 0	IT / 0
	R5B_03	4.7	3.2	0.058	0.060	0.050	0.077	4.4	3	10	204 / 0	61 / 0	10 / 0	10 / 0	15 / 0	5 / 0	244 / 0
	R5B_04	5.7	4.4	0.089	0.090	0.11	0.13	5.3	3	10	248 / 0	112 / 0	11 / 0	11 / 0	15 / 0	6 / 0	245 / 0
	R5B_05	5.6	3.9	0.075	0.072	0.057	0.10	5.2	3	10	115 / 0	80 / 0	12 / 0	12 / 0	16 / 0	6 / 0	105 / 0
5C	R5C_01	7.2	5.8	0.083	0.081	0.077	0.085	7.1	3	10	>250 / 0	118 / 0	13 / 0	13 / 0	19 / 0	7 / 2	>250 / 1
	R5C_02	8.0	6.4	0.12	0.12	0.090	0.13	7.8	3	10	>250 / 8	148 / 6	13 / 6	13 / 6	20 / 7	7 / 7	>250 / 10
	R5C_03	4.9	3.2	0.098	0.10	0.086	0.11	4.4	3	10	120 / 0	58 / 0	14 / 0	13 / 0	21 / 0	8 / 0	103 / 0
	R5C_04	6.1	4.4	0.11	0.12	0.088	0.13	5.7	3	10	132 / 8	79 / 6	14 / 6	14 / 6	22 / 7	8 / 8	123 / 9
	R5C_05	37	1.8	0.13	0.19	0.14	0.18	37	3	10	>250 / >250	8 / 8	14 / 14	14 / 14	24 / 23	8 / 8	>250 / >250
	R5C_06	29	1.5	0.17	0.25	0.15	0.19	27	3	10	>250 / 194	9 / 9	15 / 15	16 / 16	28 / 27	10 / 10	>250 / 171
6	Woods Pond	16	1.5	0.24	0.21	0.16	0.13	3.7	3	10	210 / 97	10 / 10	18 / 17	18 / 18	37 / 33	11 / 11	73 / 5
7A		0.43	0.41	0.41	0.41	0.41	0.41	0.42	3	10	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
7B		4.2	3.9	4.0	0.92	0.044	0.17	4.1	3	10	>250 / 0	174 / 0	190 / 0	19 / 0	39 / 0	12 / 0	>250 / 0
7C		4.1	4.0	4.0	0.092	0.048	0.027	4.1	3	10	>250 / 0	>250 / 0	>250 / 0	19 / 0	40 / 0	12 / 0	>250 / 0
7D		1.4	0.92	0.94	0.90	0.87	0.95	1.2	3	10	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
7E		1.2	1.2	1.3	0.44	0.014	0.013	1.2	3	10	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
7F		0.74	0.61	0.61	0.59	0.55	0.60	0.69	3	10	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
7G		5.1	4.7	5.0	1.4	0.044	0.233	5.1	3	10	194 / 0	190 / 0	200 / 0	20 / 0	42 / 0	13 / 0	192 / 0
7H		0.40	0.39	0.40	0.40	0.39	0.39	0.40	3	10	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
8	Rising Pond	2.9	2.7	0.35	0.13	0.070	0.20	2.8	3	10	21 / 0	25 / 0	17 / 0	20 / 0	26 / 0	14 / 0	26 / 0

Notes

[1] *Exposure areas in Reach 5 represent EPA spatial bins (1/4 to 1/2-mile segments as defined in EPA's Model Validation Report)*

[2] *Model endpoint concentrations after projection*

IMPG = interim media protection goal

IT = Increasing trend in model extrapolation; no time-to-achieve estimated.

Key:

= post-remediation EPC is higher than Upper Bound IMPG

= post-remediation EPC is between Lower and Upper Bound IMPGs

= post-remediation EPC is below Lower Bound IMPG

<value>/<value> *= Time to achieve the lower bound and upper bound IMPG, respectively (years)*

<value> = time to achieve predicted by the model

<value> = time to achieve based on highly uncertain extrapolation of the model results as described in Section 3.2.1 of the Revised CMS Report

Table 8-14. Evaluation of attainment of amphibian IMPGs for combined SED/FP alternatives.

Exposure Area ID[1]	Area (acre)	Floodplain Pre-Remediation EPC (mg/kg)[2]	Floodplain Post-Remediation EPC (mg/kg)[2] / Projected Sediment Concentrations (mg/kg)							IMPG Attainment								
			SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	Lower Bound IMPG (mg/kg)	Upper Bound IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Floodplain Vernal Pools																		
5-VP-3	1.9	73	73	5.6	5.6	5.6	3.1	3.3	73	3.27	5.6							
5-VP-1	0.044	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	3.27	5.6							
8-VP-5	0.043	23	23	5.6	5.6	5.6	0.45	0.45	23	3.27	5.6							
8-VP-4	0.24	3.9	3.9	3.9	3.9	3.9	3.3	3.3	3.9	3.27	5.6							
8-VP-3	0.024	7.7	7.7	0.021	0.021	0.021	0.021	0.021	7.7	3.27	5.6							
8-VP-2	0.57	69	69	5.6	5.6	5.6	3.1	3.2	69	3.27	5.6							
18-VP-2	0.61	7.2	7.2	5.6	5.6	5.6	3.3	3.0	7.2	3.27	5.6							
18-VP-1	0.28	8.1	8.1	5.6	5.6	5.6	3.3	3.3	8.1	3.27	5.6							
19-VP-7	0.068	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	3.27	5.6							
19-VP-2	0.0080	34	34	0.021	0.021	0.021	0.021	0.021	34	3.27	5.6							
19-VP-1	0.18	32	32	5.6	5.6	5.6	3.3	2.4	32	3.27	5.6							
19-VP-3	0.031	10	10	5.6	5.6	5.6	3.3	2.8	10	3.27	5.6							
19-VP-4	0.094	6.0	6.0	5.6	5.6	5.6	0.021	0.021	6.0	3.27	5.6							
19-VP-8	0.057	91	91	0.021	0.021	0.021	0.021	0.021	91	3.27	5.6							
19-VP-5	0.51	45	45	5.6	5.6	5.6	3.3	3.3	45	3.27	5.6							
19-VP-6	1.2	24	24	5.6	5.6	5.6	3.3	3.3	24	3.27	5.6							
23-VP-2	0.18	47	47	5.6	3.7	3.7	3.3	0.76	47	3.27	5.6							
23-VP-1	0.30	75	75	5.6	5.3	5.3	0.021	2.2	75	3.27	5.6							
23A-VP-1	0.45	10	10	5.6	5.6	5.6	3.3	3.3	10	3.27	5.6							
23B-VP-1	0.068	7.2	7.2	5.6	5.6	5.6	3.3	3.3	7.2	3.27	5.6							
23B-VP-2	0.091	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	3.27	5.6							
27B-VP-2	0.28	11	11	5.6	5.6	5.6	3.3	3.3	11	3.27	5.6							
27B-VP-3	0.062	16	16	0.021	0.021	0.021	0.021	0.021	16	3.27	5.6							
27B-VP-1	0.072	12	12	5.6	5.6	5.6	3.3	3.3	12	3.27	5.6							
27-VP-2	0.47	21	21	5.6	5.6	5.6	3.3	3.3	21	3.27	5.6							
27A-VP-1	0.20	31	31	5.6	5.6	5.6	3.3	3.3	31	3.27	5.6							
27-VP-1	1.3	23	23	5.6	5.6	5.6	3.3	3.3	23	3.27	5.6							
26-VP-1	0.036	40	40	5.6	5.6	5.6	3.3	1.4	40	3.27	5.6							
33-VP-1	0.022	9.5	9.5	0.021	0.021	0.021	0.021	0.021	9.5	3.27	5.6							
33-VP-2	0.12	70	70	5.6	4.8	4.8	0.021	0.021	70	3.27	5.6							
38-VP-1	0.43	36	36	5.6	5.6	5.6	3.3	3.3	36	3.27	5.6							
38A-VP-1	0.020	5.0	5.0	5.0	5.0	5.0	0.021	0.021	5.0	3.27	5.6							
38-VP-3	0.046	28	28	5.6	5.6	5.6	0.021	0.021	28	3.27	5.6							
38-VP-2	0.17	46	46	5.6	5.1	5.1	3.1	3.1	46	3.27	5.6							
40-VP-3	0.46	67	67	5.6	5.6	5.6	2.7	2.7	67	3.27	5.6							
40-VP-2	0.36	18	18	5.6	5.6	5.6	3.3	3.3	18	3.27	5.6							
40A-VP-1	0.11	68	68	5.6	5.6	5.6	3.3	3.3	68	3.27	5.6							
40-VP-1	0.47	57	57	5.6	5.6	5.6	3.3	3.3	57	3.27	5.6							
42-VP-1	0.22	64	64	5.6	5.6	5.6	2.8	2.8	64	3.27	5.6							
42-VP-2	0.28	46	46	5.6	5.6	5.6	3.3	3.3	46	3.27	5.6							
42-VP-3	0.050	41	41	5.6	5.6	5.6	0.021	0.021	41	3.27	5.6							
42-VP-5	0.58	73	73	5.6	5.6	5.6	3.3	3.3	73	3.27	5.6							
42-VP-4	1.0	34	34	5.6	5.6	5.6	3.3	3.3	34	3.27	5.6							
42A-VP-1	1.5	35	35	5.6	5.6	5.6	3.3	3.3	35	3.27	5.6							
46-VP-2	7.1	140	140	5.6	5.6	5.6	3.0	3.3	140	3.27	5.6							
46-VP-1	0.52	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	3.27	5.6							
46-VP-5	0.056	125	125	0.021	0.021	0.021	0.021	0.021	125	3.27	5.6							
46-VP-3	1.4	153	153	3.2	3.2	3.2	3.3	3.2	153	3.27	5.6							
46-VP-4	0.011	125	125	0.021	0.021	0.021	0.021	0.021	125	3.27	5.6							
49A-VP-1	0.019	16	16	0.021	0.021	0.021	0.021	0.021	16	3.27	5.6							
49-VP-1	1.2	18	18	5.6	5.6	5.6	3.3	3.3	18	3.27	5.6							
49B-VP-1	0.0044	26	26	0.021	0.021	0.021	0.021	0.021	26	3.27	5.6							
66A-VP-1	0.032	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	3.27	5.6							
69-VP-1	0.0074	12	12	0.021	0.021	0.021	0.021	0.021	12	3.27	5.6							
8-VP-6	0.086	47	47	5.6	5.6	5.6	0.021	0.021	47	3.27	5.6							
12-VP-1	0.080	14	14	0.021	0.021	0.021	0.021	0.021	14	3.27	5.6							
39-VP-1	2.0	39	39	5.6	5.6	5.6	2.3	2.3	39	3.27	5.6							
54-VP-1	0.20	21	21	5.6	5.6	5.6	3.0	3.0	21	3.27	5.6							
55-VP-1	0.59	7.6	7.6	5.6	5.6	5.6	3.3	3.3	7.6	3.27	5.6							
55A-VP-1	2.0	40	40	5.6	5.6	5.6	3.2	3.2	40	3.27	5.6							
58A-VP-1	0.32	25	25	5.6	5.6	5.6	3.3	3.3	25	3.27	5.6							
67A-VP-1	0.12	51	51	5.6	5.6	5.6	3.3	3.3	51	3.27	5.6							
61A-VP-1	0.19	18	18	5.3	5.3	5.3	3.2	3.2	18	3.27	5.6							
61A-VP-2	1.2	19	19	5.5	5.5	5.5	3.3	3.3	19	3.27	5.6							
56A-VP-1	0.58	73	73	5.6	5.6	5.6	3.3	2.7	73	3.27	5.6							
23-VP-3	1.3	22	22	5.6	5.6	5.6	3.0	3.0	22	3.27	5.6							
Sediment - Small Backwaters (< 2 acres)																		
BWS_01	1.9	---	5.7	4.2	4.1	0.18	0.20	0.21	5.6	3.27	5.6	113 / 54	72 / 32	70 / 32	2 / 2	3 / 3	1 / 1	114 / 52
BWS_02	1.8	---	5.9	5.0	0.14	0.14	0.16	0.21	5.6	3.27	5.6	109 / 57	99 / 38	3 / 3	3 / 3	4 / 4	2 / 2	124 / 52
BWS_03	1.9	---	3.0	1.8	0.20	0.20	0.18	0.24	2.4	3.27	5.6	48 / 31	38 / 28	3 / 3	3 / 3	5 / 5	2 / 2	41 / 30
BWS_04	0.30	---	23	22	0.087	0.12	0.19	0.22	22	3.27	5.6	>250 / >250	>250 / >250	3 / 3	3 / 3	5 / 5	2 / 2	>250 / >250
BWS_06	0.56	---	2.2	0.26	0.24	0.18	0.13	0.19	1.3	3.27	5.6	30 / 12	17 / 10	17 / 10	10 / 10	14 / 11	5 / 5	20 / 11
BWS_07	0.12	---	5.4	5.4	5.4	0.030	0.11	0.11	5.4	3.27	5.6	>250 / 4	>250 / 4	>250 / 4	10 / 4	14 / 14	5 / 5	>250 / 13
BWS_08	0.35	---	37	37	0.060	0.061	0.29	0.26	37	3.27	5.6	>250 / >250	>250 / >250	12 / 12	12 / 12	18 / 18	7 / 7	>250 / >250
BWS_09	0.28	---	19	19	0.098	0.098	0.21	0.23	20	3.27	5.6	>250 / >250	>250 / >250	13 / 13	13 / 13	18 / 18	7 / 7	>250 / >250
BWS_10	1.5	---	16	15	0.078	0.080	0.27	0.38	16	3.27	5.6	>250 / >250	>250 / >250	13 / 13	13 / 13	19 / 19	7 / 7	>250 / >250
BWS_11	0.11	---	2.1	0.14	0.12	0.13	0.093	0.13	1.3	3.27	5.6	10 / 5	7 / 5	7 / 5	7 / 5	8 / 5	7 / 5	8 / 5
BWS_12	1.7	---	6.1	4.7	4.2	0.11	0.10	0.14	6.0	3.27	5.6	109 / 61	76 / 42	67 / 38	13 / 13	20 / 20	7 / 7	107 / 59
BWS_13	0.37	---	10	9.2	8.9	0.11	0.10	0.10	10	3.27	5.6	>250 / >250	>250 / >250	>250 / >250	13 / 13	20 / 20	7 / 7	>250 / >250
BWS_14	0.57	---	8.8	8.1	7.8	0.049	0.20	0.14	9.0	3.27	5.6	>250 / 213	>250 / 143	>250 / 130	13 / 13	20 / 20	7 / 7	>250 / >250
BWS_15	0.90	---	8.9	6.7	5.6	0.10	0.12	0.16	9.2	3.27	5.6	167 / 107	116 / 69	86 / 52	13 / 13	21 / 21	7 / 7	201 / 124
BWS_16	1.0	---	3.2	1.2	0.77	0.094	0.12	0.14	2.8	3.27	5.6	52 / 23	30 / 17	27 / 17	14 / 14	21 / 18	8 / 8	46 / 22
BWS_17	0.58	---	2.4	0.44	0.27	0.11	0.088	0.13	1.6	3.27	5.6	32 / 6	14 / 5	15 / 5	14 / 5	16 / 6	8 / 6	19 / 6
BWS_18	0.84	---	2.3	0.29	0.24	0.10	0.074	0.11	1.4	3.27	5.6	32 / 12	19 / 11	20 / 10	14 / 10	19 / 11	8 / 8	22 / 11
BWS_19	0.99	---	20	20	0.074	0.072	0.11	0.15	21	3.27	5.6	>250 / >250	>250 / >250	14 / 14	14 / 14	23 / 23	8 / 8	>250 / >250
BWS_20	1.3	---	5.8	4.4	4.1	0.11	0.12	0.14	6.4	3.27	5.6	95 / 55	74 / 36	67 / 36	15 / 15	24 / 24	8 / 8	130 / 68

Table 8-14. Evaluation of attainment of amphibian IMPGs for combined SED/FP alternatives.

Exposure Area ID[1]	Area (acre)	Floodplain Pre-Remediation EPC (mg/kg)[2]	Floodplain Post-Remediation EPC (mg/kg)[2] / Projected Sediment Concentrations (mg/kg)							IMPG Attainment									
			SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	Lower Bound IMPG (mg/kg)	Upper Bound IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Sediment - Large Backwaters (> 2 acres)																			
BWL_01	2.1	---	11	11	0.11	1.5	0.15	0.18	11	3.27	5.6	180 / 124	166 / 115	8 / 8	8 / 8	12 / 12	4 / 4	177 / 123
BWL_02	5.5	---	5.7	4.2	3.9	0.11	0.14	0.17	5.2	3.27	5.6	97 / 54	66 / 35	60 / 32	12 / 12	17 / 17	6 / 6	87 / 48
BWL_03	2.4	---	3.6	2.2	1.8	0.096	0.10	0.14	3.3	3.27	5.6	58 / 25	37 / 16	33 / 16	13 / 13	19 / 18	7 / 7	53 / 22
BWL_04	2.1	---	4.4	2.4	1.9	0.12	0.14	0.15	3.8	3.27	5.6	81 / 32	38 / 26	34 / 26	14 / 14	21 / 21	8 / 8	66 / 31
BWL_05	12	---	14	12	0.22	0.25	0.11	0.19	14	3.27	5.6	200 / 146	147 / 108	14 / 14	14 / 14	23 / 23	8 / 8	202 / 147
BWL_07	22	---	20	19	0.17	0.18	0.11	0.22	20	3.27	5.6	>250 / >250	>250 / 225	15 / 15	15 / 15	25 / 25	9 / 9	>250 / >250
BWL_08	4.1	---	13	11	1.3	0.19	0.10	0.18	14	3.27	5.6	>250 / 183	207 / 140	15 / 15	15 / 15	26 / 26	9 / 9	>250 / >250
BWL_09	7.0	---	15	14	0.16	0.24	0.10	0.18	15	3.27	5.6	>250 / 228	239 / 170	15 / 15	16 / 15	26 / 26	10 / 9	>250 / 227
BWL_10	6.4	---	13	12	0.13	0.18	0.16	0.21	13	3.27	5.6	>250 / 223	>250 / 189	15 / 15	16 / 16	27 / 27	10 / 10	>250 / 226
BWL_11	4.6	---	2.3	2.3	0.024	0.024	0.022	0.023	2.3	3.27	5.6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0

Key:

- [white] = *post-remediation EPC is higher than Upper Bound IMPG*
- [light blue] = *post-remediation EPC is between Lower and Upper Bound IMPGs*
- [blue] = *post-remediation EPC is below Lower Bound IMPG*
- *<value>* = Time to achieve the IMPG (years), as predicted by the model
- *<value>* (grey) = Time to achieve the IMPG (years), based on highly uncertain extrapolation of the model results as described in Section 3.2.1 of the Revised CMS Report

Notes:

[1] *See Revised CMS Report Figure 4-5 for locations of vernal pools.*

[2] *EPC is calculated for the top 1 ft of floodplain soil.*

Table 8-16. Evaluation of attainment of IMPGs for fish protection for combined SED/FP alternatives.

Ecological Receptor	Reach	Projected Fish Concentrations (mg/kg)[1]							IMPG Attainment							
		SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Fish protection	Warmwater fish tissue (whole body)															
	5A	28	0.98	1.0	0.99	0.68	1.2	16	55	*5*	*3*	*3*	*3*	*3*	*4*	*3*
	5B	36	12	0.89	0.86	0.58	1.1	25		*8*	*5*	*5*	*5*	*6*	*6*	*4*
	5C	29	7.0	0.65	0.63	0.43	0.71	22		*0*	*0*	*0*	*0*	*0*	*6*	*0*
	5D	36	24	1.4	1.4	1.1	1.6	41		*36*	*11*	*14*	*15*	*24*	*9*	*36*
	6 (WP)	34	2.8	0.70	0.68	0.50	0.64	14		*7*	*5*	*5*	*5*	*5*	*7*	*4*
	7A	25	4.8	1.6	1.5	1.3	1.6	16		*0*	*0*	*0*	*0*	*0*	*6*	*0*
	7B	22	8.2	6.1	1.6	0.40	0.82	16		*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7C	24	6.7	4.0	0.77	0.47	0.75	17		*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7D	21	5.2	3.0	2.7	2.5	2.9	14		*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7E	16	3.9	2.2	1.3	0.71	0.84	11		*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7F	13	3.1	1.9	1.7	1.5	1.7	8.5		*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7G	14	4.8	3.9	1.5	0.60	0.84	9.9		*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7H	11	2.8	1.6	1.5	1.3	1.5	7.4		*0*	*0*	*0*	*0*	*0*	*0*	*0*
	8 (RP)	14	6.0	1.3	0.84	0.67	0.91	10		*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Coldwater fish tissue (whole body) - Trout Below PSA															
	7A	49	9.6	3.2	3.0	2.6	3.2	32	14	*173*	*18*	*20*	*21*	*34*	*13*	*137*
	7B	44	16	12	3.2	0.81	1.6	32		*179*	*77*	*30*	*20*	*40*	*13*	*174*
	7C	49	13	7.9	1.5	0.95	1.5	33		*181*	*51*	*21*	*21*	*41*	*14*	*159*
	7D	42	10	6.0	5.4	4.9	5.7	29		*183*	*22*	*20*	*21*	*41*	*14*	*159*
	7E	32	7.7	4.4	2.6	1.4	1.7	22		*130*	*18*	*20*	*20*	*33*	*13*	*104*
	7F	25	6.3	3.7	3.4	3.0	3.5	17		*104*	*14*	*19*	*20*	*31*	*13*	*83*
	7G	27	9.7	7.8	3.0	1.2	1.7	20		*123*	*21*	*19*	*20*	*33*	*13*	*122*
	7H	22	5.5	3.3	3.0	2.7	2.9	15		*89*	*12*	*11*	*19*	*30*	*12*	*61*

Notes

[1] *Model endpoint concentrations after projection (autumn average)*

IMPG = interim media protection goal

IT = Increasing trend in model extrapolation; no time-to-achieve estimated.

Key

(white cell) = model prediction exceeds the IMPG

(blue cell) = model prediction is lower than the IMPG

<value> = Time to achieve the IMPG (years), as predicted by the model

<value> (grey) = Time to achieve the IMPG (years), based on highly uncertain extrapolation of the model results as described in Section 3.2.1 of the Revised CMS Repo

Table 8-18. Evaluation of IMPG attainment for insectivorous birds (wood duck) for combined SED/FP alternatives.

Reach	Averaging Area	Model-Predicted Sediment Endpoint PCB Concentrations (mg/kg)							Calculated Target Floodplain Soil Levels (mg/kg)[1]							Post-Remediation Floodplain EPC (mg/kg)							IMPG Attainment						
		SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
5A	K1	4.3	0.20	0.20	0.21	0.089	0.24	2.8	33	54	54	54	55	54	40	29	21	17	17	3.4	13	28							
	K2	11	1.8	0.80	0.093	0.36	0.22	7.1	*n/a*	46	51	55	53	54	18	9.8	7.9	6.7	6.7	4.6	6.7	7.9							
	K3	13	1.7	0.058	0.058	0.063	0.17	7.9	*n/a*	46	55	55	55	54	14	53	19	18	18	2.7	11	26							
	K4	15	0.020	0.020	0.020	0.024	0.17	15	*n/a*	55	55	55	55	54	*n/a*	16	15	12	12	4.6	11	16							
	K5	19	0.023	0.024	0.023	0.028	0.16	0.74	*n/a*	55	55	55	55	54	51	22	18	14	14	6.0	14	21							
5B	K6	9.7	7.4	0.053	0.31	0.051	0.11	8.3	*n/a*	0.3	55	53	55	54	*n/a*	25	24	19	19	5.7	18	25							
	K7	6.3	4.2	0.16	0.065	0.062	0.092	5.5	8.4	24	54	55	55	54	15	30	22	22	22	4.5	15	28							
	K8	7.3	5.8	1.2	0.085	0.095	0.12	7.0	1.0	12	46	54	54	54	3.3	24	18	18	18	4.7	11	23							
5C/D	K9	7.0	5.4	1.4	0.10	0.11	0.14	6.7	42	45	52	55	55	55	42	25	23	17	17	8.3	12	25							
	K10	18	7.2	0.17	0.19	0.11	0.17	18	21	41	55	55	55	55	22	13	12	12	12	7.4	9.5	13							
	K11	20	12	0.40	0.20	0.11	0.18	20	17	32	54	55	55	55	18	14	14	13	13	6.1	11	14							
6	K12	19	1.8	0.21	0.22	0.16	0.16	8.5	20	52	55	55	55	55	40	23	23	15	15	11	12	23							

Key

= IMPG is attained

Notes:

(n/a) denotes IMPG values not attainable given the predicted sediment level.

[1] *Target floodplain soil levels calculated in accordance with method described in Appendix D to the Revised CMS Report.*

Table 8-20. Evaluation of attainment of IMPGs for consumption of fish by piscivorous birds and threatened and endangered species for combined SED/FP alternatives.

Ecological Receptor	Reach	Projected Fish Concentrations (mg/kg)[1]							IMPG Attainment							
		SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
	Fish tissue (whole body)															
Piscivorous birds (represented by osprey)	5A	21	0.55	0.56	0.55	0.38	0.71	11	3.2	*211*	*10*	*10*	*10*	*12*	*9*	*173*
	5B	22	11	0.44	0.42	0.30	0.54	17	3.2	*>250*	*202*	*12*	*12*	*17*	*10*	*>250*
	5C	23	7.0	0.41	0.41	0.28	0.44	20	3.2	*>250*	*114*	*17*	*17*	*28*	*11*	*>250*
	5D	21	15	0.79	0.77	0.62	0.83	24	3.2	*244*	*96*	*18*	*18*	*28*	*12*	*199*
	6 (WP)	22	1.9	0.45	0.43	0.32	0.40	9.1	3.2	*>250*	*13*	*19*	*20*	*39*	*13*	*146*
	7A	11	2.4	1.1	1.1	0.97	1.1	7.2	3.2	*173*	*18*	*20*	*20*	*34*	*13*	*150*
	7B	16	8.4	7.5	1.7	0.26	0.63	13	3.2	*>250*	*>250*	*>250*	*20*	*40*	*13*	*>250*
	7C	12	4.4	3.2	0.36	0.23	0.33	8.6	3.2	*203*	*130*	*41*	*20*	*41*	*13*	*210*
	7D	11	3.4	2.5	2.3	2.2	2.4	7.7	3.2	*244*	*64*	*22*	*21*	*42*	*15*	*248*
	7E	7.4	2.2	1.5	0.79	0.32	0.36	5.1	3.2	*133*	*22*	*19*	*19*	*36*	*12*	*112*
	7F	6.1	1.9	1.3	1.2	1.1	1.2	4.2	3.2	*119*	*17*	*18*	*20*	*31*	*12*	*103*
	7G	7.3	3.5	3.1	1.1	0.28	0.42	5.7	3.2	*171*	*68*	*22*	*20*	*42*	*13*	*189*
	7H	5.0	1.5	1.1	1.0	0.95	1.0	3.5	3.2	*94*	*12*	*11*	*19*	*29*	*12*	*78*
	8 (RP)	7.8	4.4	0.78	0.43	0.34	0.49	6.3	3.2	*156*	*115*	*19*	*21*	*49*	*15*	*243*
	Fish tissue (whole body)															
Threatened and endangered species (represented by bald eagle)	5A	25	0.45	0.46	0.45	0.31	0.65	13	30.41	*31*	*3*	*3*	*4*	*5*	*3*	*3*
	5B	23	13	0.40	0.38	0.28	0.49	19	30.41	*9*	*5*	*5*	*5*	*6*	*5*	*4*
	5C	24	7.7	0.37	0.38	0.26	0.40	21	30.41	*24*	*7*	*7*	*7*	*8*	*7*	*7*
	5D	19	15	0.67	0.62	0.49	0.66	21	30.41	*25*	*10*	*14*	*14*	*21*	*8*	*35*
	6 (WP)	18	1.6	0.34	0.32	0.24	0.28	6.8	30.41	*7*	*5*	*5*	*5*	*5*	*7*	*4*
	7A	9.2	2.3	1.2	1.1	1.1	1.2	6.2	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7B	16	9.5	8.8	1.9	0.24	0.63	13	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7C	11	4.7	3.7	0.32	0.20	0.28	8.2	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7D	10	3.6	2.9	2.7	2.5	2.9	7.4	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7E	6.5	2.2	1.7	0.81	0.27	0.31	4.6	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7F	5.5	1.9	1.4	1.4	1.2	1.4	3.9	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7G	7.0	3.8	3.6	1.1	0.24	0.39	5.7	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	7H	4.4	1.5	1.1	1.1	1.0	1.1	3.2	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	8 (RP)	7.7	4.9	0.79	0.41	0.32	0.47	6.4	30.41	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Notes

[1] *Model endpoint concentrations after projection (autumn average)*

IMPG = interim media protection goal

IT = Increasing trend in model extrapolation; no time-to-achieve estimated.

Key

[white box] = model prediction exceeds the IMPG

[blue box] = model prediction is lower than the IMPG

<value> = Time to achieve the IMPG (years), as predicted by the model

<value> (grey) = Time to achieve the IMPG (years), based on highly uncertain extrapolation of the model results as described in Section 3.2.1 of the Revised CMS Report

Table 8-22. Evaluation of IMPG attainment for piscivorous mammals (mink) for combined SED/FP alternatives.

Averaging Area	Model-Predicted Sediment Endpoint PCB Concentrations (mg/kg)							Calculated Target Floodplain Soil Levels (mg/kg)[1] – Lower Bound							Calculated Target Floodplain Soil Levels (mg/kg)[1] – Upper Bound						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Reaches 5A/5B	11	2.9	0.40	0.11	0.087	0.16	6.9	*n/a*	*n/a*	6.9	8.6	8.7	8.3	*n/a*	*n/a*	5.7	20	22	22	21	*n/a*
Reaches 5C/5D/6	17	6.2	0.42	0.19	0.13	0.16	13	*n/a*	*n/a*	8.0	8.4	8.6	8.5	*n/a*	*n/a*	9.4	21	21	21	21	*n/a*

Averaging Area	Post-Remediation Floodplain EPC (mg/kg)[1]							IMPG Attainment – Lower Bound							IMPG Attainment – Upper Bound						
	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
Reaches 5A/5B	22	17	14	14	3.4	12	20					[shaded]					[shaded]	[shaded]	[shaded]	[shaded]	
Reaches 5C/5D/6	17	15	14	14	6.7	9.8	17					[shaded]					[shaded]	[shaded]	[shaded]	[shaded]	

Key

[shaded] = IMPG is attained

Notes:

(n/a) denotes IMPG values not attainable given the predicted sediment level.

[1] *Target floodplain soil levels calculated in accordance with method described in Appendix E to the Revised CMS Report.*

Table 8-24. Evaluation of attainment of IMPGs for omnivorous/carnivorous mammals for combined SED/FP alternatives.

Averaging Area ID[1]	Pre-Remediation EPC (mg/kg)[2]	Floodplain Post-Remediation EPC (mg/kg)[2]							IMPG Attainment								
		SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9	Lower Bound IMPG (mg/kg)	Upper Bound IMPG (mg/kg)	SED 2 / FP 1	SED 3 / FP 3	SED 5 / FP 4	SED 6 / FP 4	SED 8 / FP 7	SED 9 / FP 8	SED 10 / FP 9
G1	20	20	14	12	12	3.3	9.9	19	21.1	34.3							
G2	51	51	18	14	14	2.7	11	23	21.1	34.3							
G3	19	19	17	14	14	3.5	13	18	21.1	34.3							
G4	27	27	24	21	21	5	18	27	21.1	34.3							
G5	28	28	23	19	19	6.3	10	28	21.1	34.3							
G6	12	12	12	12	12	7.1	9.3	12	21.1	34.3							
G7	18	18	17	14	14	8.3	12	17	21.1	34.3							

Key:

= *post-remediation EPC is higher than Upper Bound IMPG*

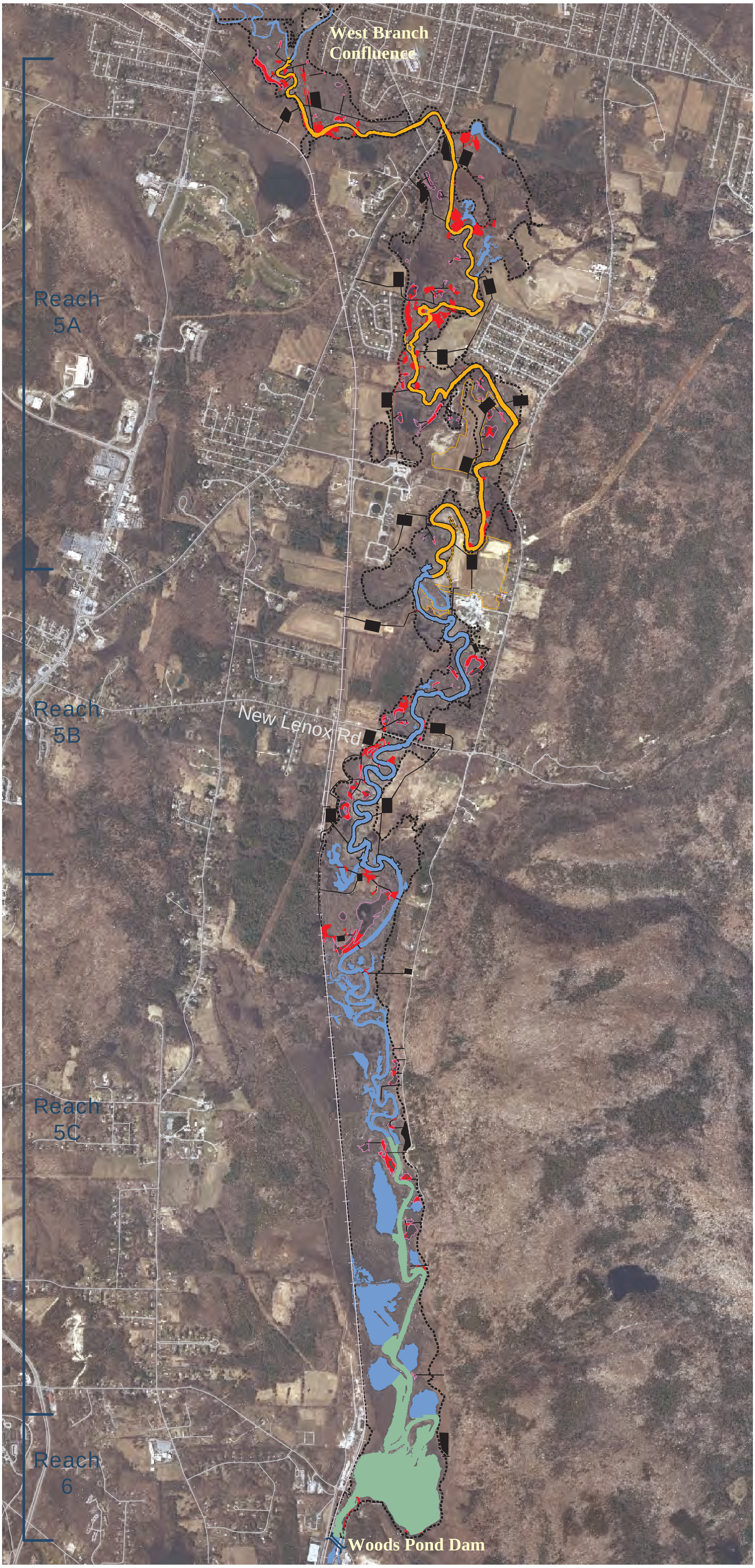
= *post-remediation EPC is between Lower and Upper Bound IMPGs*

= *post-remediation EPC is below Lower Bound IMPG*

Notes:

[1] *See Revised CMS Report Figure 4-6 for averaging areas for omnivorous/carnivorous mammals (based on short-tailed shrews).*

[2] *EPC is calculated for the top 1 ft of floodplain soil.*



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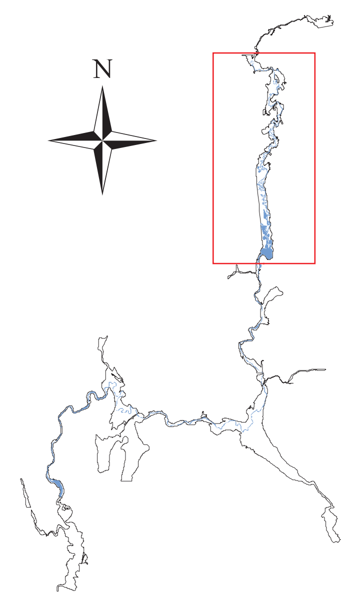

SCALE

0 0.25 0.5 Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 1 mg/kg PCB Isopleth
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Removal of Top 2 ft
- Thin-layer Capping
- Floodplain Soil Removal
- Access Road/ Staging Area

SED 3/FP 3 includes bank removal/ stabilization for Reaches 5A and 5B.

Figure 8-1a.

Remedial Action(s) for SED 3/FP 3 in Reaches 5 and 6.

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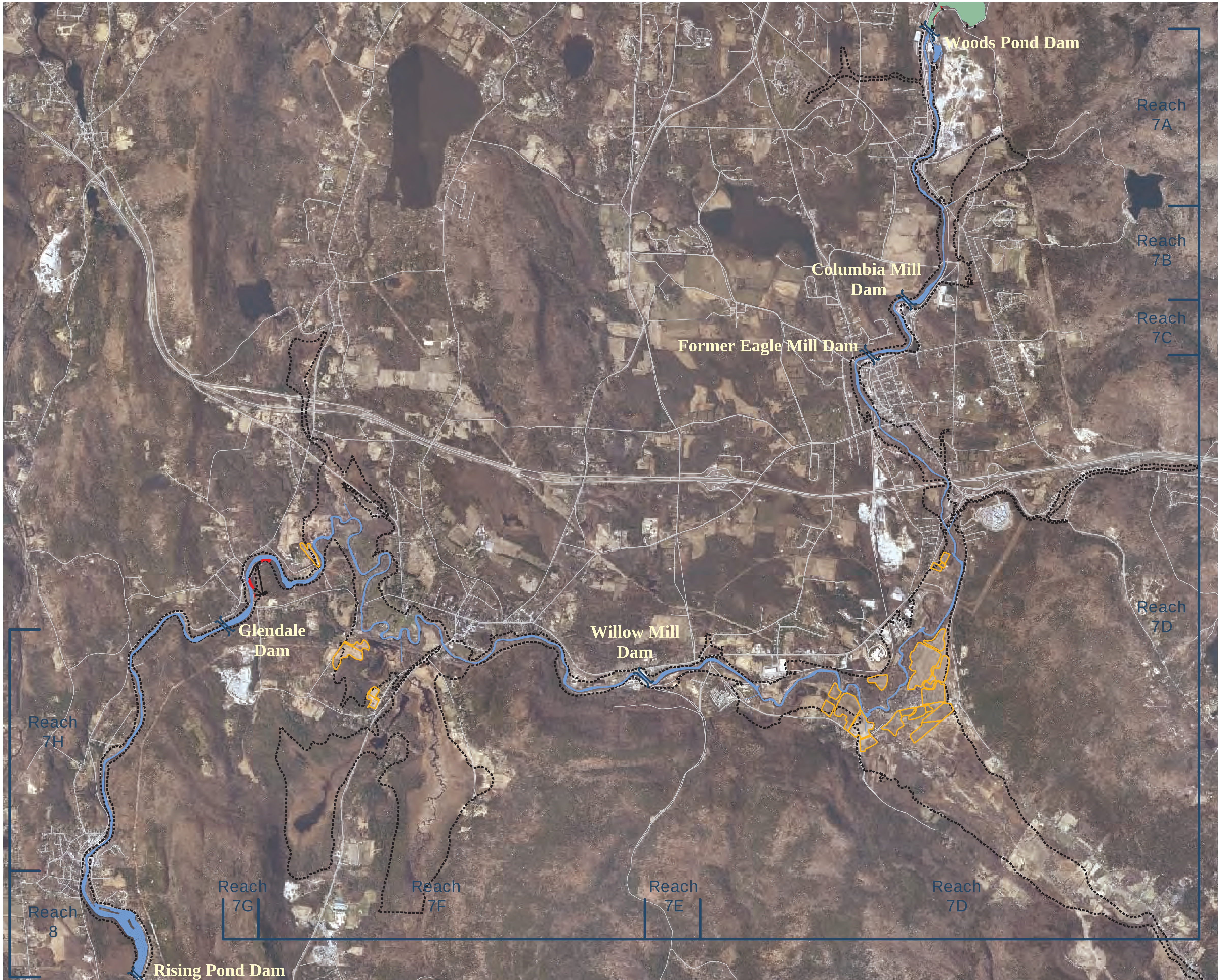

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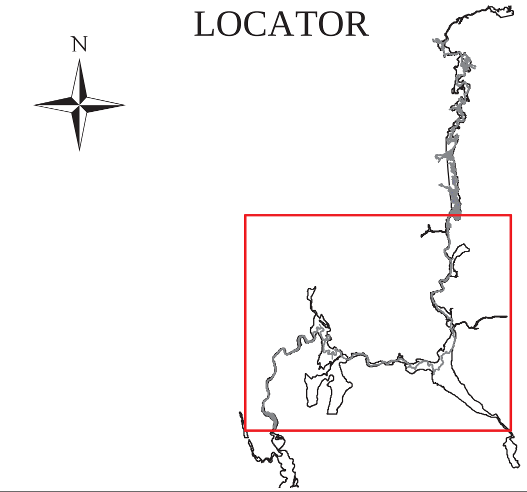

SCALE

0 0.5 1 2 Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 100-yr Floodplain
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Thin-layer Capping
- Floodplain Soil Removal
- Access Road/ Staging Area

Figure 8-1b.

Remedial Action(s) for SED 3/FP 3 in Reaches 7 and 8.

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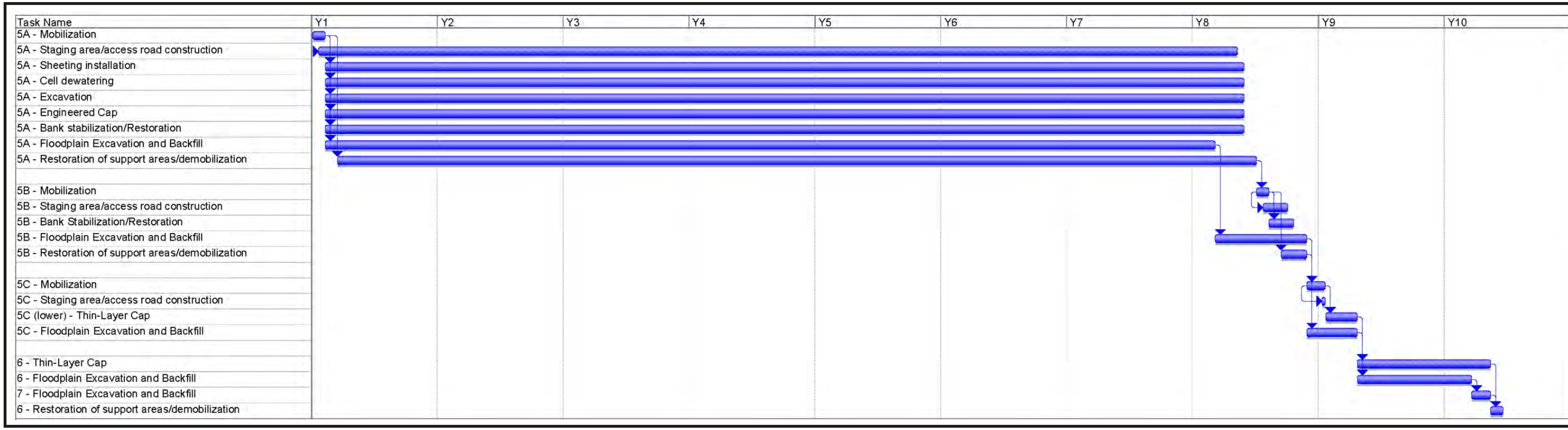

NOTES:

1. The general timeline associated with Reach 5A and 5B, and subsequent reaches, illustrates the overall timeframe when excavation, capping, and bank stabilization/restoration activities are occurring in terms of construction years. In Reaches 5A and 5B, the river channel will be divided in to a series of dry isolation cells for the performance of excavation, capping, and bank stabilization/restoration activities. However, as there are a total of 176 dry removal cells in Reach 5A alone, it is not possible to illustrate the sequential performance of remedial activities in each of these cells in a similar fashion.

2. It was assumed that the construction schedule for combined SED/FP alternatives would be determined by the sediment component. Floodplain excavation and backfill activities are considered to progress along with the adjacent work in the channel; as such, the construction schedule shown illustrates the period of time over which the floodplain activities may be performed, not the actual construction duration.

3. Y = Year.

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CONSTRUCTION TIMELINE FOR IMPLEMENTATION OF SED 3/FP 3

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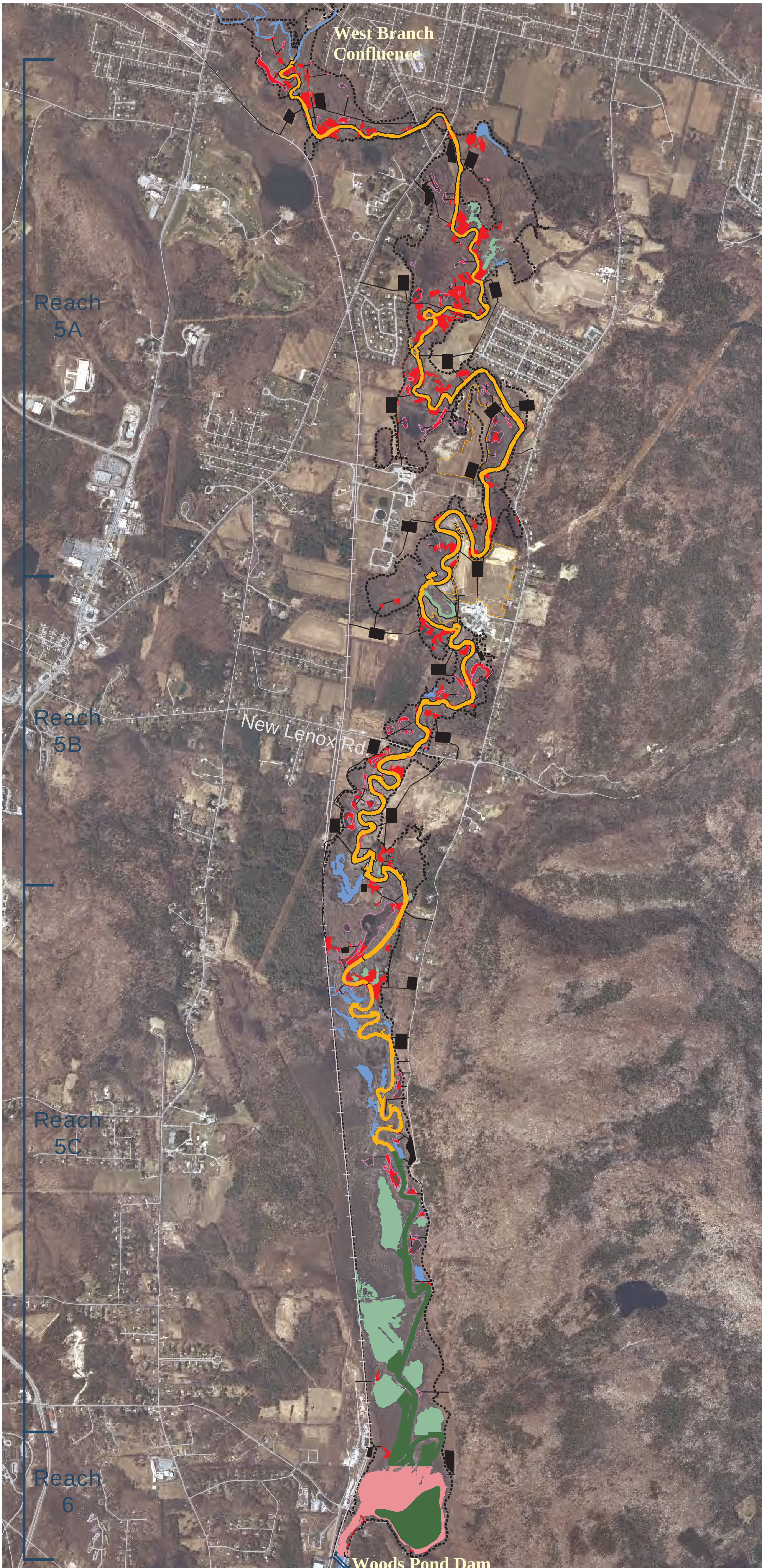
FIGURE
8-2



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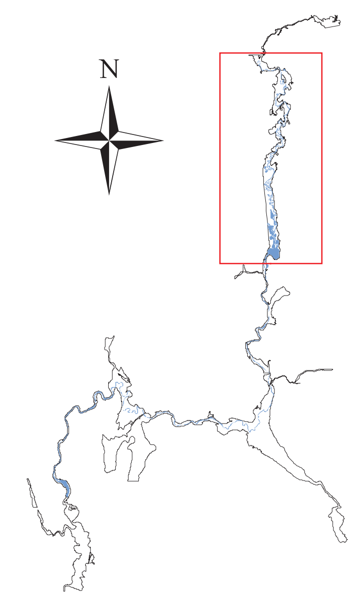

SCALE

0 0.25 0.5
Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 1 mg/kg PCB Isopleth
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Removal of Top 1.5 ft
- Removal of Top 2 ft
- Engineered Capping Only
- Thin-layer Capping

- Floodplain Soil Removal
- Access Road/ Staging Area

SED 5/FP 4 includes bank removal/ stabilization for Reaches 5A and 5B.

Figure 8-3a.

Remedial Action(s) for SED 5/FP 4 in Reaches 5 and 6.

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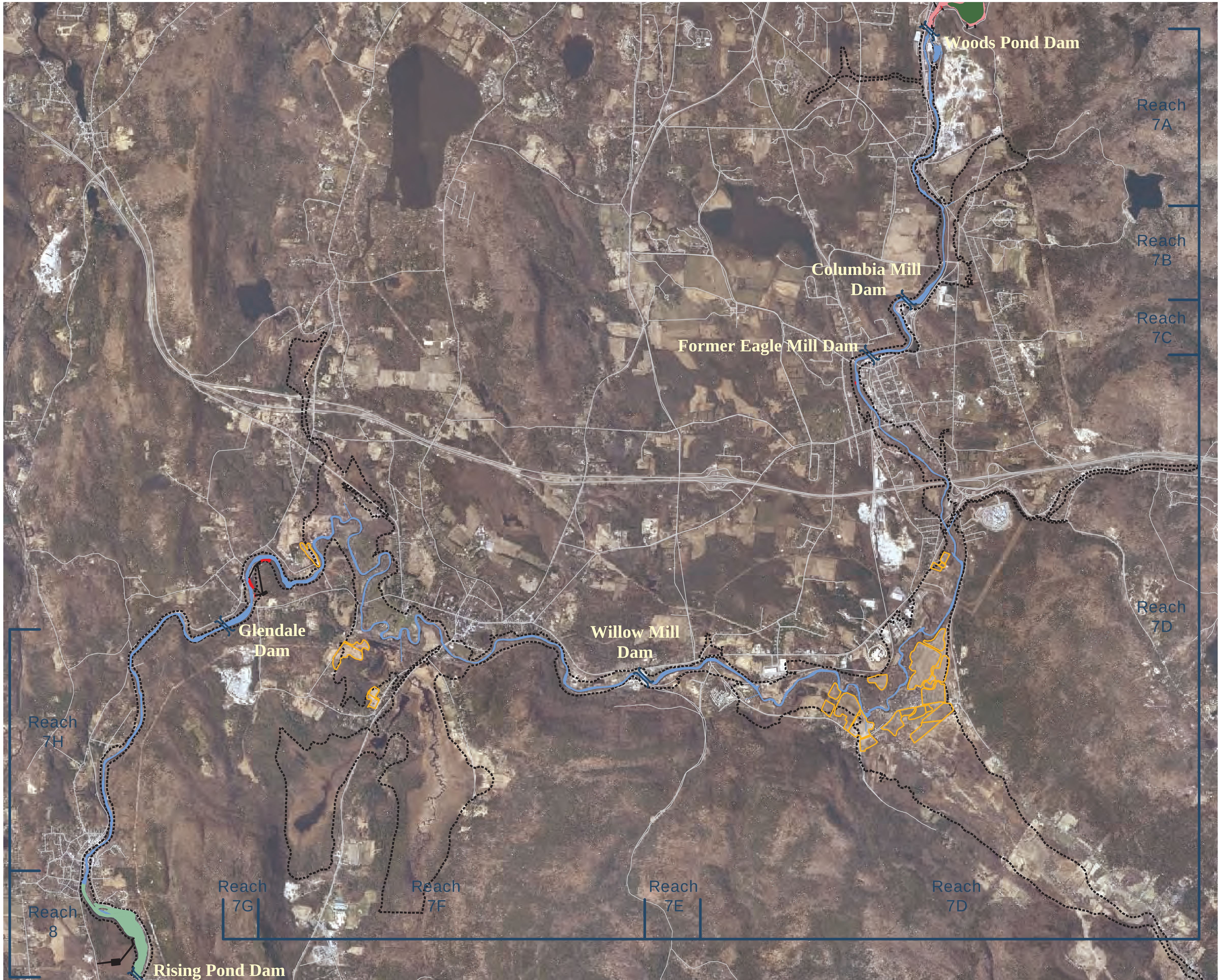

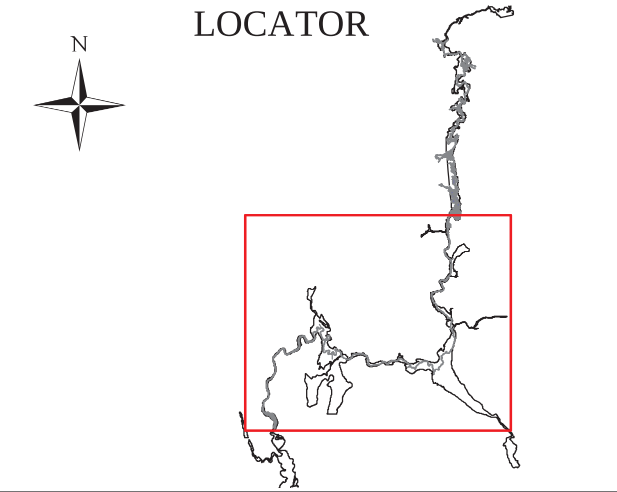

SCALE

0 0.5 1 2 Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 100-yr Floodplain
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Removal of Top 1.5 ft
- Engineered Capping Only
- Thin-layer Capping
- Floodplain Soil Removal
- Access Road/ Staging Area

Figure 8-3b.

Remedial Action(s) for SED 5/FP 4 in Reaches 7 and 8.

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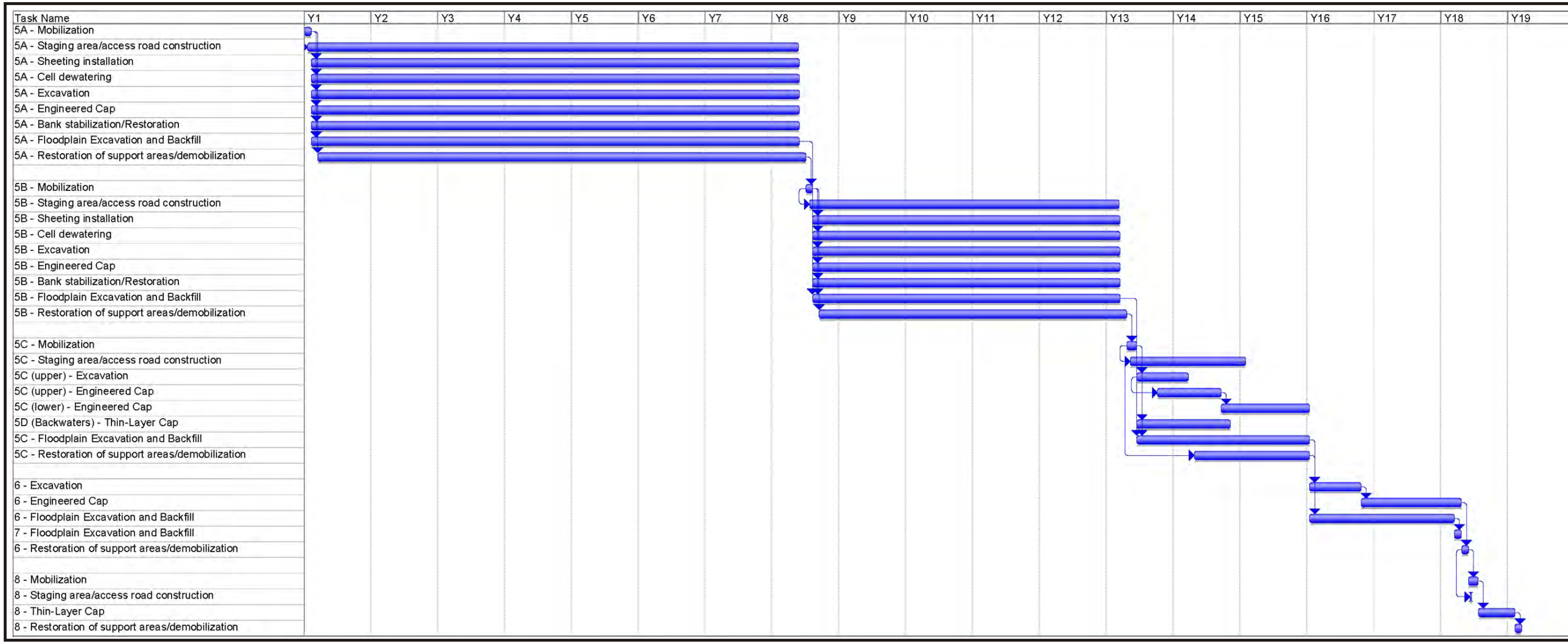

NOTE:

1. The general timeline associated with Reach 5A and 5B, and subsequent reaches, illustrates the overall timeframe when excavation, capping, and bank stabilization/restoration activities are occurring in terms of construction years. In Reaches 5A and 5B, the river channel will be divided in to a series of dry isolation cells for the performance of excavation, capping, and bank stabilization/restoration activities. However, as there are a total of 176 dry removal cells in Reach 5A alone, it is not possible to illustrate the sequential performance of remedial activities in each of these cells in a similar fashion.

2. It was assumed that the construction schedule for combined SED/FP alternatives would be determined by the sediment component. Floodplain excavation and backfill activities are considered to progress along with the adjacent work in the channel; as such, the construction schedule shown illustrates the period of time over which the floodplain activities may be performed, not the actual construction duration.

3. Y = Year.

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CONSTRUCTION TIMELINE FOR IMPLEMENTATION OF SED 5/FP 4

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FIGURE
8-4

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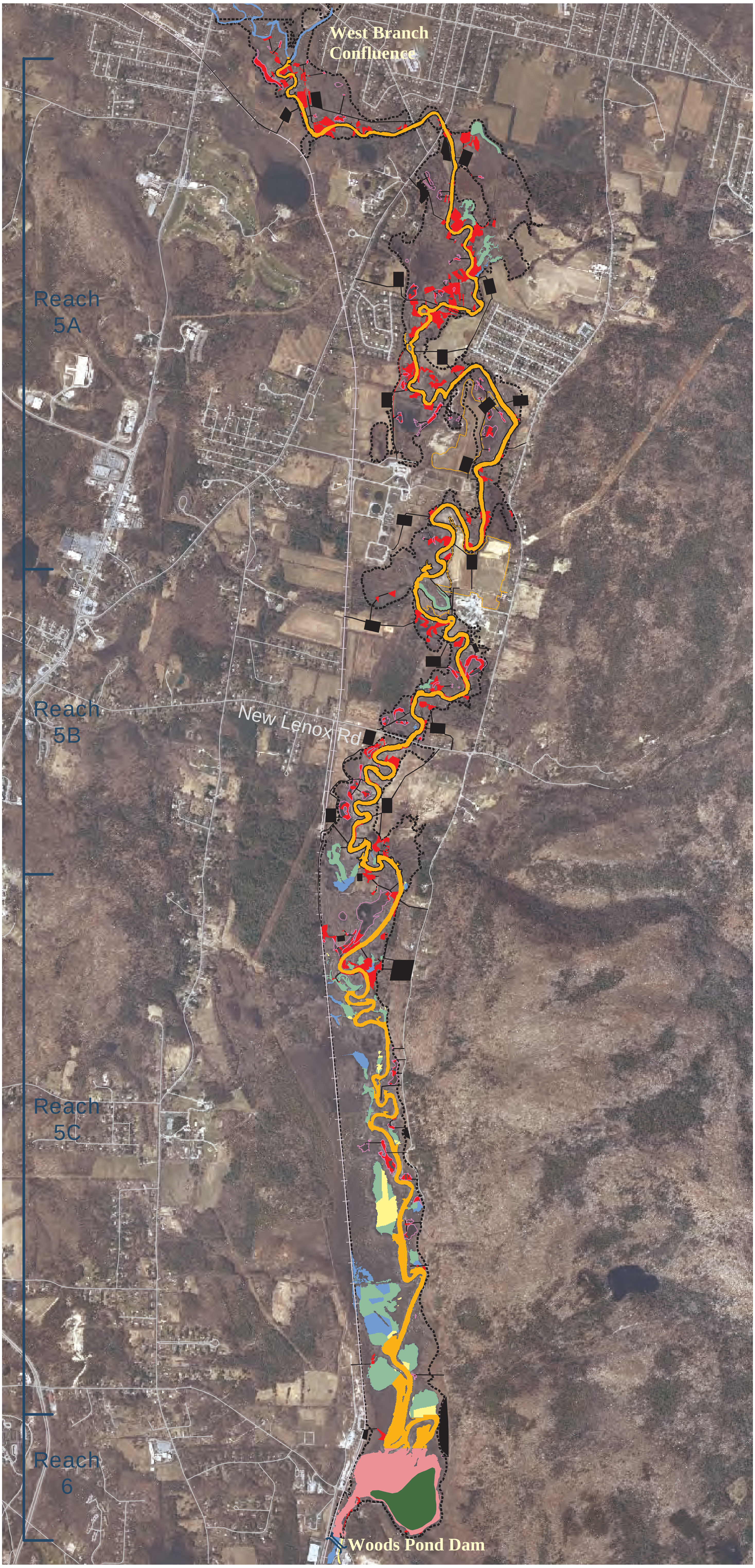

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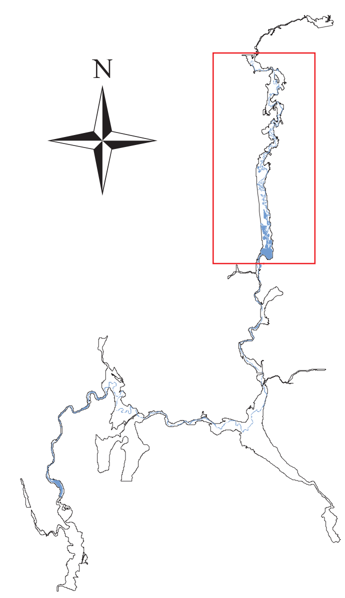

SCALE

0 0.25 0.5 Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 1 mg/kg PCB Isopleth
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Removal of Top 1 ft
- Removal of Top 1.5 ft
- Removal of Top 2 ft
- Engineered Capping Only
- Thin-layer Capping
- Floodplain Soil Removal
- Access Road/ Staging Area

SED 6/FP 4 includes bank removal/ stabilization for Reaches 5A and 5B.

Figure 8-5a.

Remedial Action(s) for SED 6/FP 4 in Reaches 5 and 6.

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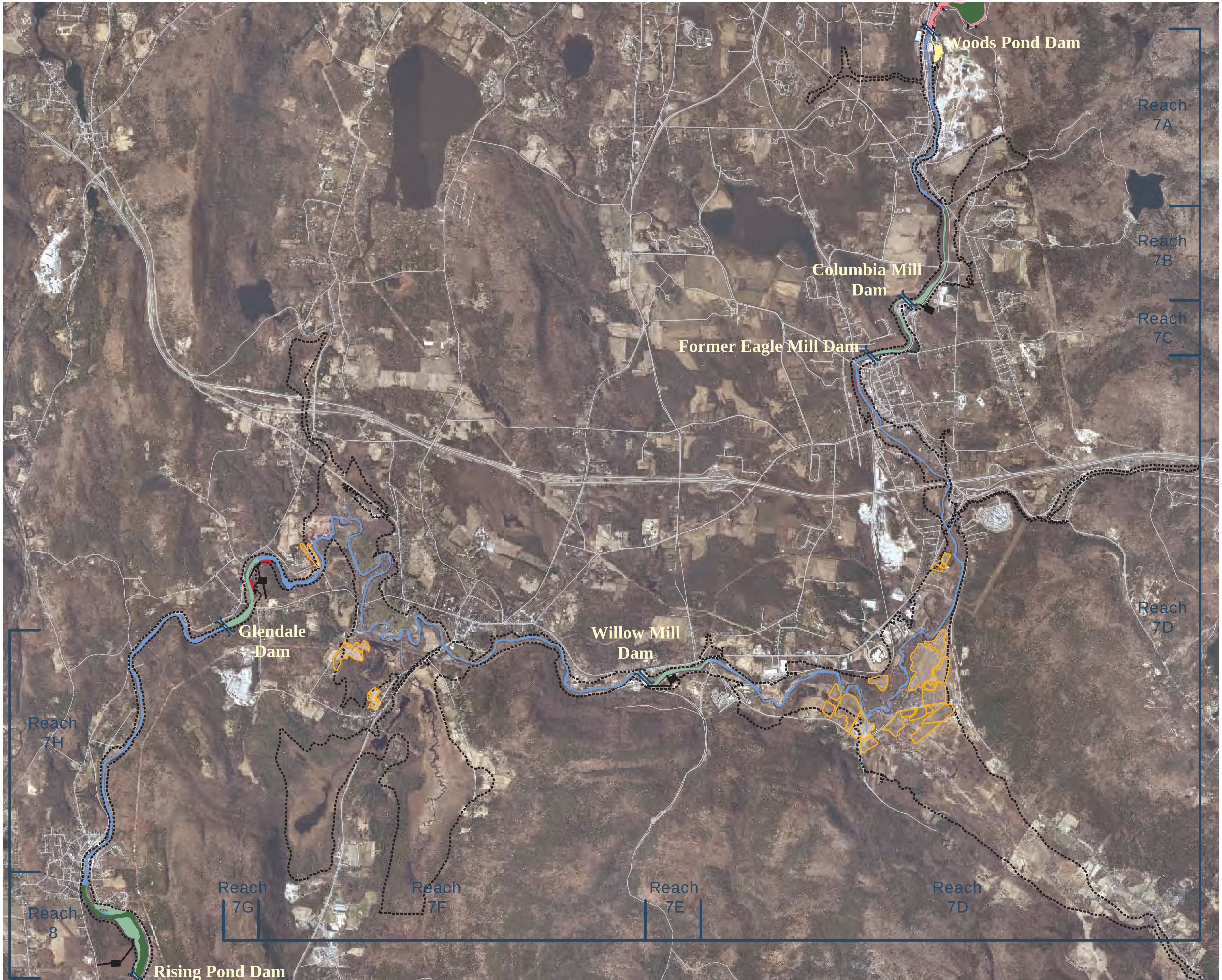

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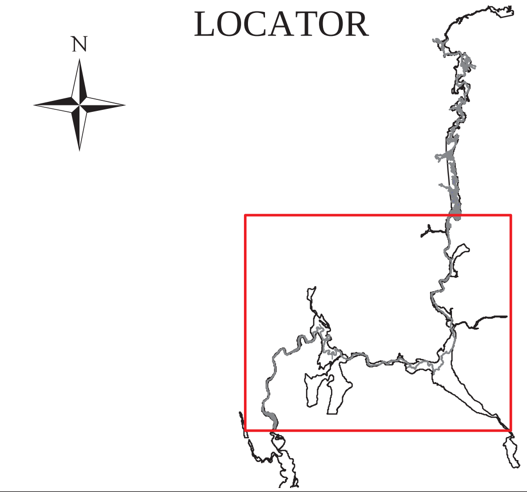

SCALE

0 0.5 1 2 Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 100-yr Floodplain
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Removal of Top 1 ft
- Removal of Top 1.5 ft
- Engineered Capping Only
- Thin-layer Capping
- Floodplain Soil Removal
- Access Road/ Staging Area

Figure 8-5b.

Remedial Action(s) for SED 6/FP 4 in Reaches 7 and 8.

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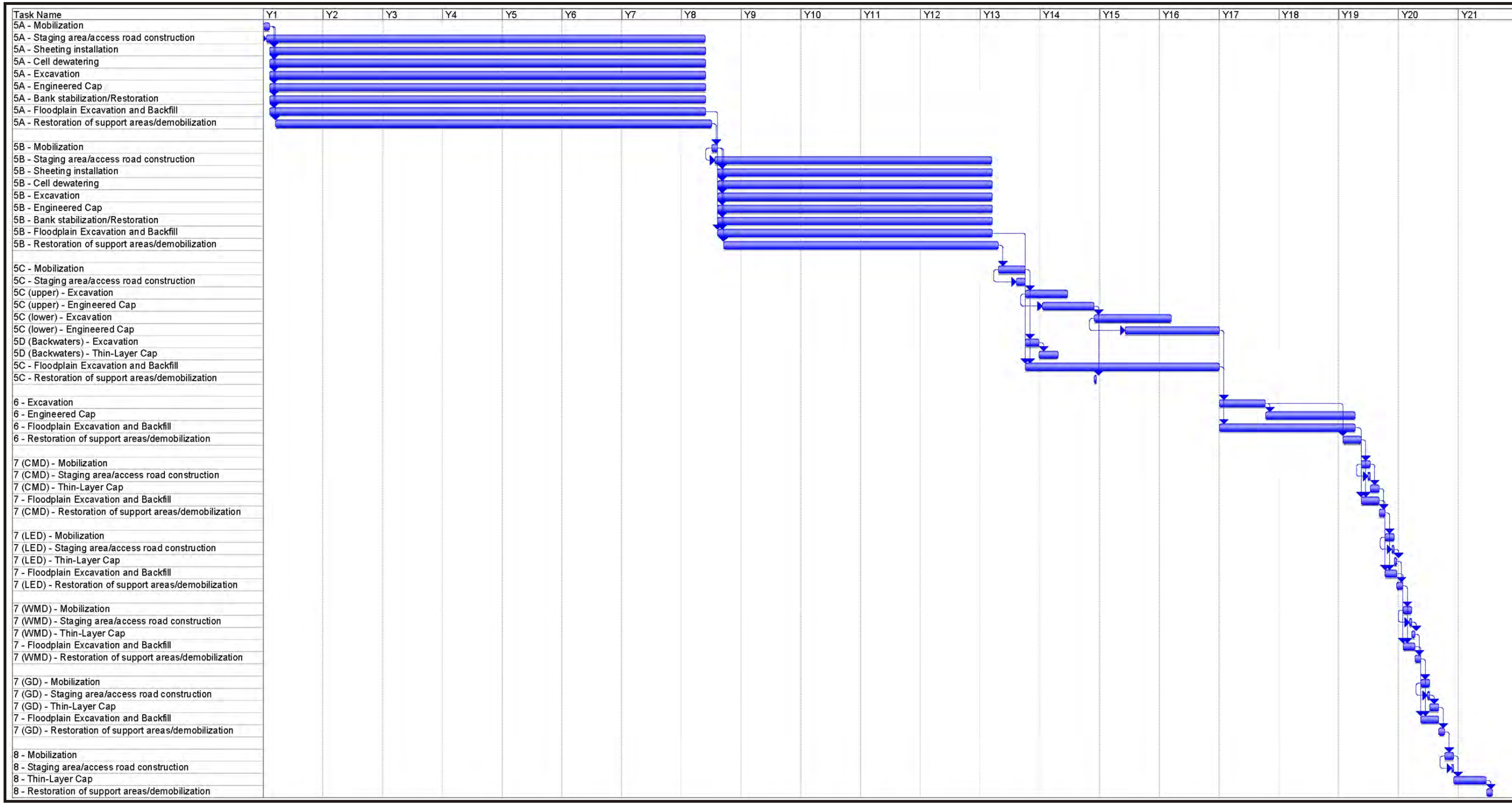

NOTES:

1. The general timeline associated with Reach 5A and 5B, and subsequent reaches, illustrates the overall timeframe when excavation, capping, and bank stabilization/restoration activities are occurring in terms of construction years. In Reaches 5A and 5B, the river channel will be divided in to a series of dry isolation cells for the performance of excavation, capping, and bank stabilization/restoration activities. However, as there are a total of 176 dry removal cells in Reach 5A alone, it is not possible to illustrate the sequential performance of remedial activities in each of these cells in a similar fashion.

2. It was assumed that the construction schedule for combined SED/FP alternatives would be determined by the sediment component. Floodplain excavation and backfill activities are considered to progress along with the adjacent work in the channel; as such, the construction schedule shown illustrates the period of time over which the floodplain activities may be performed, not the actual construction duration.

3. CMD = Columbia Mill Dam; LED = Lee/Eagle Dam; WMD = Willow Mill Dam; GD = Glendale Dam; Y = Year.

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CONSTRUCTION TIMELINE FOR IMPLEMENTATION OF SED 6/FP 4

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FIGURE

8-6

10/04/2010 SYRACUSE-NY-141ENV-DJHOWES
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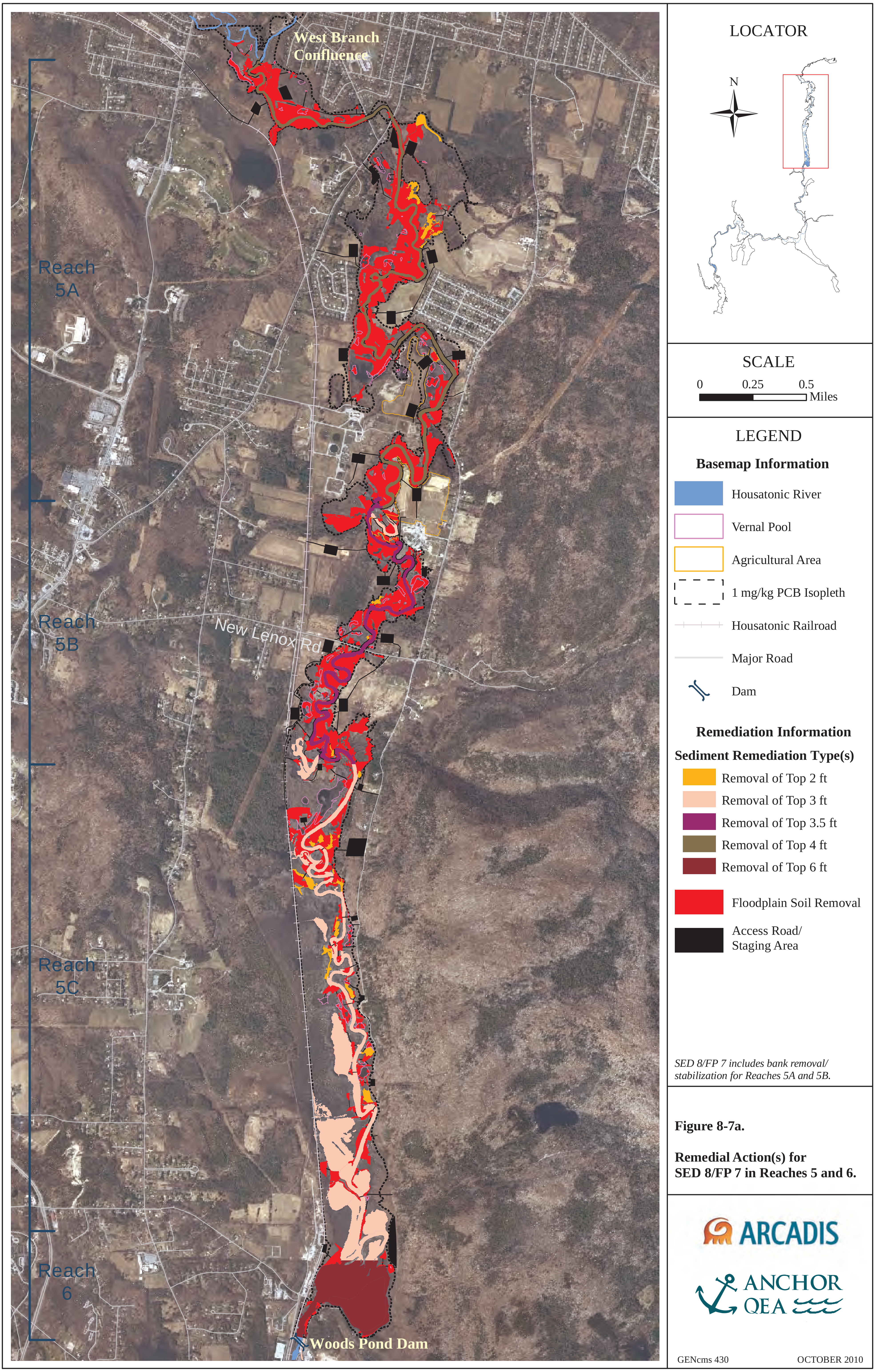

Figure 8-7a.

Remedial Action(s) for SED 8/FP 7 in Reaches 5 and 6.

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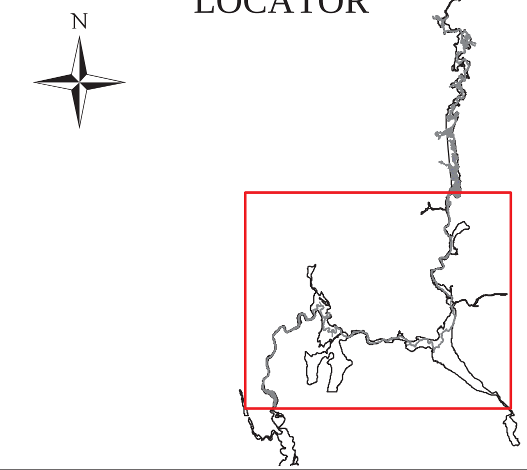

SCALE

0 0.5 1 2 Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 100-yr Floodplain
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Removal of Top 2 ft
- Removal of Top 3 ft
- Removal of Top 6 ft
- Removal of Top 7 ft

- Floodplain Soil Removal
- Access Road/ Staging Area

Figure 8-7b.

Remedial Action(s) for SED 8/FP 7 in Reaches 7 and 8.

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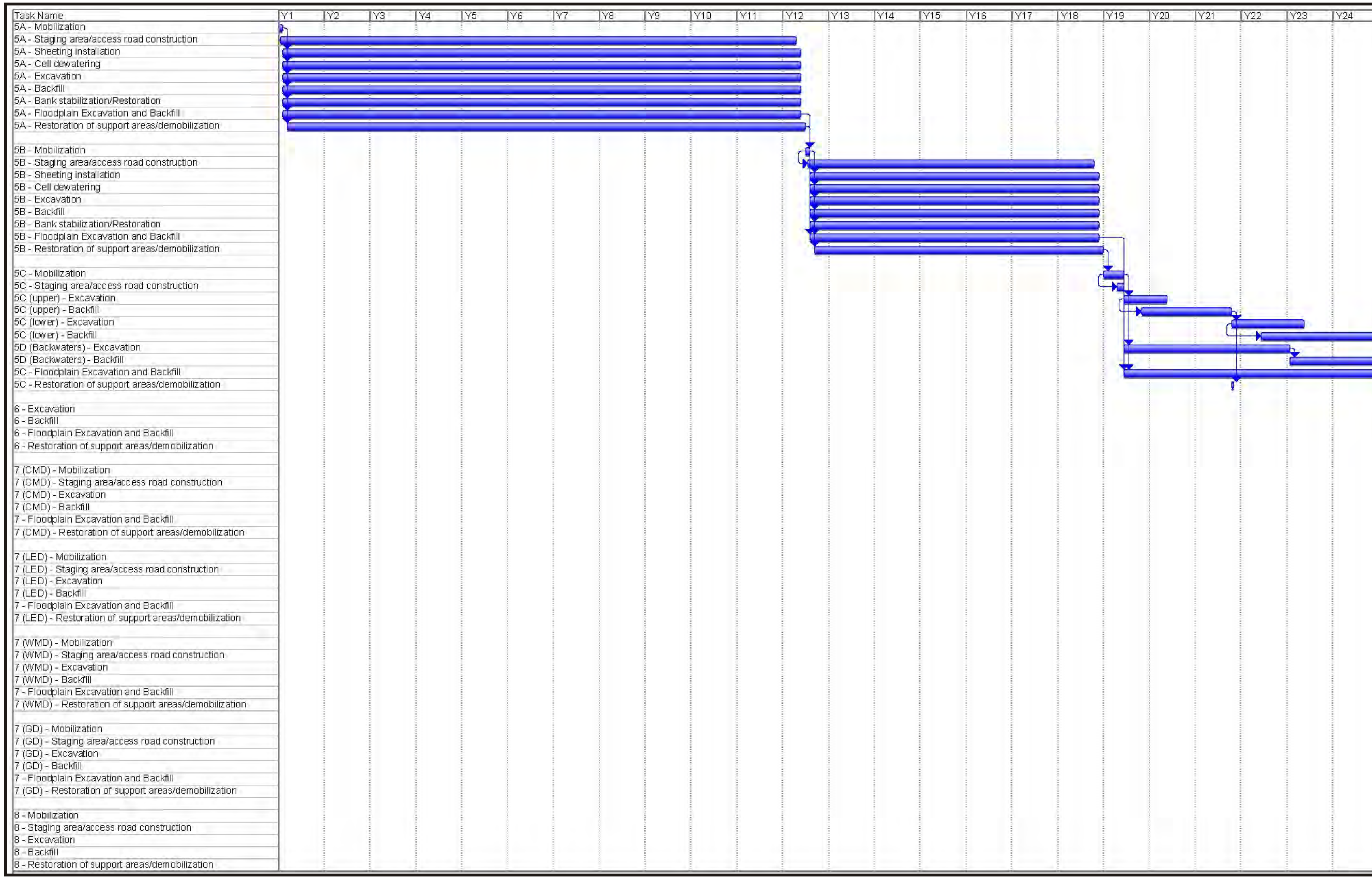

See Figure 8-8b for Continued Schedule

NOTES:

1. The general timeline associated with Reach 5A and 5B, and subsequent reaches, illustrates the overall timeframe when excavation, backfilling, and bank stabilization/restoration activities are occurring in terms of construction years. In Reaches 5A and 5B, the river channel will be divided in to a series of dry isolation cells for the performance of excavation, backfill, and bank stabilization/restoration activities. However, as there are a total of 176 dry removal cells in Reach 5A alone, it is not possible to illustrate the sequential performance of remedial activities in each of these cells in a similar fashion.

2. It was assumed that the construction schedule for combined SED/FP alternatives would be determined by the sediment component. Floodplain excavation and backfill activities are considered to progress along with the adjacent work in the channel; as such, the construction schedule shown illustrates the period of time over which the floodplain activities may be performed, not the actual construction duration.

3. CMD = Columbia Mill Dam; LED = Lee/Eagle Dam; WMD = Willow Mill Dam; GD = Glendale Dam; Y = Year.

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CONSTRUCTION TIMELINE FOR IMPLEMENTATION OF SED 8/FP 7

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FIGURE
8-8a

10/04/2010 SYRACUSE-NY-141ENV-DJHOWES
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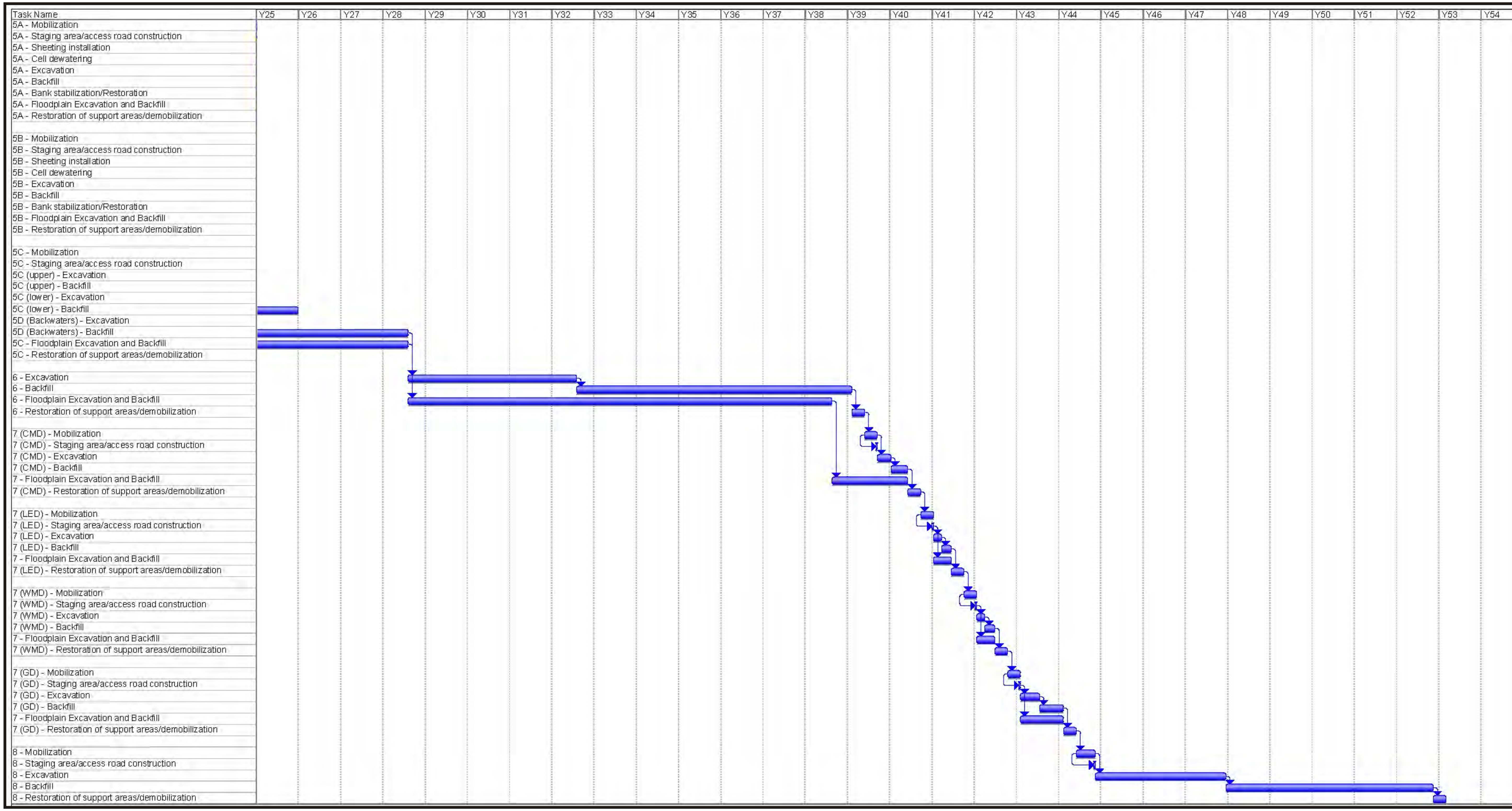

NOTES:

1. The general timeline associated with Reach 5A and 5B, and subsequent reaches, illustrates the overall timeframe when excavation, backfilling, and bank stabilization/restoration activities are occurring in terms of construction years. In Reaches 5A and 5B, the river channel will be divided in to a series of dry isolation cells for the performance of excavation, backfill, and bank stabilization/restoration activities. However, as there are a total of 176 dry removal cells in Reach 5A alone, it is not possible to illustrate the sequential performance of remedial activities in each of these cells in a similar fashion.

2. It was assumed that the construction schedule for combined SED/FP alternatives would be determined by the sediment component. Floodplain excavation and backfill activities are considered to progress along with the adjacent work in the channel; as such, the construction schedule shown illustrates the period of time over which the floodplain activities may be performed, not the actual construction duration.

3. CMD = Columbia Mill Dam; LED = Lee/Eagle Dam; WMD = Willow Mill Dam; GD = Glendale Dam; Y = Year.

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CONSTRUCTION TIMELINE FOR IMPLEMENTATION OF SED 8/FP 7

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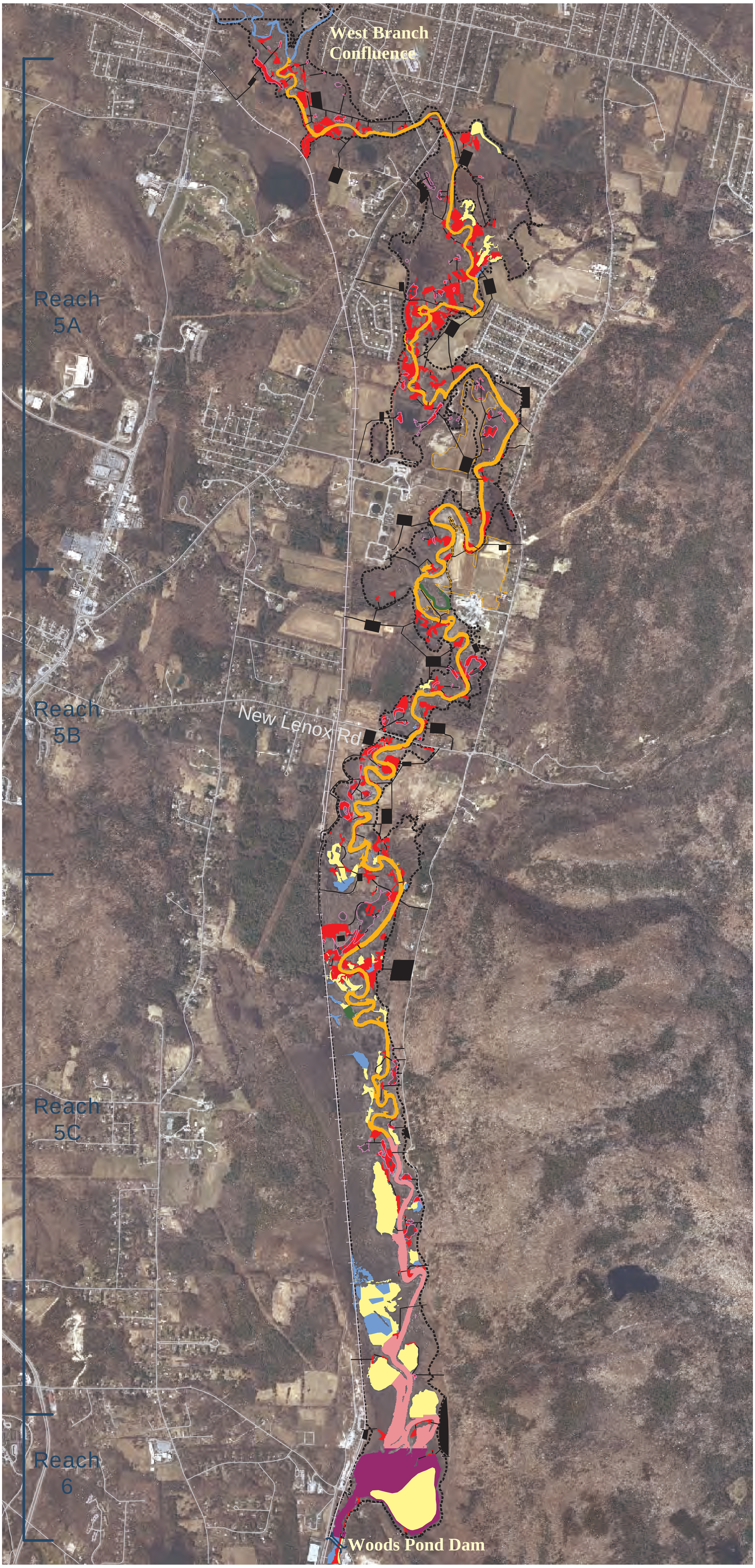
FIGURE

8-8b



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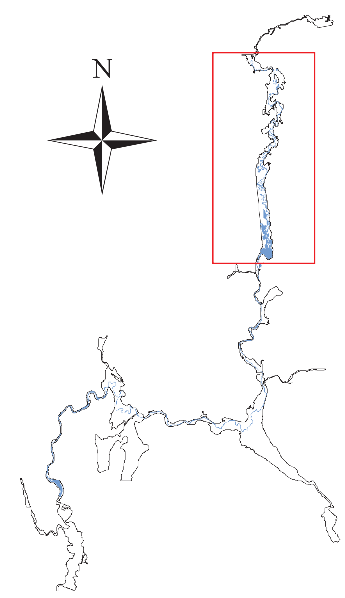

SCALE

0 0.25 0.5
Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 1 mg/kg PCB Isopleth
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Removal of Top 1 ft
- Removal of Top 1.5 ft
- Removal of Top 2 ft
- Removal of Top 3.5 ft
- Engineered Capping

- Floodplain Soil Removal
- Access Road/ Staging Area

SED 9/FP 8 includes bank removal/ stabilization for Reaches 5A and 5B.

Figure 8-9a.

Remedial Action(s) for SED 9/FP 8 in Reaches 5 and 6.

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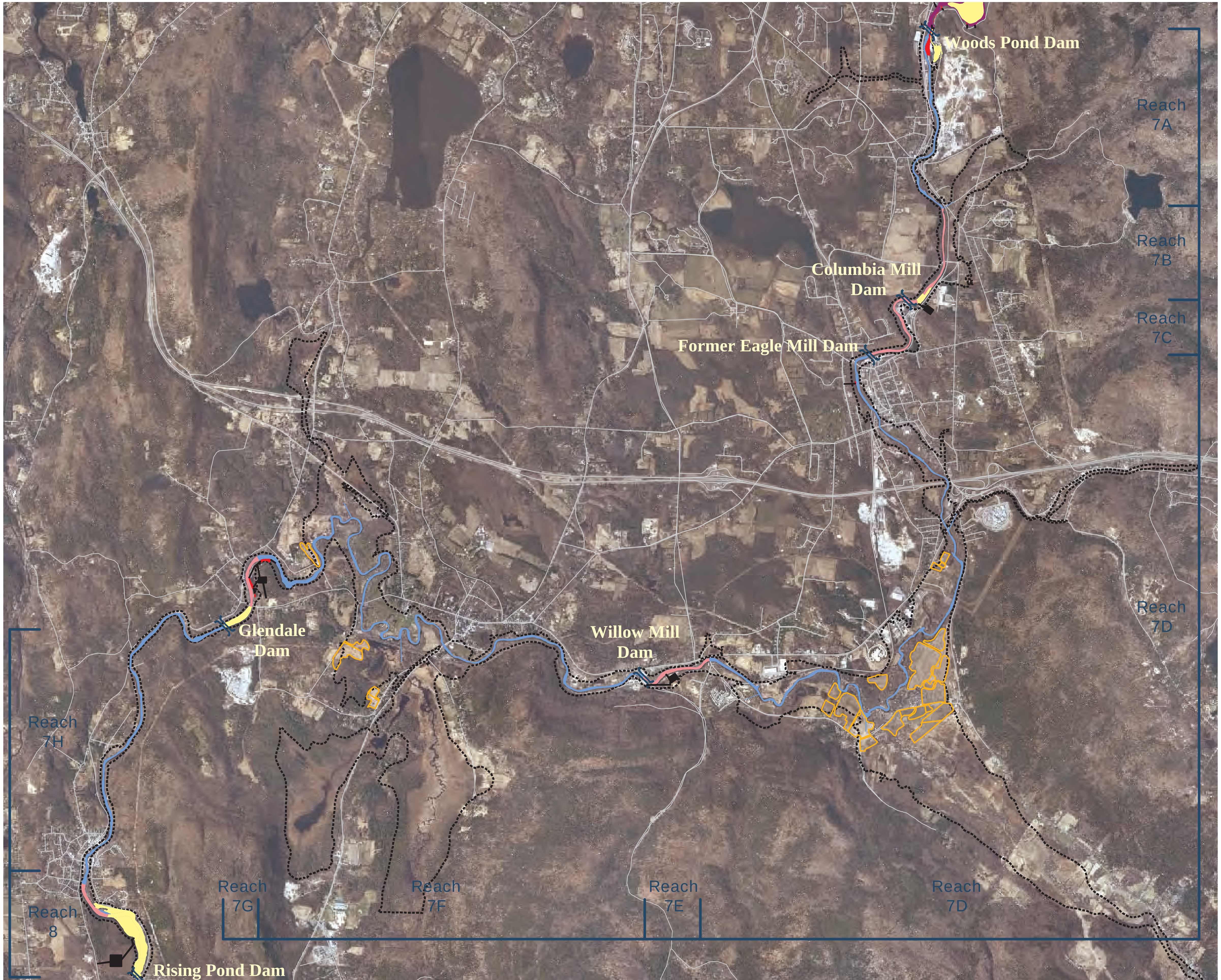

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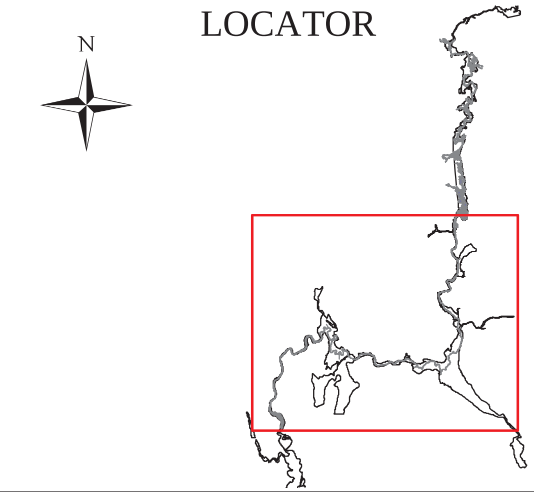

SCALE

0 | 0.5 | 1 | 2 Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 100-yr Floodplain
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Removal of Top 1 ft
- Removal of Top 1.5 ft
- Removal of Top 3.5 ft
- Engineered Capping

- Floodplain Soil Removal
- Access Road/ Staging Area

Figure 8-9b.

Remedial Action(s) for SED 9/FP 8 in Reaches 7 and 8.

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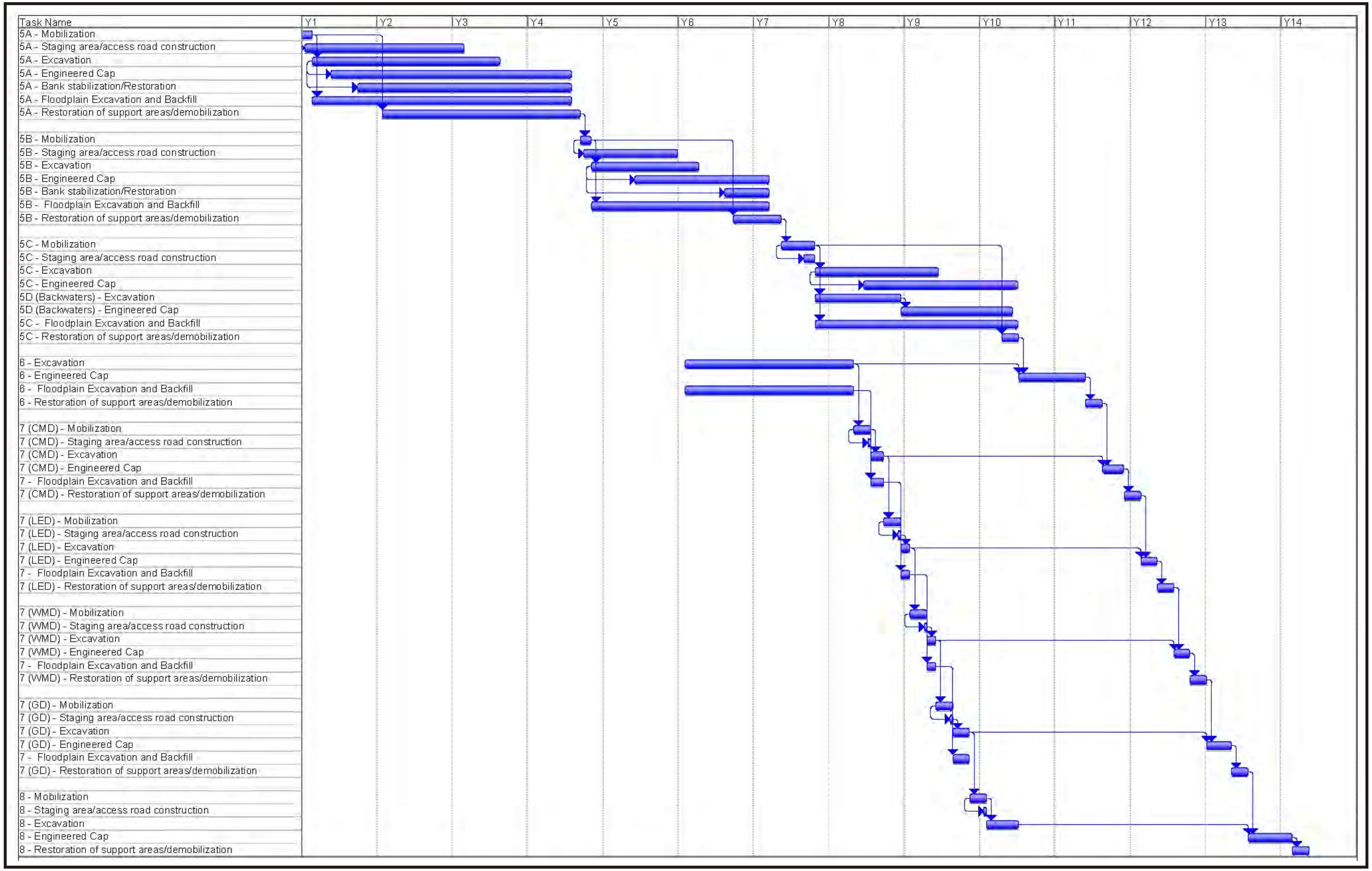

NOTES:

1.The general timeline associated with Reach 5A and 5B, and subsequent reaches, illustrates the overall timeframe when excavation, capping, and bank stabilization/restoration activities are occurring in terms of construction years.

2. It was assumed that the construction schedule for combined SED/FP alternatives would be determined by the sediment component. Floodplain excavation and backfill activities are considered to progress along with the adjacent work in the channel; as such, the construction schedule shown illustrates the period of time over which the floodplain activities maybe be performed, not the actual construction duration.

3. CMD = Columbia Mill Dam; LED = Lee/Eagle Dam; WMD = Willow Mill Dam; GD = Glendale Dam; Y = Year.

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CONSTRUCTION TIMELINE FOR IMPLEMENTATION OF SED 9/FP 8

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FIGURE

8-10

10/04/2010 SYRACUSE-NY-141ENV-DJHOWES
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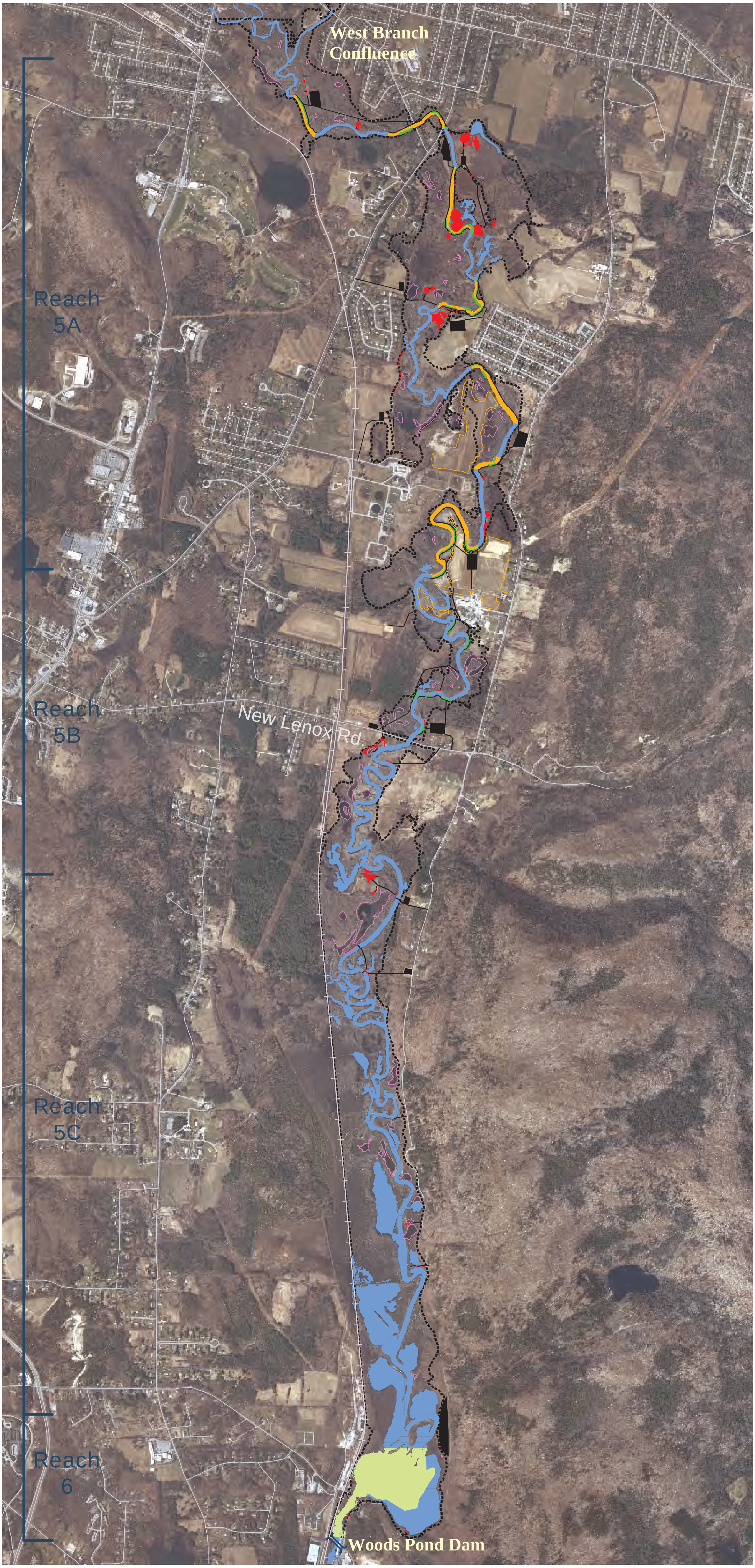

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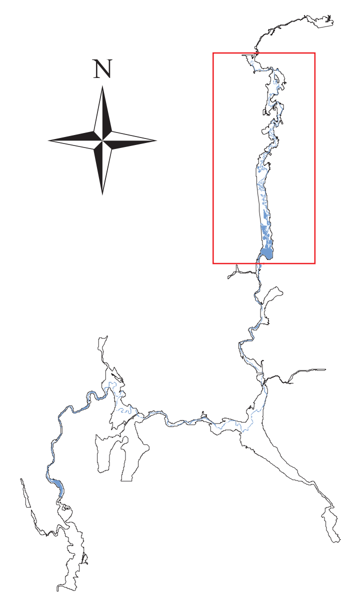

SCALE

0 0.25 0.5 Miles

LEGEND

Basemap Information

- Housatonic River
- Vernal Pool
- Agricultural Area
- 1 mg/kg PCB Isopleth
- Housatonic Railroad
- Major Road
- Dam

Remediation Information

Sediment Remediation Type(s)

- Bank Remediation
- Removal of Top 2 ft
- Removal of Top 2.5 ft
- Floodplain Soil Removal
- Access Road/ Staging Area

Figure 8-11a.

Remedial Action(s) for SED 10/FP 9 in Reaches 5 and 6.

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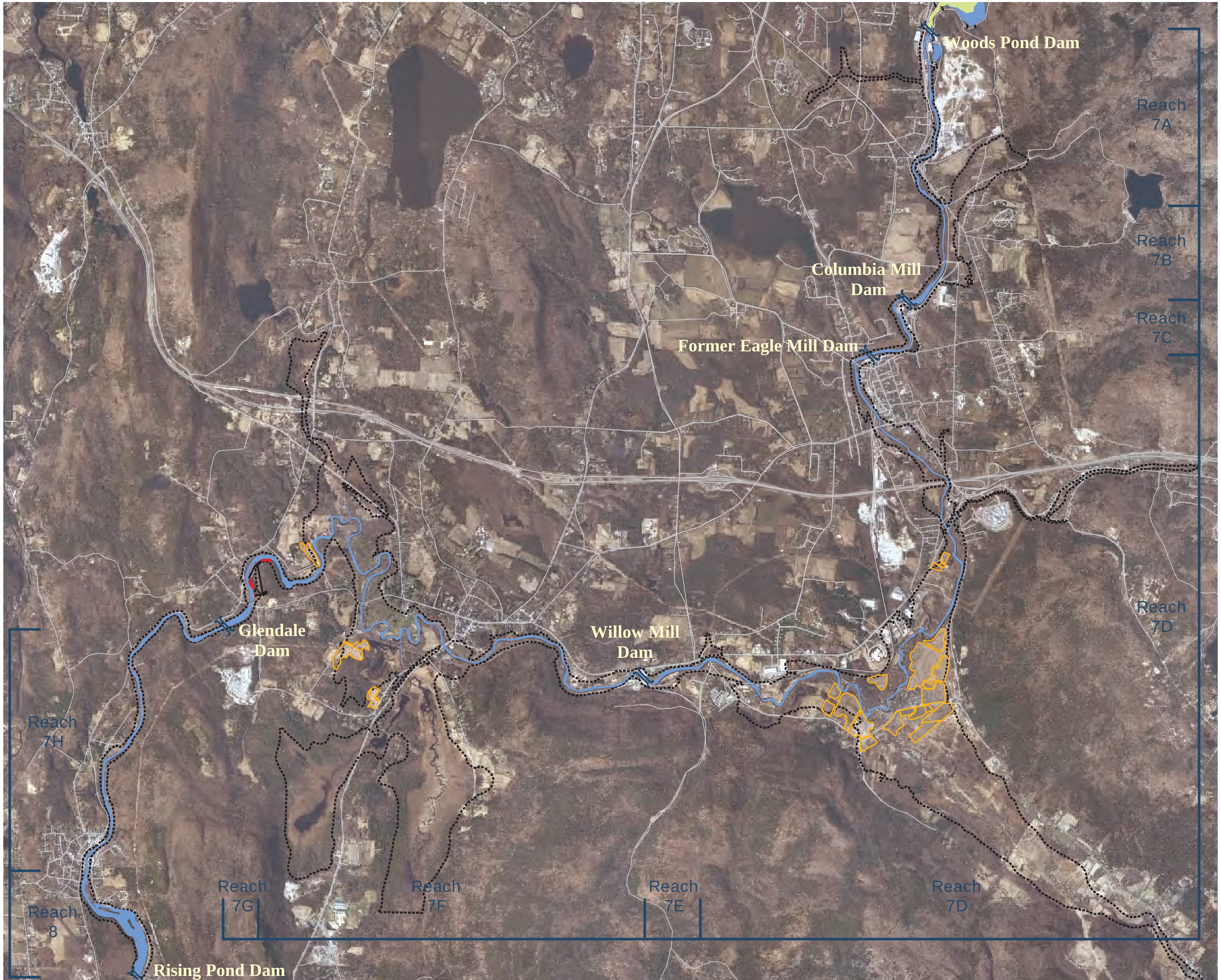

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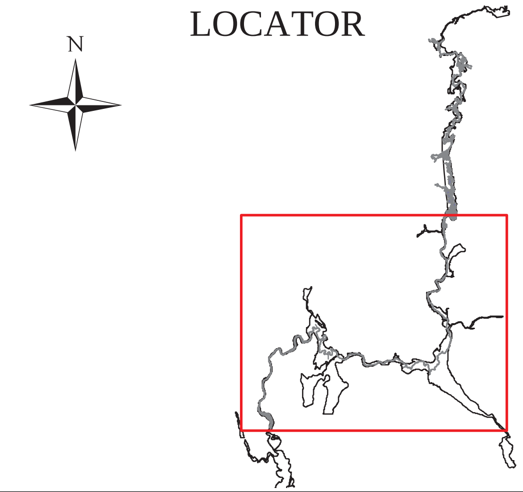

SCALE

0 0.5 1 2 Miles

LEGEND

Basemap Information

Housatonic River
Vernal Pool
Agricultural Area
100-yr Floodplain
Housatonic Railroad
Major Road
Dam

Remediation Information

Sediment Remediation Type(s)

Removal of Top 2.5 ft
Floodplain Soil Removal
Access Road/ Staging Area

Figure 8-11b.

Remedial Action(s) for SED 10/FP 9 in Reaches 7 and 8.

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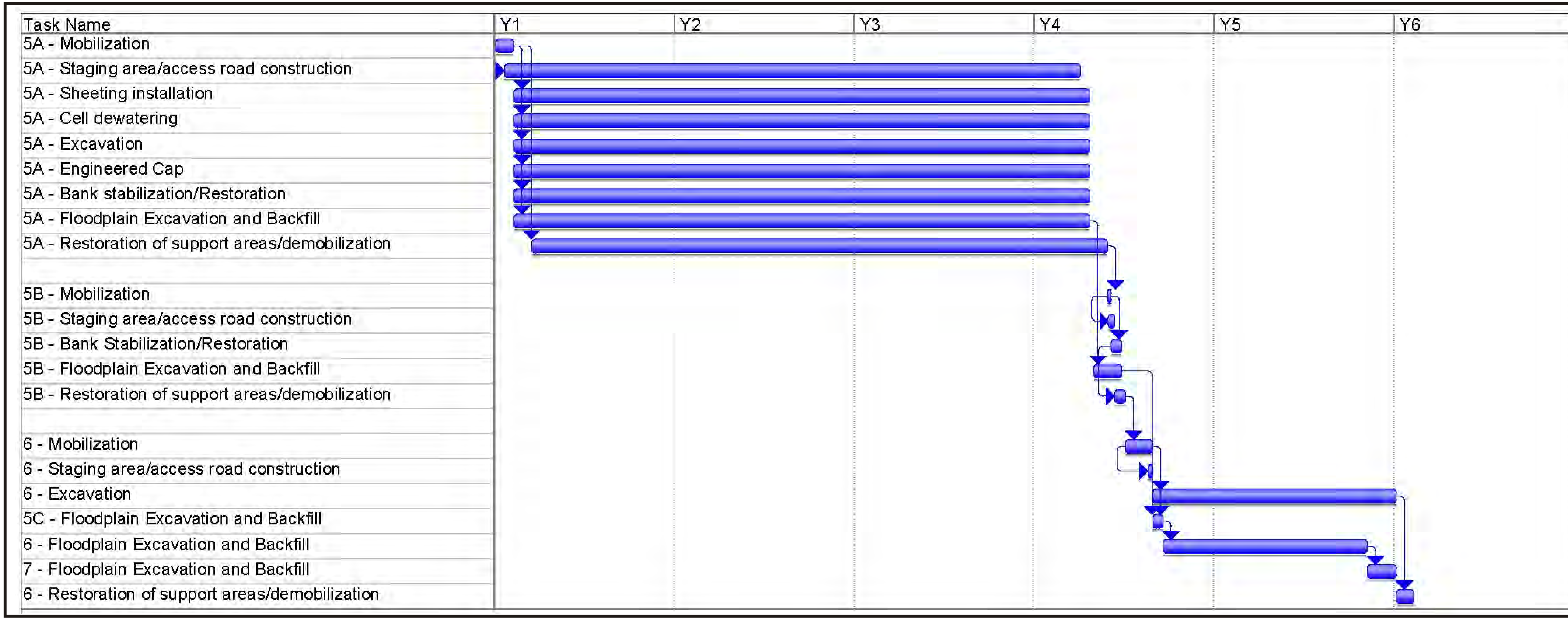

NOTES:

1. The general timeline associated with Reach 5A and 5B, and subsequent reaches, illustrates the overall timeframe when excavation, capping, and bank stabilization/restoration activities are occurring in terms of construction years. In Reaches 5A and 5B, the river channel will be divided in to a series of dry isolation cells for the performance of excavation, capping, and bank stabilization/restoration activities. However, as there are nearly 100 dry removal cells in Reach 5A alone, it is not possible to illustrate the sequential performance of remedial activities in each of these cells in a similar fashion.

2. It was assumed that the construction schedule for combined SED/FP alternatives would be determined by the sediment component. Floodplain excavation and backfill activities are considered to progress along with the adjacent work in the channel; as such, the construction schedule shown illustrates the period of time over which the floodplain activities may be performed, not the actual construction duration.

3. Y = Year.

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CONSTRUCTION TIMELINE FOR IMPLEMENTATION OF SED 10/FP 9

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FIGURE

8-12

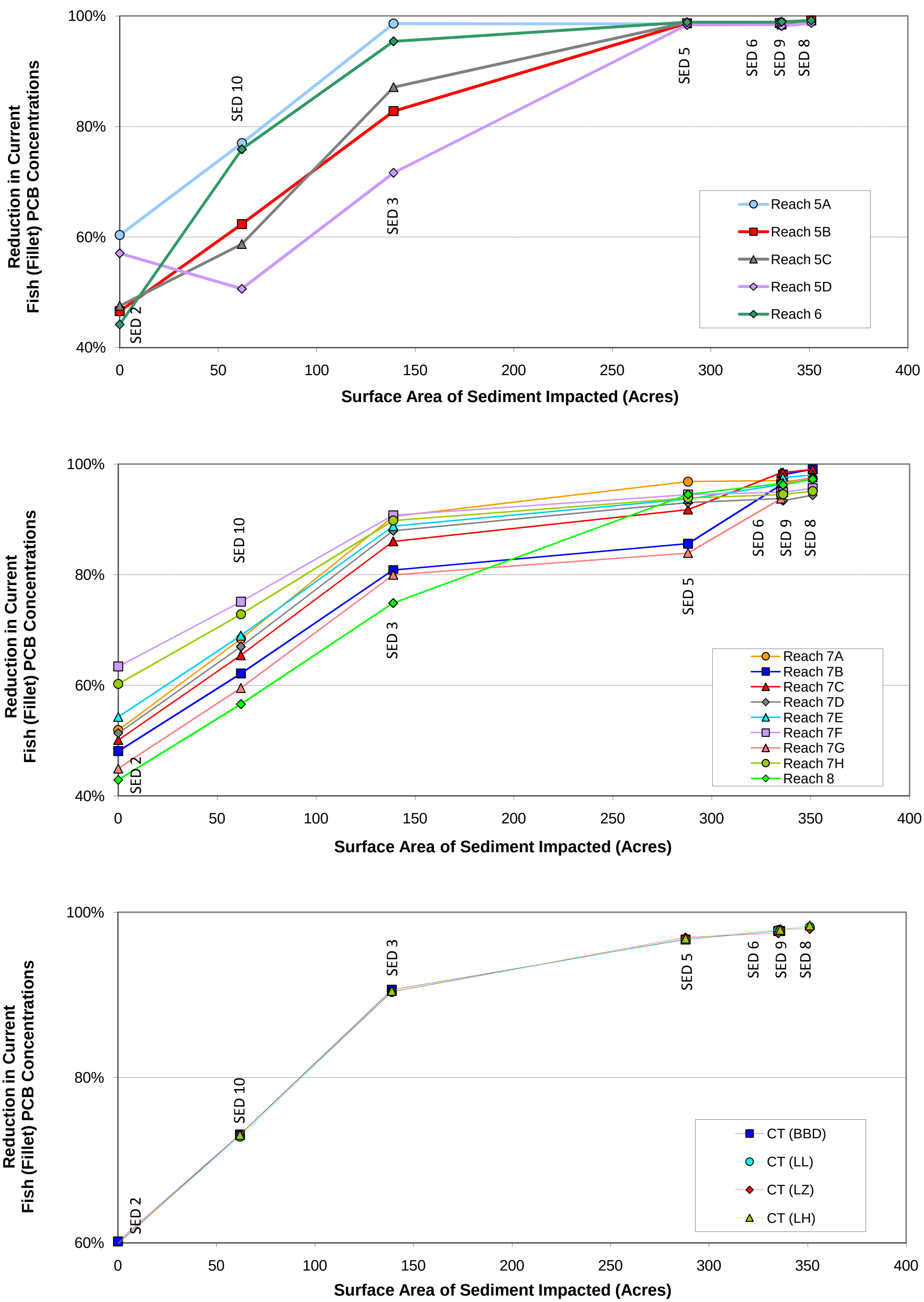

Figure 8-13. Reduction in Current Fish (Fillet) PCB Concentrations Over the Model Projection Period Versus Surface Area Addressed in Remedy.

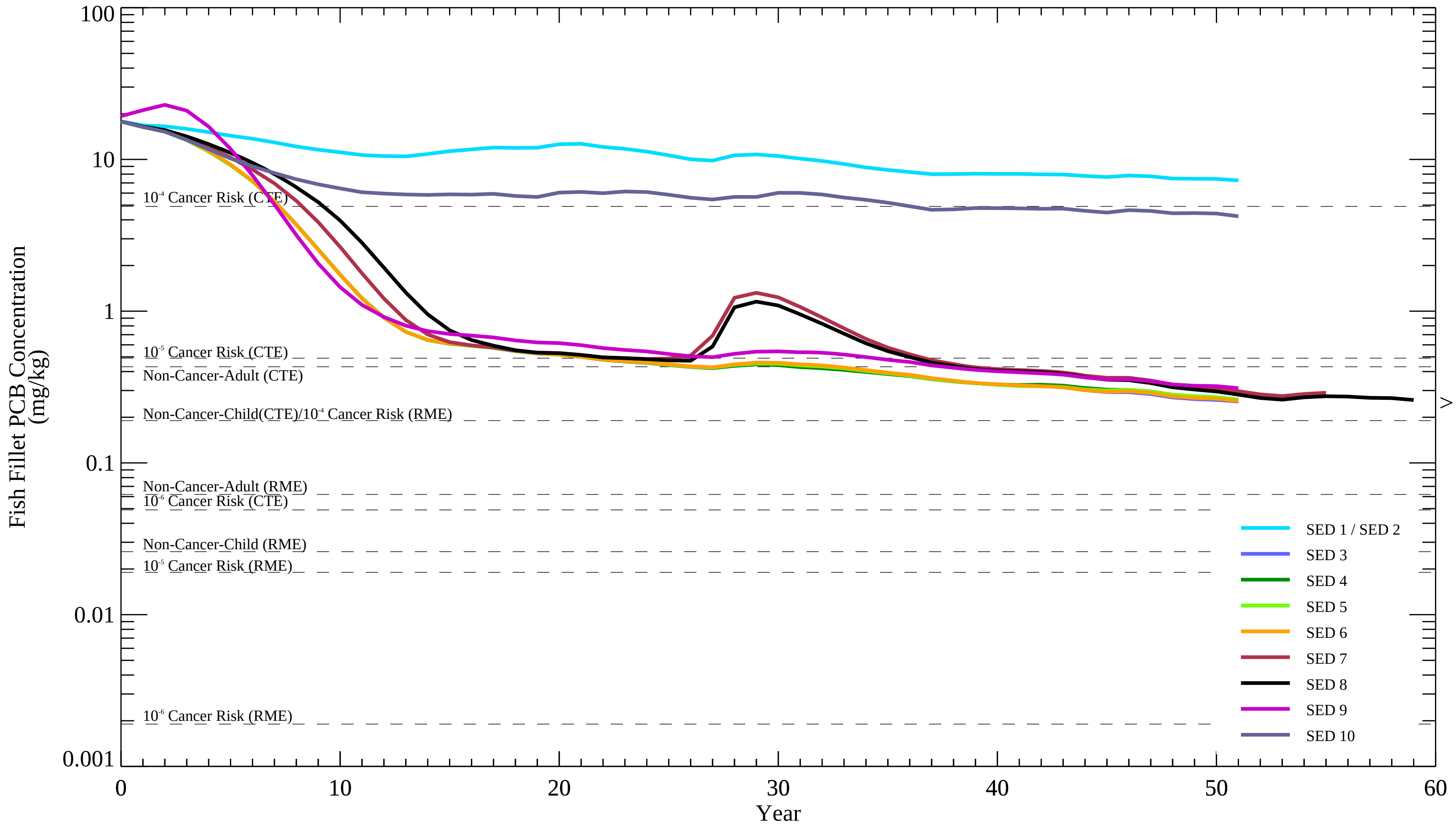

Figure 8-14a. Average fillet PCB concentrations in largemouth bass from Reach 5A

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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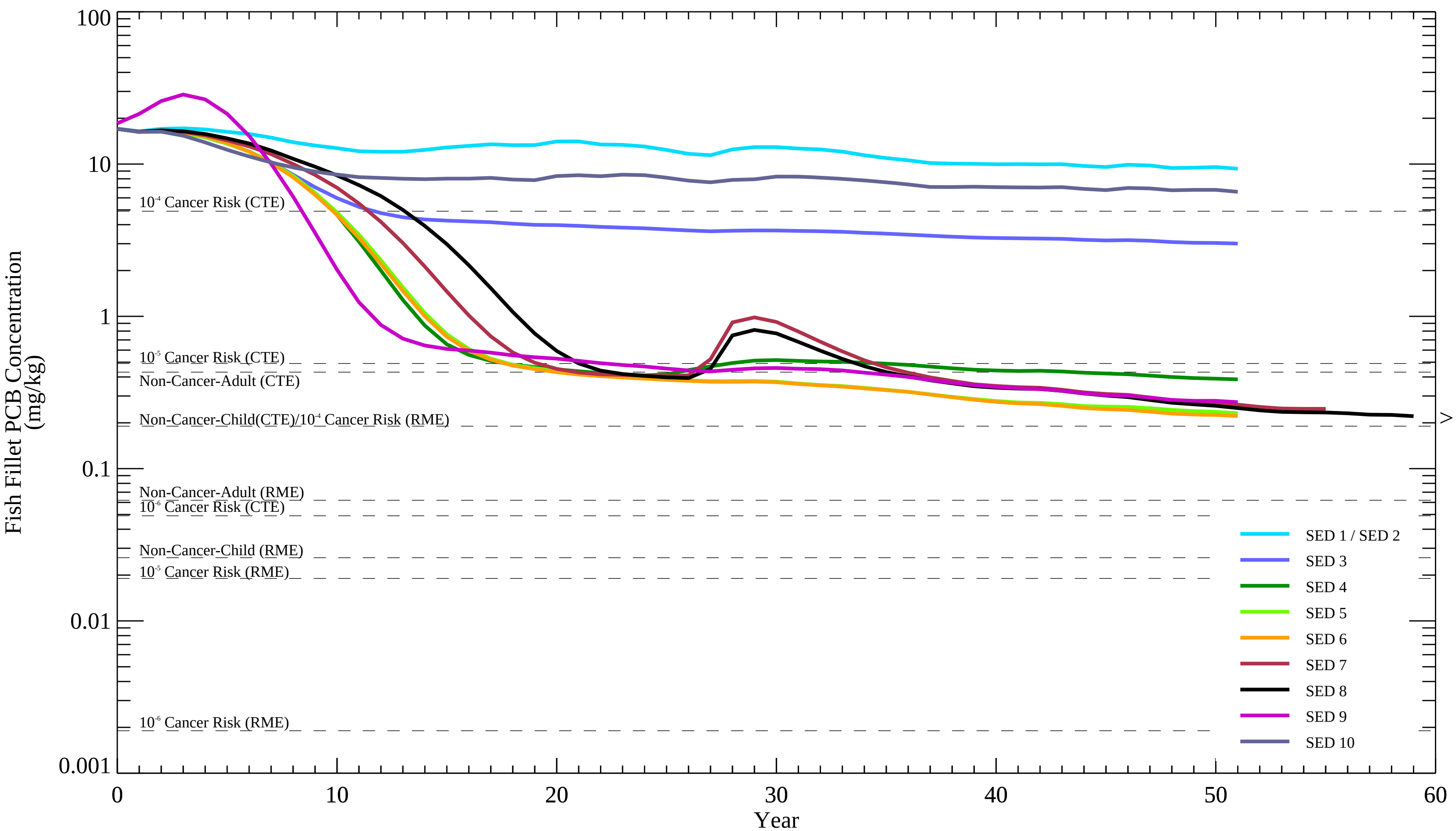

Figure 8-14b. Average fillet PCB concentrations in largemouth bass from Reach 5B

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

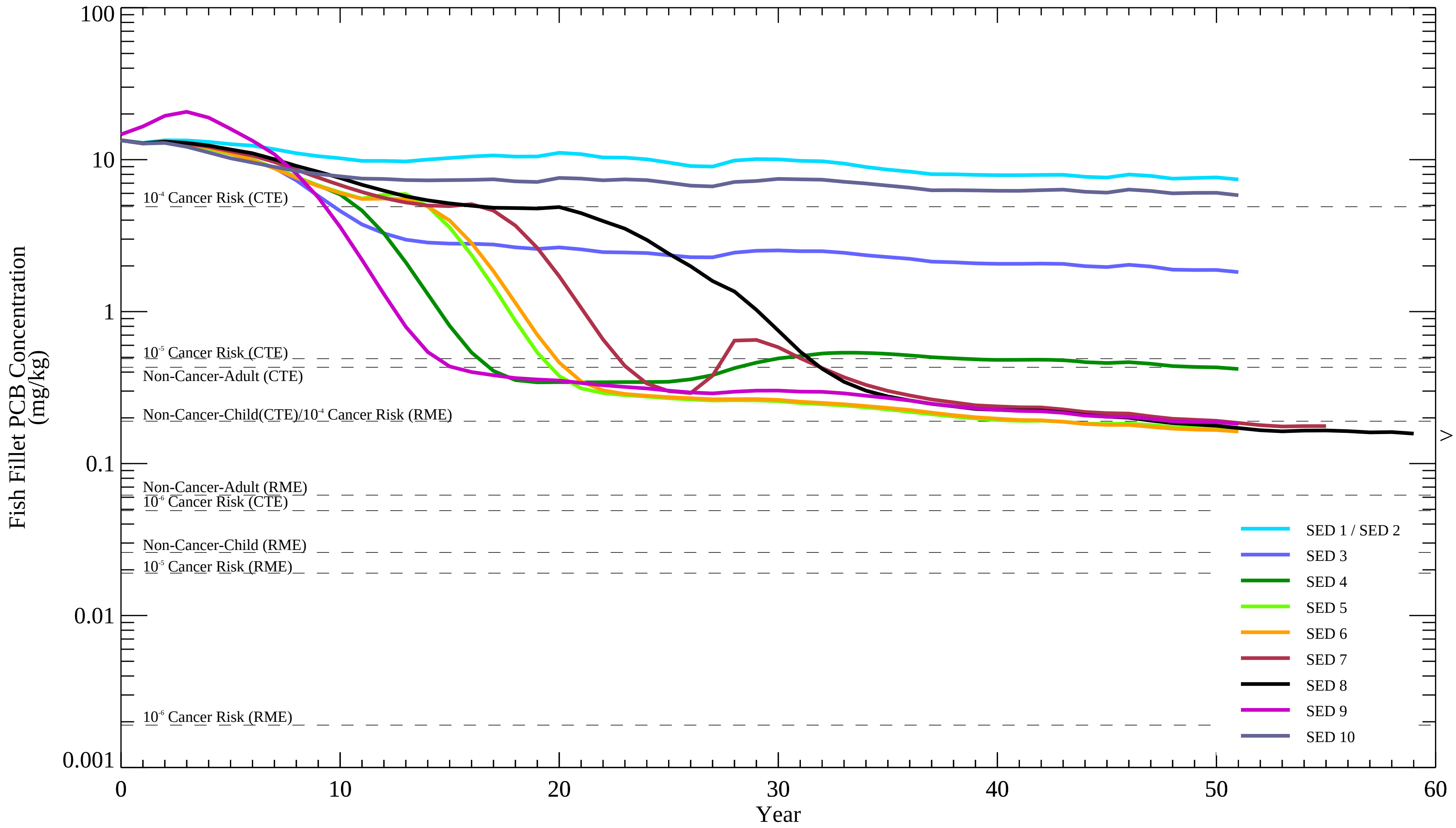

Figure 8-14c. Average fillet PCB concentrations in largemouth bass from Reach 5C

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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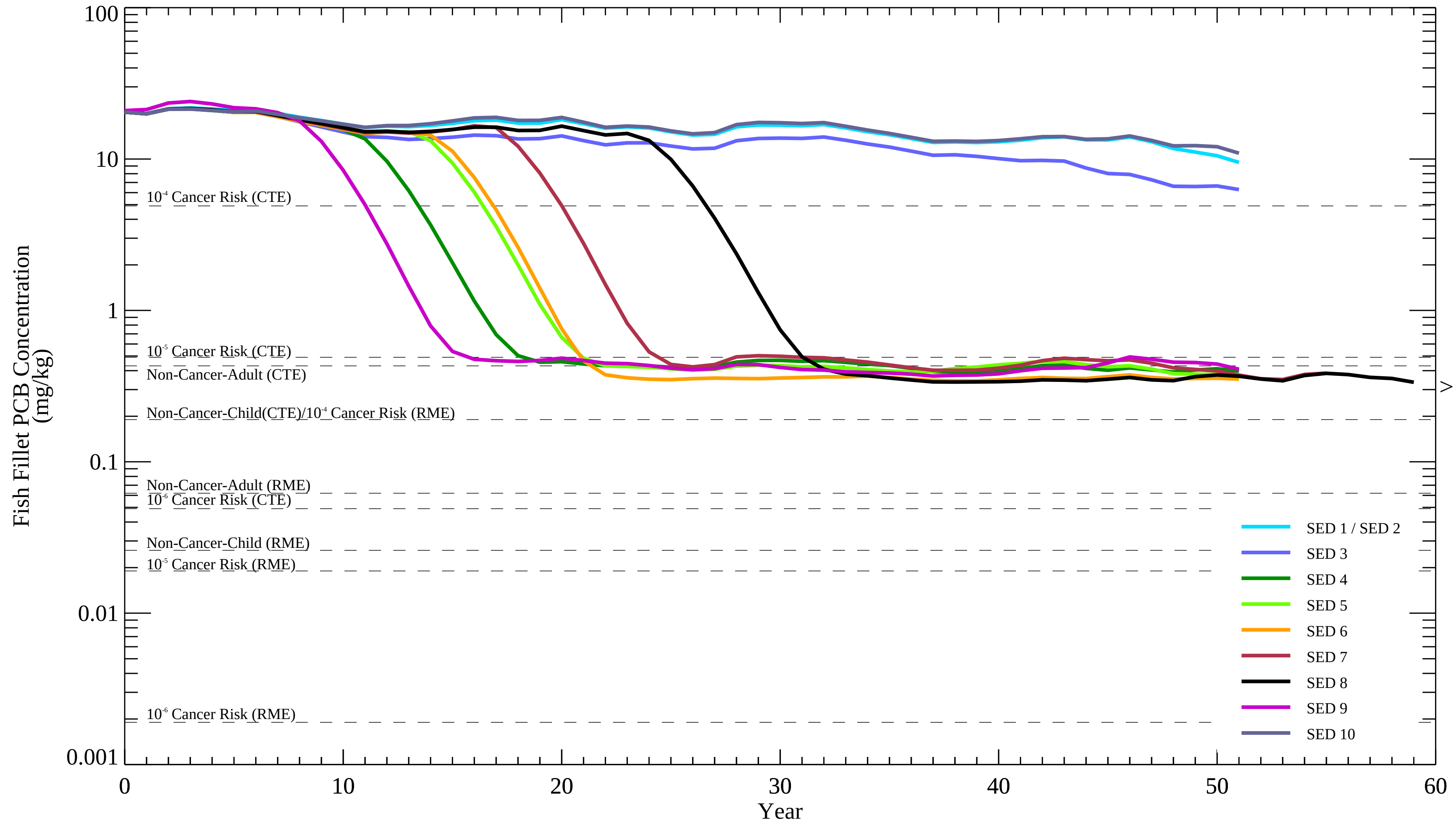

Figure 8-14d. Average fillet PCB concentrations in largemouth bass from Reach 5D

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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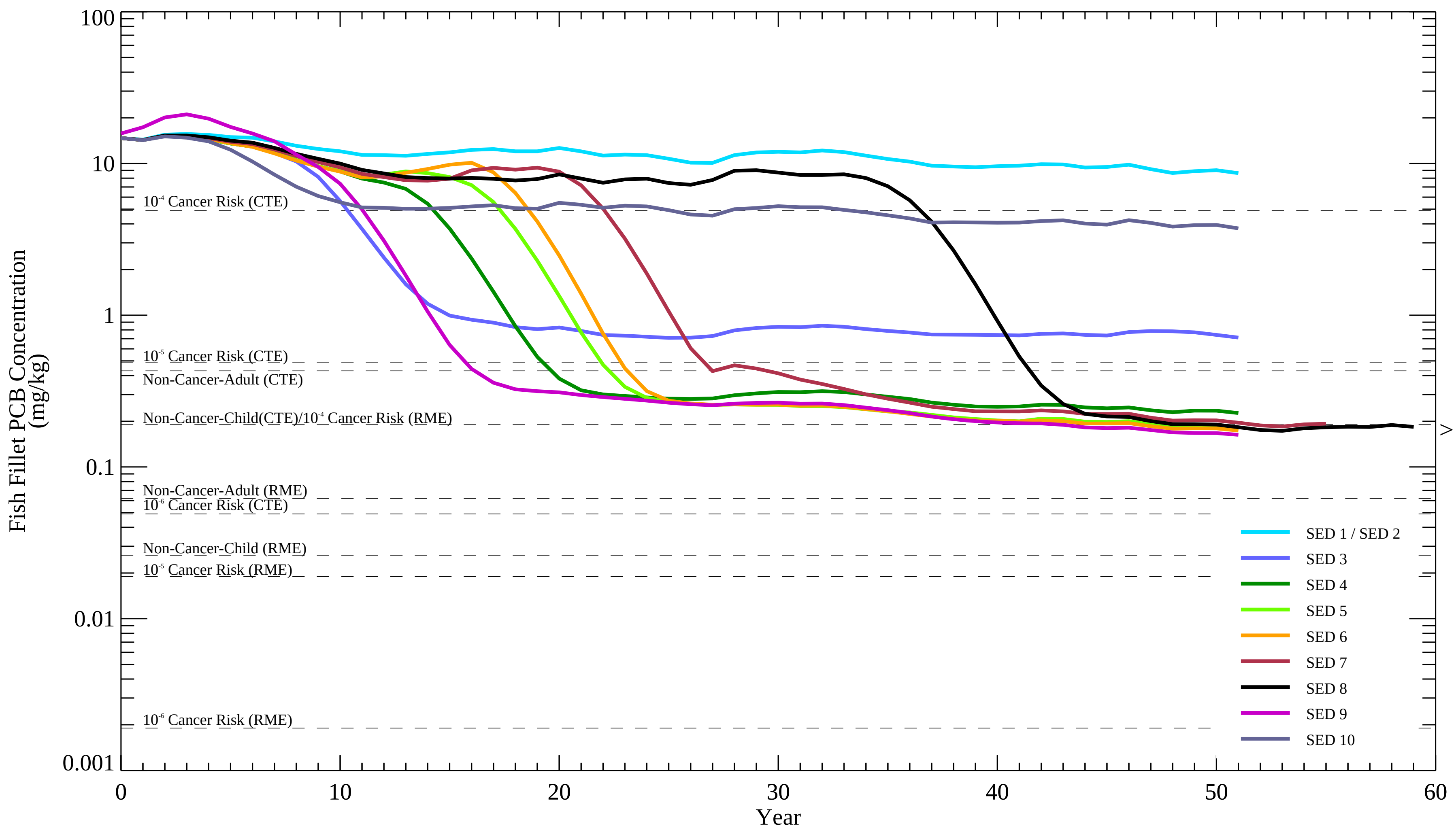

Figure 8-14e. Average fillet PCB concentrations in largemouth bass from Reach 6

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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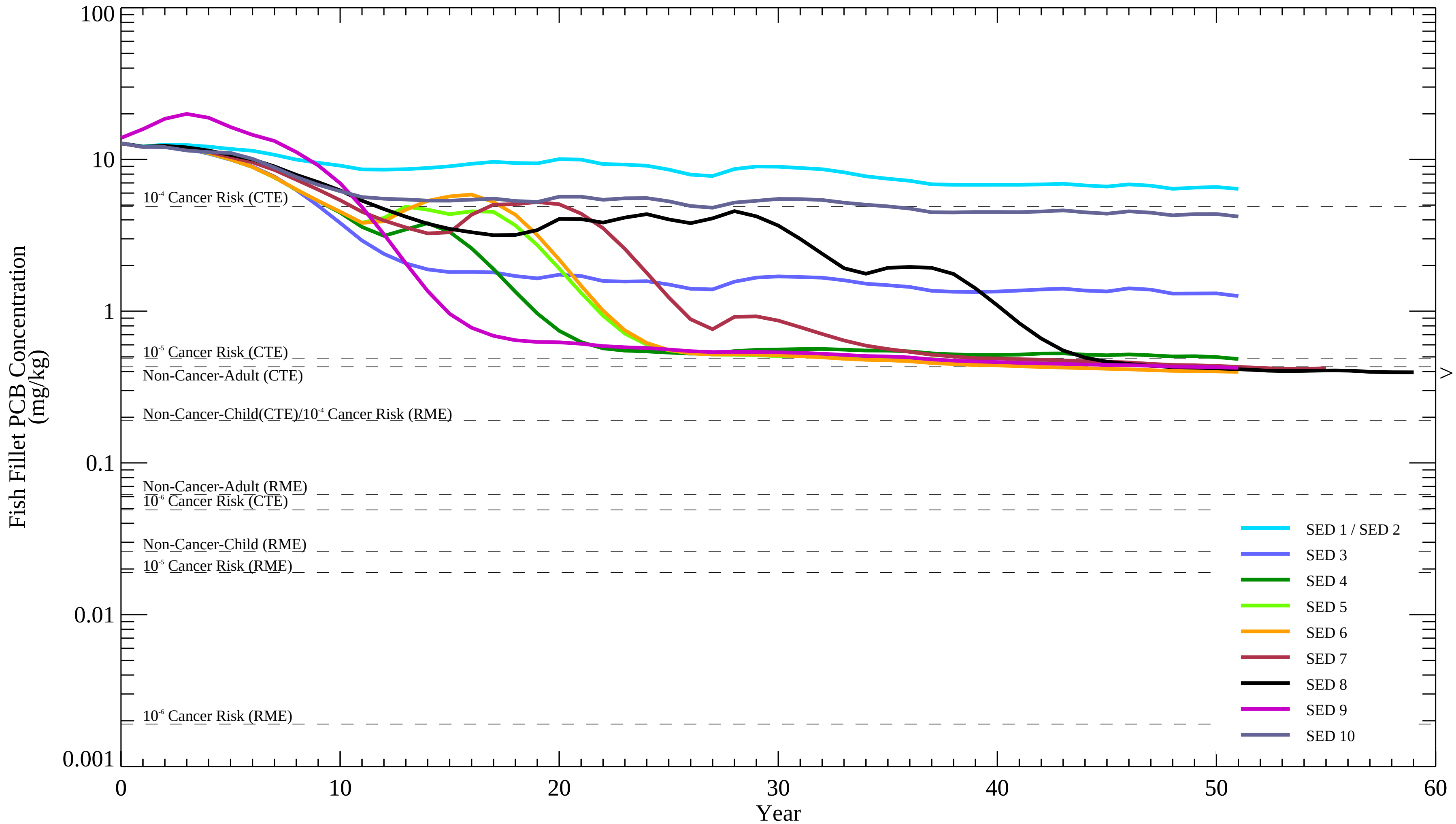

Figure 8-14f. Average fillet PCB concentrations in largemouth bass from Reach 7A

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

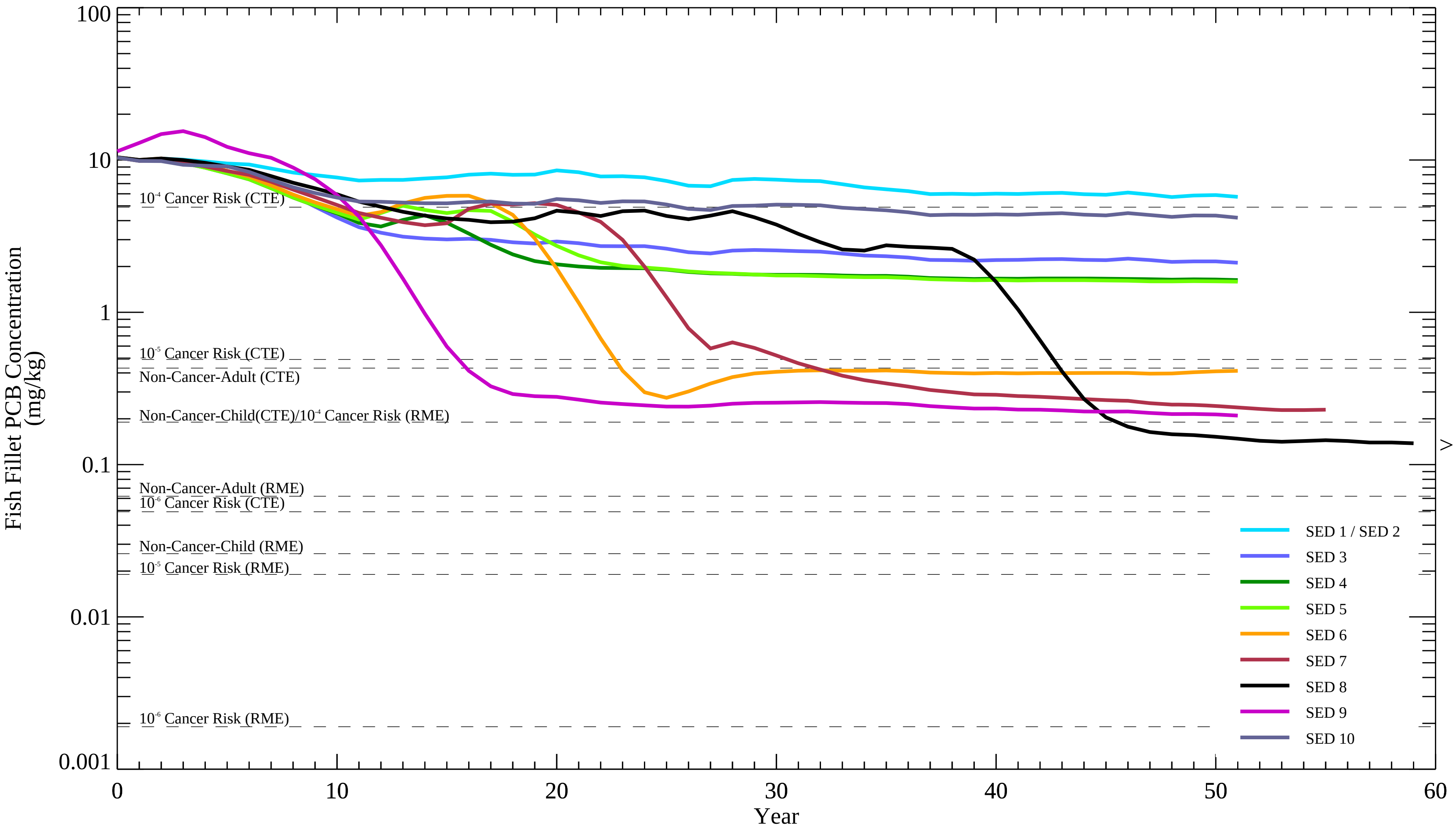

Figure 8-14g. Average fillet PCB concentrations in largemouth bass from Reach 7B

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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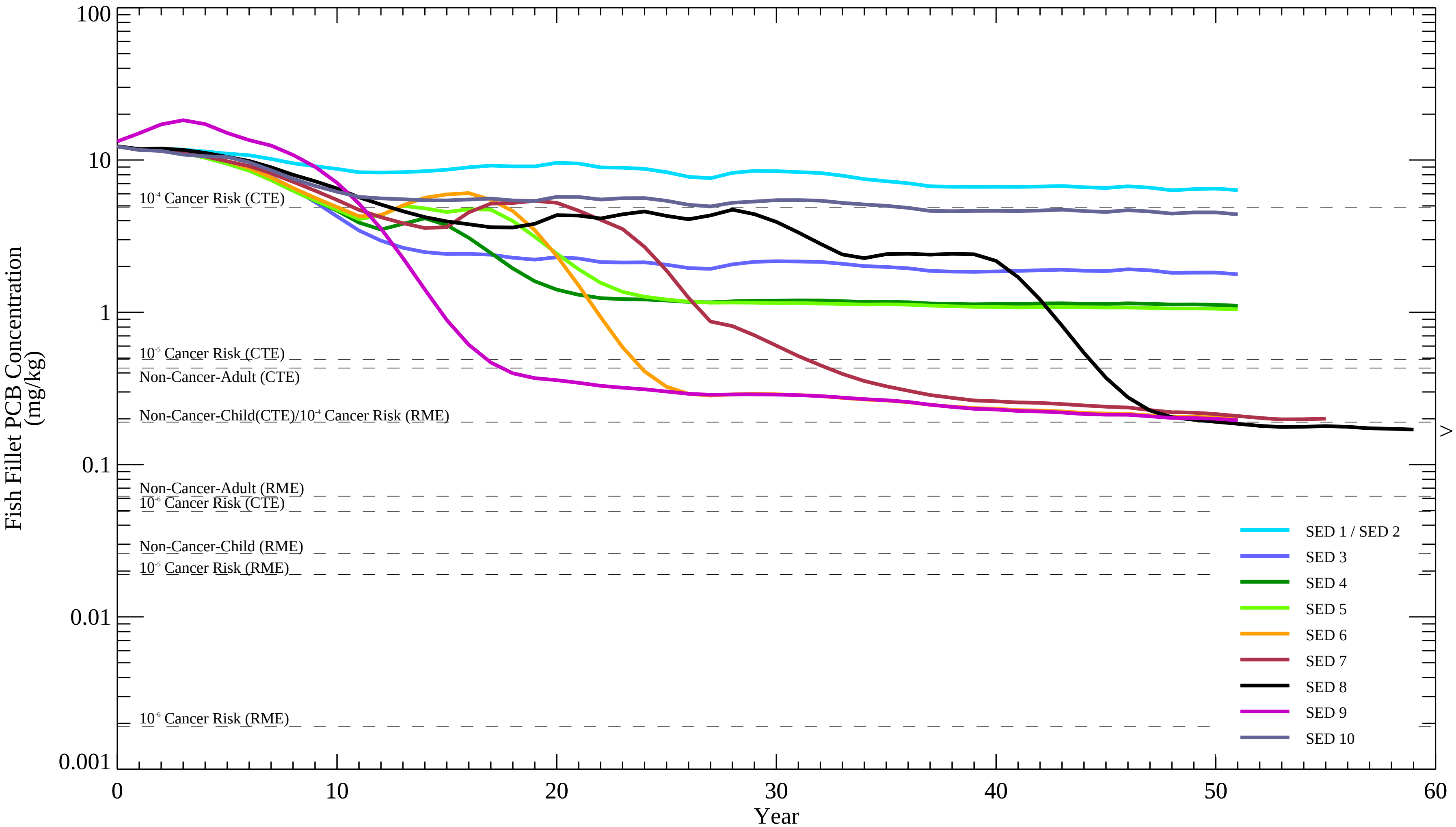

Figure 8-14h. Average fillet PCB concentrations in largemouth bass from Reach 7C

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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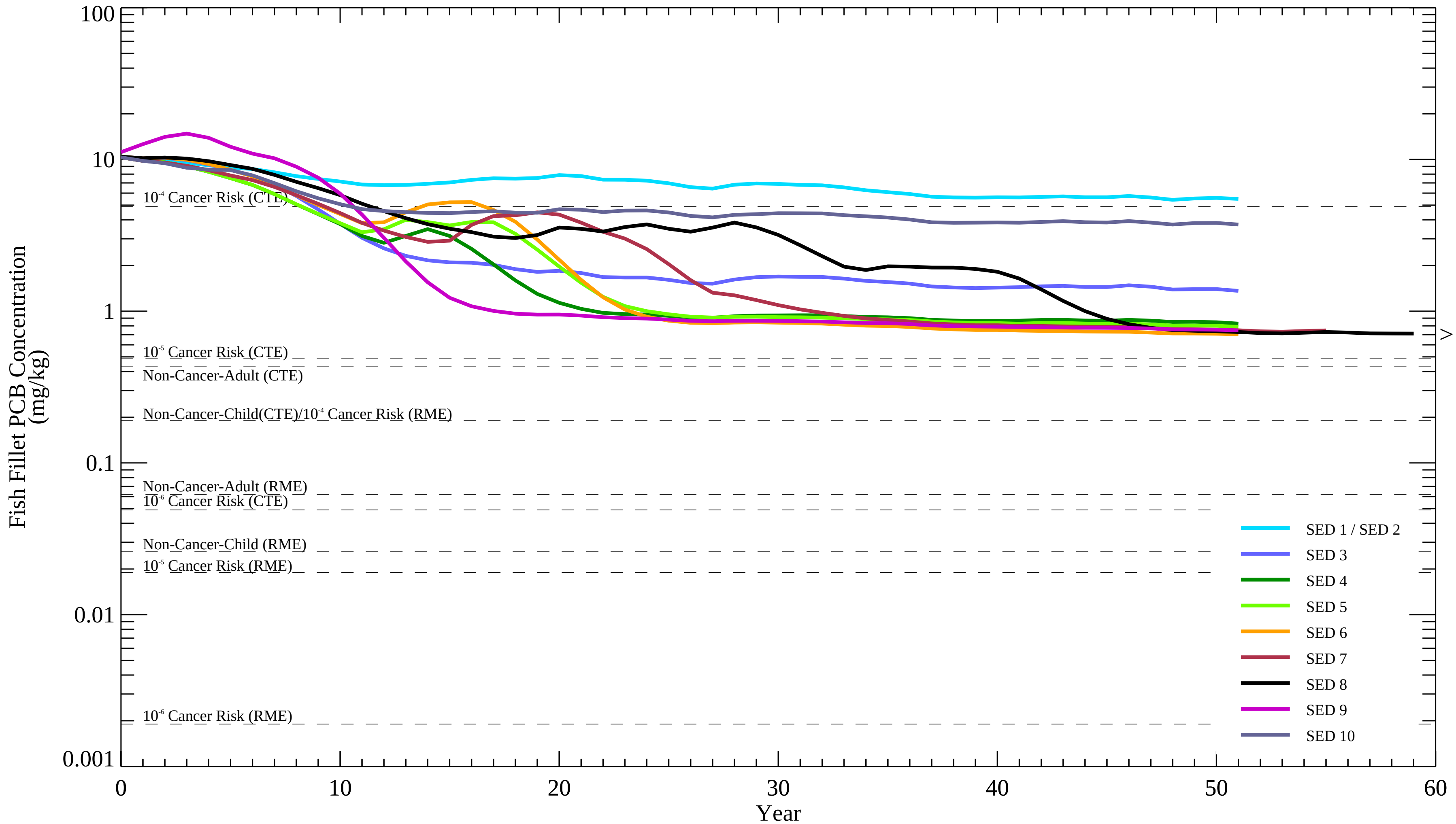

Figure 8-14i. Average fillet PCB concentrations in largemouth bass from Reach 7D

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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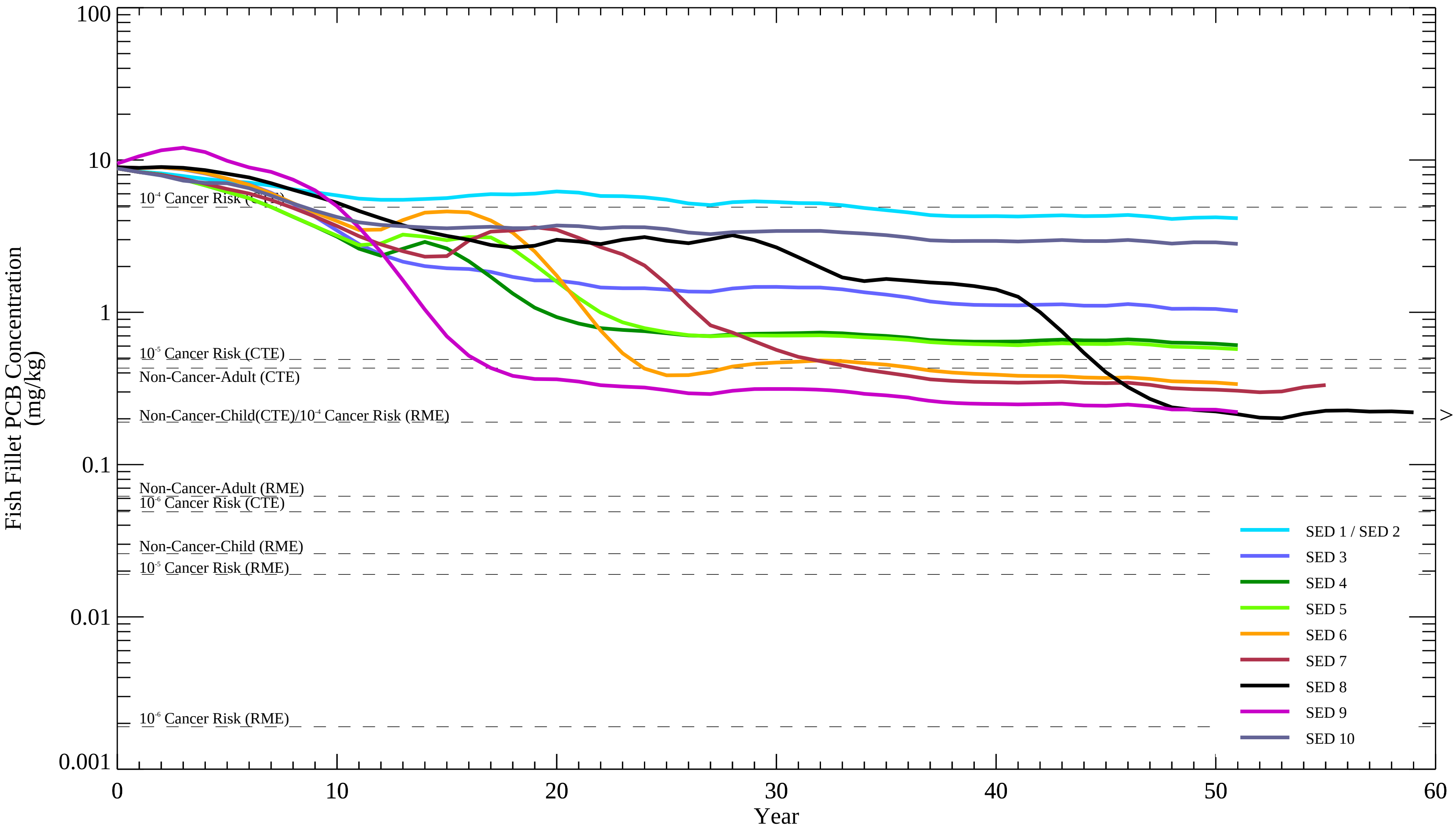

Figure 8-14j. Average fillet PCB concentrations in largemouth bass from Reach 7E

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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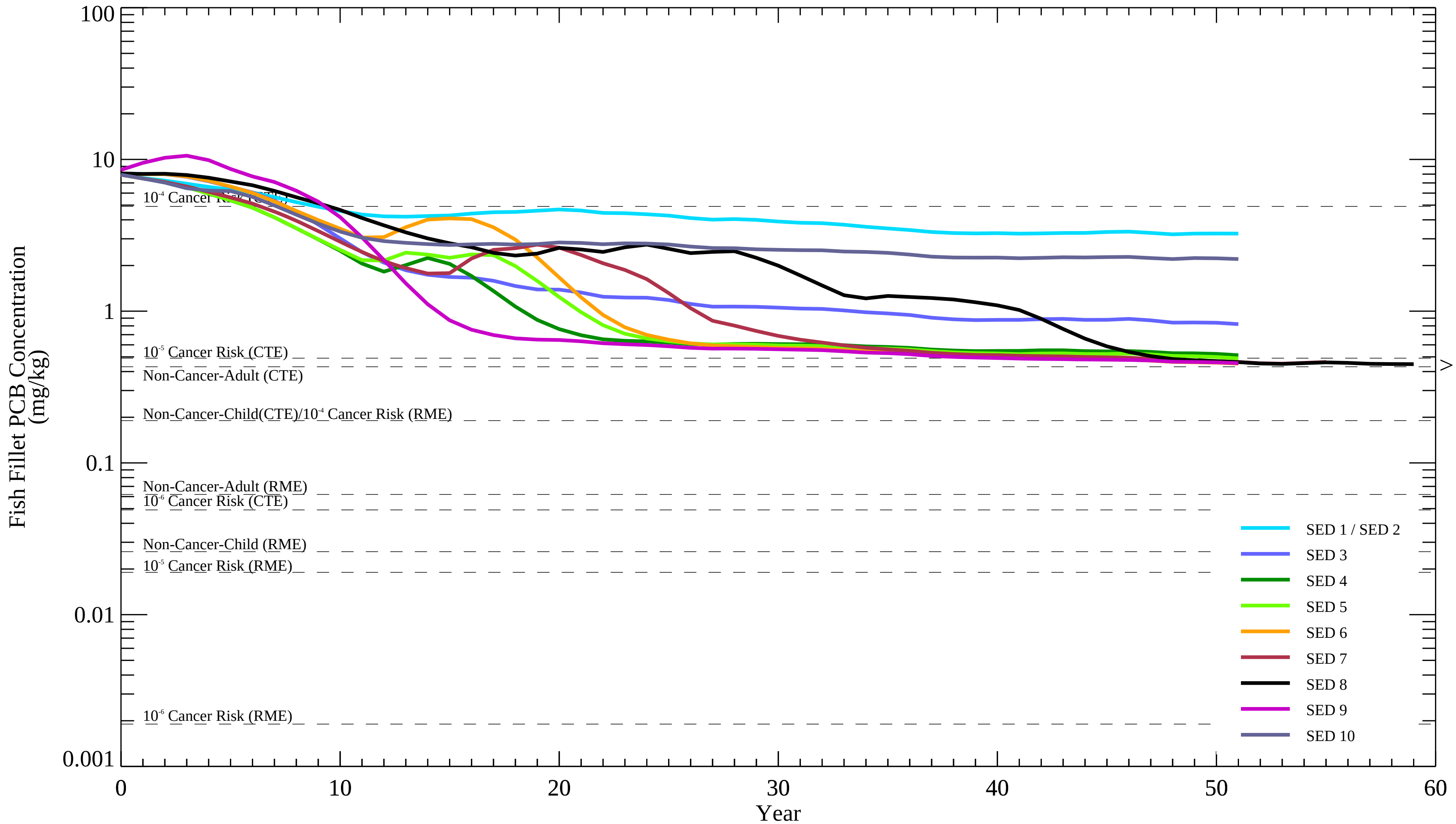

Figure 8-14k. Average fillet PCB concentrations in largemouth bass from Reach 7F

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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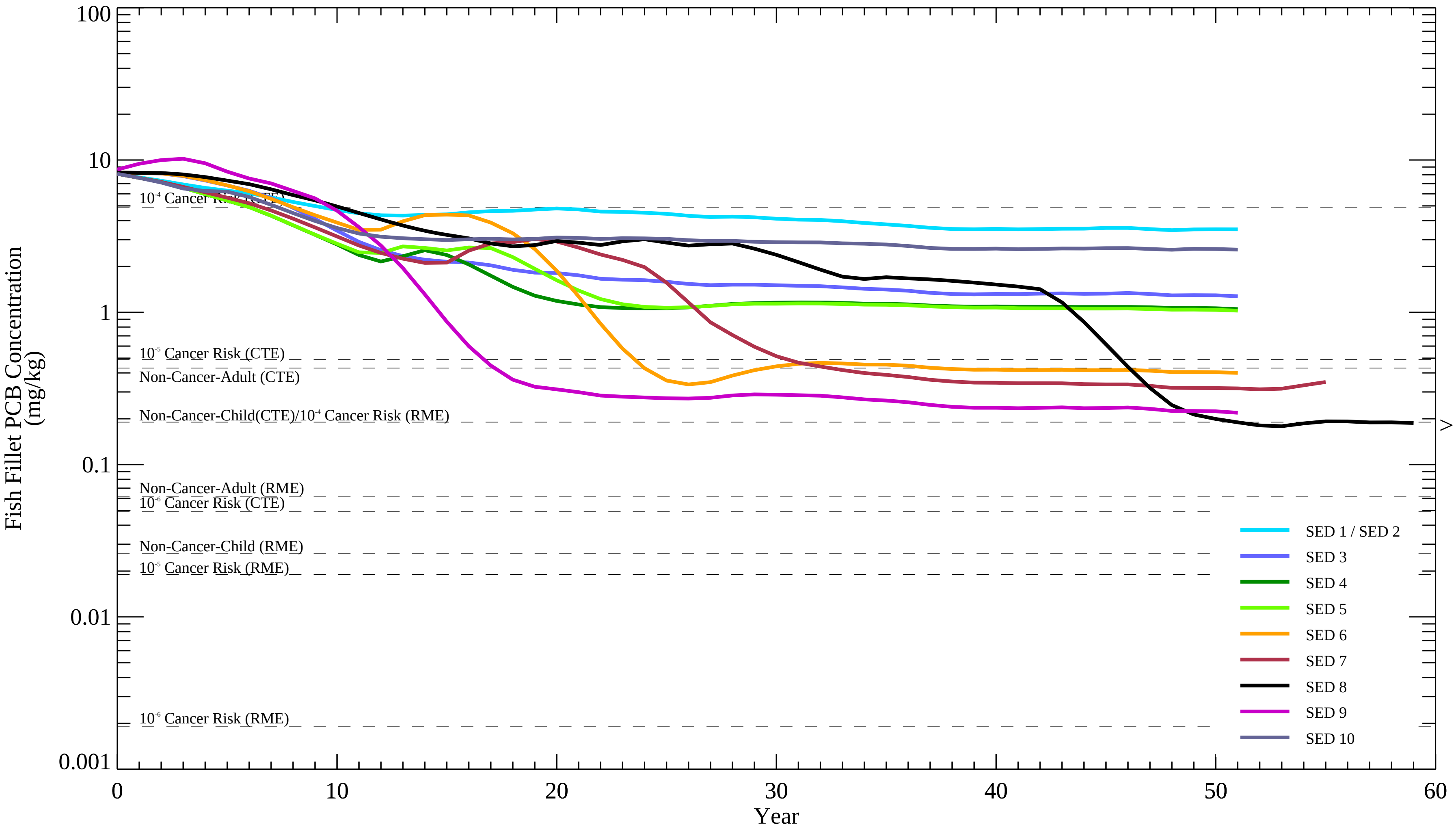

Figure 8-14l. Average fillet PCB concentrations in largemouth bass from Reach 7G

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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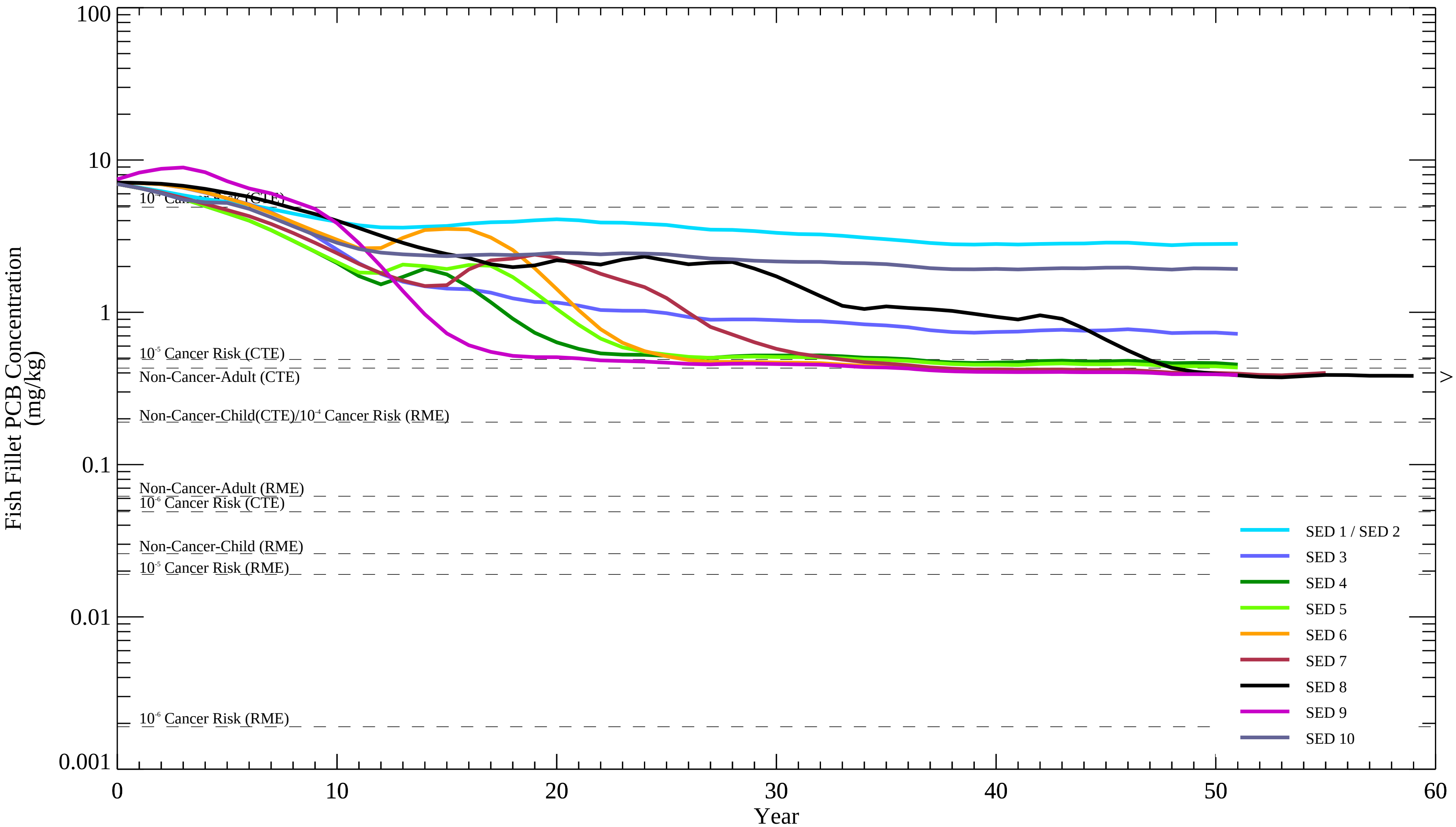

Figure 8-14m. Average fillet PCB concentrations in largemouth bass from Reach 7H

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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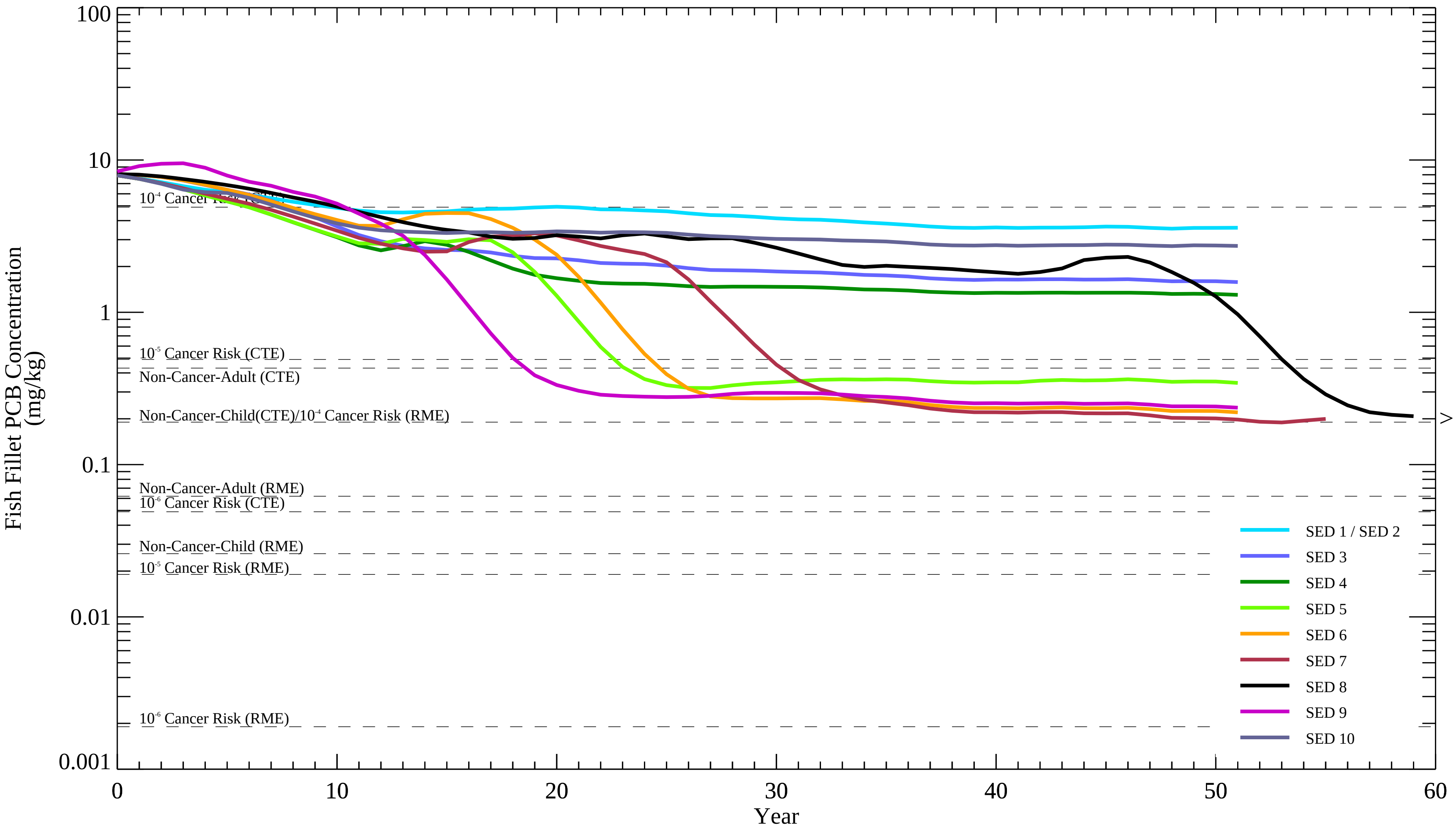

Figure 8-14n. Average fillet PCB concentrations in largemouth bass from Reach 8

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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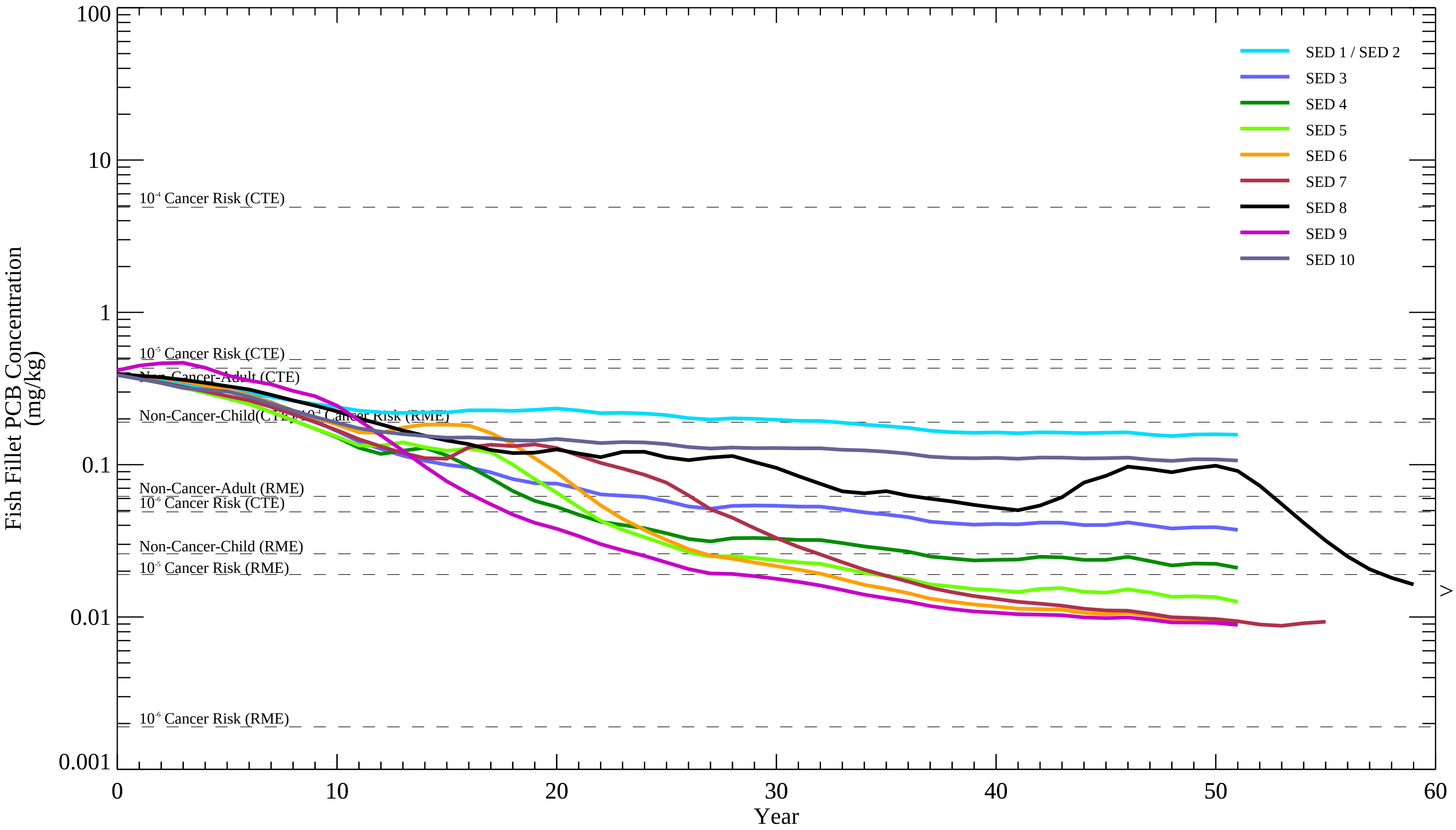

Figure 8-14o. Average fillet PCB concentrations in largemouth bass from Bulls Bridge

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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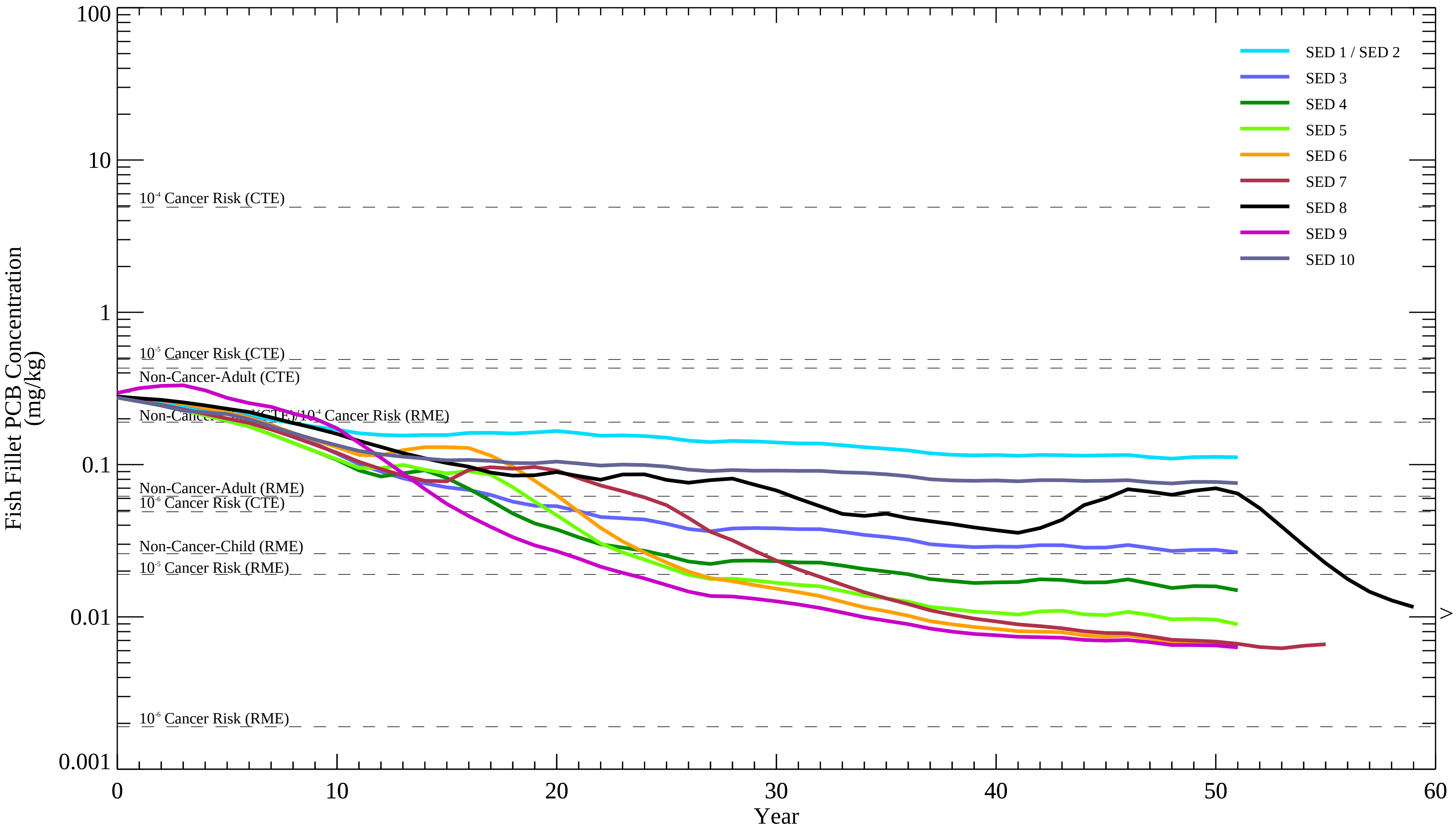

Figure 8-14p. Average fillet PCB concentrations in largemouth bass from Lake Lillinonah

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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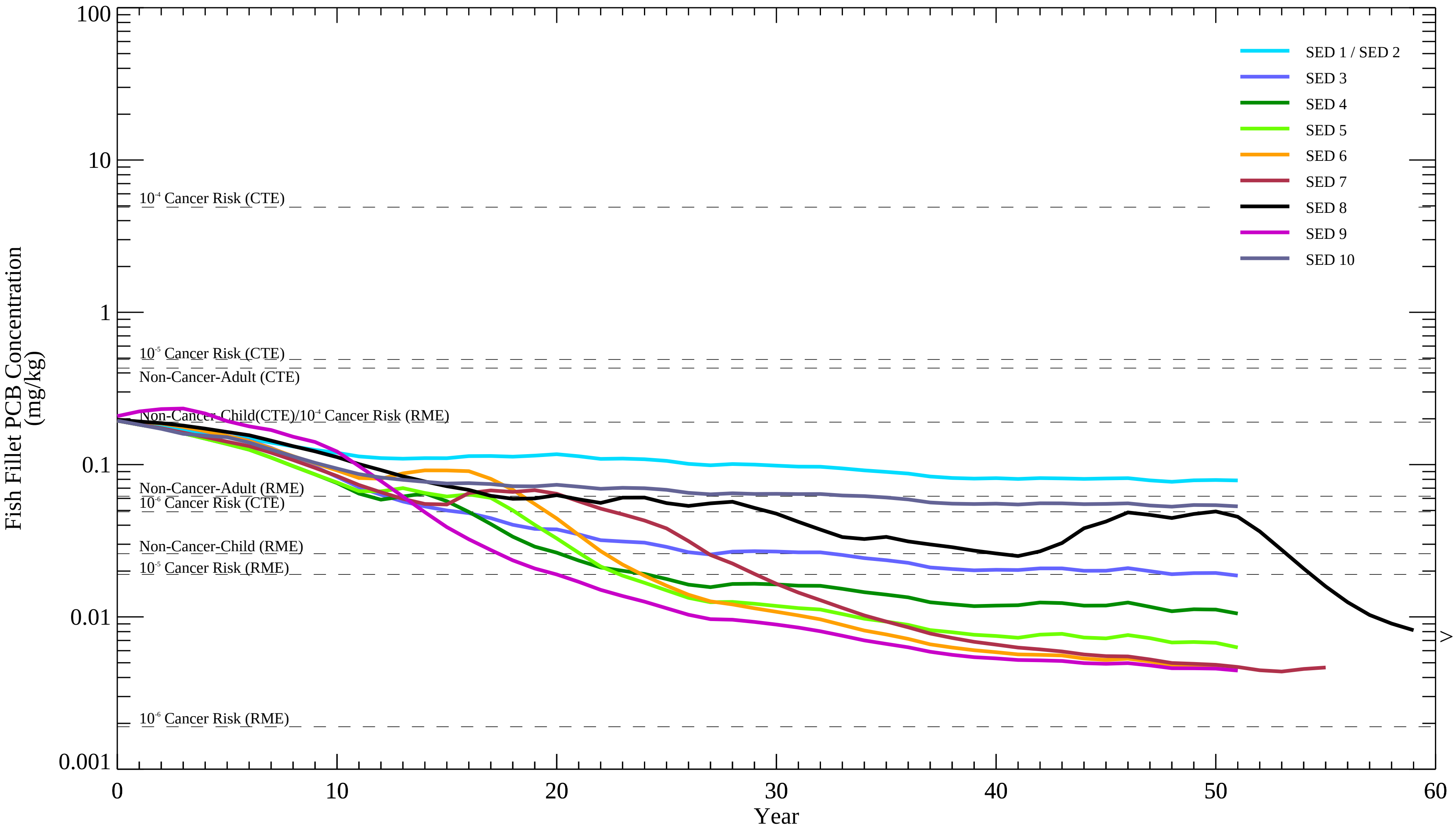

Figure 8-14q. Average fillet PCB concentrations in largemouth bass from Lake Zoar

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

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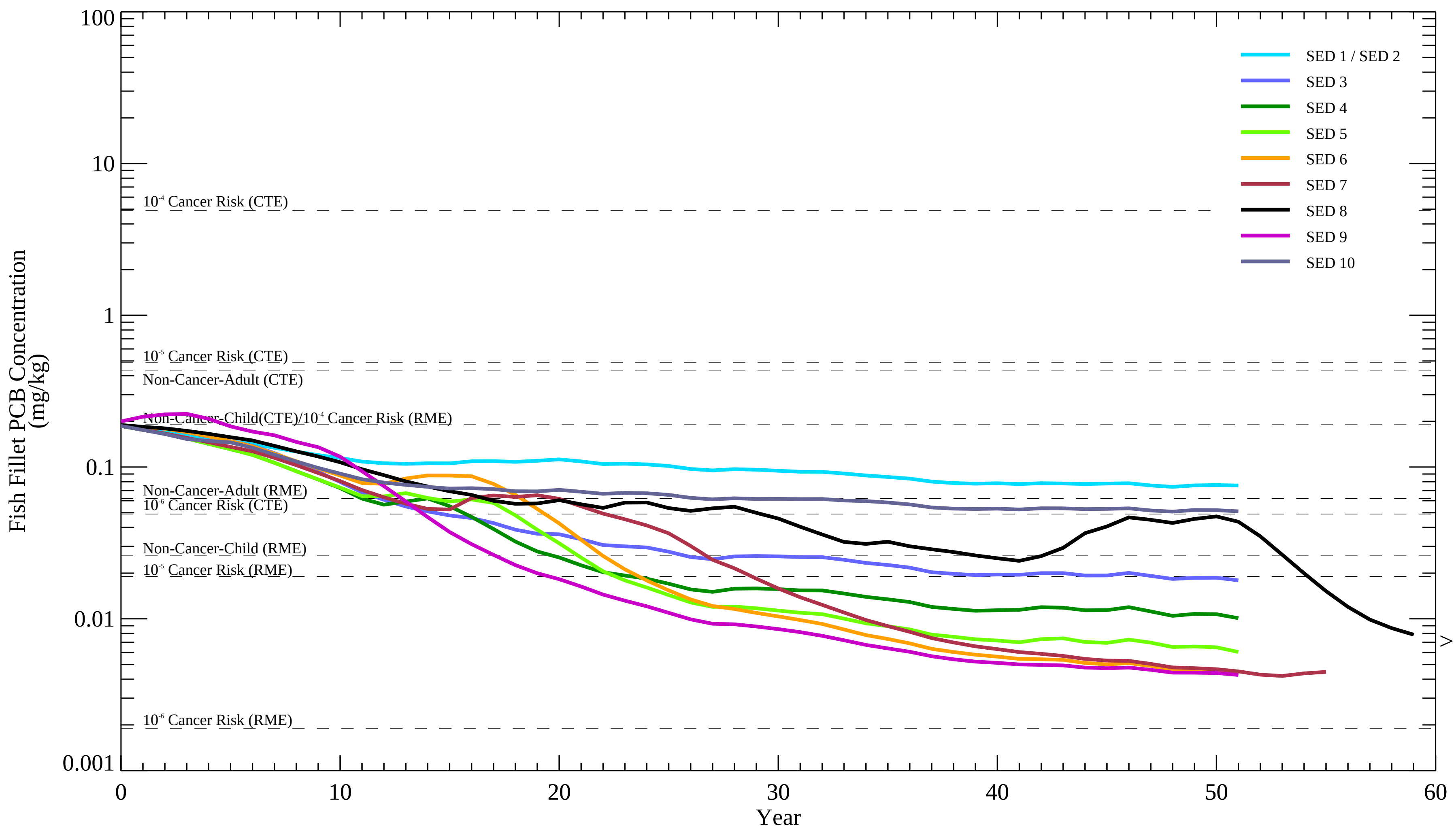

Figure 8-14r. Average fillet PCB concentrations in largemouth bass from Lake Housatonic

Notes: Average calculated for days from Aug. 28th through Oct. 26th of each year; Average calculated for fish ages 5 to 9.
Fillet based concentrations were calculated as whole body concentrations divided by 5.0.
Horizontal lines represent fish consumption (deterministic) IMPGs.

9. Detailed Analyses of Remedial Alternatives for Treatment and/or Disposition of Removed Sediments and Soils

This section describes and evaluates the five alternatives developed for treatment and/or disposition of removed sediments, riverbank soils, and floodplain soils from the Rest of River area. As described in the CMS Proposal, the five treatment/disposition alternatives were selected for detailed evaluation based on the review and screening of a wide range of potential technologies and process options.[480] The treatment/disposition alternatives approved by EPA for evaluation are:

- TD 1 – Disposal in an off-site permitted landfill or landfills;
- TD 2 – Disposition in a local in-water Confined Disposal Facility (CDF) or Facilities;
- TD 3 – Disposition in a local on-site Upland Disposal Facility or Facilities;
- TD 4 – Chemical extraction of PCBs from removed sediment/soil; and
- TD 5 – Thermal desorption of PCBs from removed sediment/soil.

Each treatment/disposition alternative has been evaluated in detail based on the General Standards and Selection Decision Factors specified in the Permit (described in Sections 2.1 and 2.2) other than attainment of IMPGs, which is not relevant to the treatment/disposition alternatives. The results of these detailed evaluations are presented in Sections 9.1 though 9.5. A comparative evaluation of these five alternatives was also performed using the same criteria, as presented in Section 9.6.

9.1 Evaluation of Off-Site Disposal in Permitted Landfill(s) (TD 1)

9.1.1 Description of Alternative

Implementation of TD 1 would involve the transportation of removed sediment and floodplain soil to existing commercial solid waste and/or TSCA-permitted landfill for disposal. Off-site disposal in permitted landfills is a widely used method of disposal of sediments and soil from environmental remediation projects (EPA, 2005d). It has been

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480 As noted in Section 1.6, the process options identified and retained in the CMS Proposal for dewatering and *ex situ* stabilization/solidification of removed sediment and soil prior to treatment/disposition have been evaluated as part of the sediment and floodplain soil remediation alternatives, and hence are not discussed in this section.

employed at many sites, including for a portion of the sediments/soils removed from the Upper ½-Mile and 1½-Mile Reaches of the Housatonic River. Permitted landfills are subject to design, operation, and monitoring in accordance with regulatory standards and requirements designed to assure their long-term effectiveness.

Sediments and soils would be loaded into trucks at the staging areas (following dewatering where necessary) and transported over public roadways to an appropriate off-site permitted landfill. The trucks would be manifested, covered, and labeled in accordance with federal and state regulations.

Truck transportation is widely used as a method for transporting sediments and soils to off-site disposal facilities, and was selected as the representative method of transportation for evaluating TD 1. Utilization of rail transportation is another potential transportation option. GE retained the services of R.L. Banks and Associates, Inc. (RLBA), of Arlington, Virginia, a rail consulting firm, to evaluate the feasibility of transporting materials from the Housatonic River and floodplain by rail to an appropriate off-site disposal facility or facilities. RLBA's evaluation was limited to the physical/technical feasibility of rail transportation of these materials. Based on its evaluation, which is described in detail in Appendix B, RLBA concluded that rail transport of the excavated materials would be technically feasible. However, use of rail would still require that access roads and staging areas be constructed and trucks be used in certain reaches of the River to transport the excavated sediments and soils to the rail line, In addition, compared to rail, truck transportation would be more straightforward and present fewer logistical issues (since it would not be constrained by the availability of rail service and rail-served landfills), and it provides greater flexibility, with the ability to readily change staging areas and routes (EPA, 1994c).[481] For these reasons, truck transportation was selected as the representative method of transportation for this evaluation. If alternative TD 1 is selected as part of the overall remedy for the site, a detailed assessment would be performed during design to further evaluate the most effective method to transport sediments and soils to off-site disposal facilities.

For purposes of evaluation in the Revised CMS Report, this alternative has been evaluated for the range of potential volumes of sediments and floodplain soils that could be removed from the River and floodplain under the array of sediment and floodplain soil alternatives discussed in Sections 6 and 7. Specifically, this range extends from a low of 191,000 *in situ* cy, based on a combination of SED 3 and FP 2, to a high of 2.9 million *in situ* cy, based on a combination of SED 8 and FP 7. The assumed duration for implementation of TD 1

[481] Truck transportation has been the mode of transportation selected by GE and EPA for all of the sediments and floodplain soils removed thus far from the Upper 2 Miles of the East Branch and from the West Branch of the Housatonic River.

consists of a range from the shortest to the longest potential implementation time – specifically, from 5 years (based on the shortest-duration sediment alternative, SED 10) to 52 years (based on the longest-duration alternative, SED 8). It is assumed that any floodplain remediation could be implemented within these same time periods.[482]

For disposal purposes, it is anticipated that the removed sediments and soils would be segregated into one of two principal classifications based on PCB concentrations – material with PCB concentrations $\geq$ 50 mg/kg and material with PCB concentrations < 50 mg/kg. The material with PCB concentrations $\geq$ 50 mg/kg would be transported to and disposed of at a TSCA-permitted landfill, while the remaining material would be transported to and disposed of at a permitted solid waste landfill. One TSCA-permitted landfill that could be considered as a disposal location for TSCA materials is Waste Management LLC's Model City Landfill located in Youngstown, New York. Possible locations for disposal of materials identified as non-TSCA could include Waste Management LLC's High Acres Landfill in Fairport, New York and the Fitchburg-Westminster, Southbridge, and Bourne Landfills in Massachusetts, subject to the necessary approvals. However, if alternative TD 1 is selected, a detailed sourcing effort would be performed during design to identify appropriate off-site disposal facilities for both TSCA and non-TSCA materials.

The disposal classifications are based on the assumption that the removed sediments and soils would not constitute hazardous waste under RCRA, and thus would not be subject to the separate requirements under RCRA and comparable state regulations for disposal of hazardous waste.[483] Based on prior experience at other portions of the GE-

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[482] Note that the combination of sediment and floodplain alternatives with the shortest duration (SED 10 and FP 9) is not the same as the combination with the smallest volume (SED 3 and FP 2). For the evaluations in this section that are based on removal volumes, the latter combination is used as the basis for the lower end of the range. In addition, quantitative evaluations based on active transport operations (e.g., number of truck trips, analysis of traffic accident risks) are based on the assumed years of operation, rather than overall duration. The years of operation represent the number of years during which materials removed from the River and floodplain would be actively being transported (i.e., excluding years when the only activities being conducted under the sediment and floodplain alternatives would be capping, backfilling, or restoration activities). For TD 1, the assumed years of operation range from approximately 8 years based on SED 3 and FP 2 (the smallest-volume combination) to approximately 40 years based on SED 8 and FP 7.

[483] For purposes of evaluating TD 1, it has been assumed that the determination of whether excavated material would be subject to state regulation as hazardous waste would be based on the same criteria used in the RCRA regulations, and that wastes would not be subject to such regulation solely by virtue of having PCB concentrations $\geq$ 50 mg/kg, provided that such materials are disposed of in accordance with TSCA requirements. For example, in Massachusetts, although wastes with PCB concentrations $\geq$ 50 mg/kg are listed hazardous wastes, the Massachusetts hazardous waste regulations exempt facilities that manage such wastes so long as they comply with EPA's TSCA regulations (310 CMR 30.501(3)(a)). The other relevant criteria in the Massachusetts regulations for determining whether wastes are hazardous are comparable to those under RCRA.

Pittsfield/Housatonic River Site (e.g., the 1½-Mile Reach and floodplain), it is not anticipated that the excavated sediments and soils would constitute hazardous waste. However, representative testing of those excavated materials would be conducted using the TCLP to determine if they would fall under the RCRA definition of hazardous waste. In the event that any particular sediments or soils constitute hazardous waste, they would be segregated from the remaining materials and transported to an off-site facility authorized to receive such materials. Additionally, should any of the removed materials constitute "principal threat" wastes (as defined in Section 2.3.3) such as free NAPL or drums of liquid waste – which is not anticipated – those wastes would be segregated and transported off-site separately for treatment and disposal, as appropriate.

9.1.2 Overall Protection of Human Health and the Environment – Introduction

The first General Standard in the Permit requires an evaluation of whether a remedial alternative would provide overall protection of human health and the environment. In accordance with the NCP, application of this standard to a particular treatment/disposal alternative draws primarily on the consideration of several other Permit criteria – long-term effectiveness and permanence, including long-term adverse impacts on health or the environment, short-term effectiveness, and compliance with ARARs. The evaluation of whether TD 1 would be protective of human health and the environment is presented at the end of Section 9.1 so that it can take account of the evaluations under those other criteria.

9.1.3 Control of Sources of Releases

Placement of PCB-containing sediments and soils into off-site permitted landfills would effectively and permanently isolate those materials from being released into the environment. Permitted landfills are designed, in accordance with applicable regulatory requirements, to prevent releases to the environment, and are operated, monitored, and maintained to ensure the continued isolation of the contained materials.

9.1.4 Compliance with Federal and State ARARs

As noted in Table T-1 in Appendix C, there are no ARARs for TD-1. ARARs apply only to on-site activities and thus are not relevant to the off-site transport and disposal of sediments and soils. To the extent that ARARs are relevant to the construction of access roads and staging areas, those requirements are addressed in the consideration of alternatives for sediments and floodplain soils (Sections 6 and 7, respectively). The off-site transport and disposal activities would comply with all applicable federal, state, and local laws and regulations relating to such activities.

9.1.5 Long-Term Reliability and Effectiveness

An assessment of long-term reliability and effectiveness of an alternative includes an evaluation of the magnitude of residual risk, the adequacy and reliability of the alternative, and any potential long-term adverse impacts associated with the alternative on human health or the environment. Each of these considerations is evaluated below for TD 1.

9.1.5.1 Magnitude of Residual Risk

As required by applicable regulations, the materials disposed of in off-site permitted landfills under TD 1 would be isolated from underlying soils and groundwater and from surface receptors, which would prevent contact by human and ecological receptors with those materials.

9.1.5.2 Adequacy and Reliability of Alternative

Evaluation of the adequacy and reliability of TD 1 has included an assessment of the factors discussed below.

<u>Use of Technology under Similar Conditions</u>

Landfill disposal is commonly used to dispose of soils and sediments containing PCBs. State and federal regulations governing the use of off-site permitted landfills promote long-term reliability and effectiveness. Off-site permitted landfills were selected as part of a final remedy for a number of sites containing PCBs, including the New Bedford Harbor hot spots in Massachusetts; Burnt Fly Bog Site in Marlboro, New Jersey; General Motors Central Foundry Division in Massena, New York; Consolidated Edison Arthur Kill Generating Station in Staten Island, New York; the Hudson River in New York; and the Fox River in Wisconsin.

<u>Overall Effectiveness and Reliability</u>

Permitted landfills are subject to design, operation, and monitoring in accordance with regulatory standards and requirements designed to assure their long-term effectiveness and reliability. As a result, implementation of TD 1 is considered an effective and reliable means of permanently disposing of the removed sediment/soil.

Reliability of Operation, Monitoring, and Maintenance Requirements/Availability of Labor and Materials

The operators of the off-site permitted landfills would be responsible for operating, monitoring, and maintaining the facilities in accordance with their permits. The labor and materials needed to support such activities are considered readily available. TD 1 would involve no long-term OMM requirements as part of the Rest of River remedy.

Technical Component Replacement Requirements

These requirements would apply to the off-site landfill operator, and would not be part of TD 1.

9.1.5.3 Potential Long-Term Adverse Impacts on Human Health or the Environment

The evaluation of potential long-term adverse impacts on human health or the environment resulting from TD 1 has included an assessment of several components, as described below. The access roads necessary to facilitate transportation of excavated/dredged materials from the staging areas located along the River to local roads for transportation off-site would be constructed as part of the sediment and floodplain alternatives previously described. As such, long-term adverse impacts associated with construction of these roads are not included in this section, but have been considered in the evaluations of the sediment and floodplain soil alternatives (Sections 6 and 7, respectively). In addition, any long-term impacts associated with the off-site disposal facilities would be specific to the locations of those facilities and addressed by the operators of those facilities, and are not discussed in this report.

Potentially Affected Populations

Under TD 1, the PCB-containing sediments and soils placed in the off-site permitted landfills would remain in place permanently. There would be no long-term impacts to humans or ecological populations in the Rest of River resulting from this alternative.

Long-Term Ecological Impacts

As the PCB-containing materials would be managed at an off-site location, there would be no impacts to the ecological habitats or biota in the Rest of River resulting from off-site disposal.

Long-Term Impacts on Aesthetics and Recreational Use

Implementation of TD 1 would not produce long-term impacts on the aesthetics or recreational use of the Rest of River area.

Potential Measures to Mitigate Long-Term Adverse Impacts

No potential measures are anticipated to be needed to mitigate long-term adverse impacts.

9.1.6 Reduction of Toxicity, Mobility, or Volume

The degree to which TD 1 would reduce the toxicity, mobility, or volume of PCBs is discussed below.

Reduction of Toxicity: TD 1 would not include any treatment processes that would reduce the toxicity of the PCBs in the removed sediment and soil. These materials would be transferred to off-site permitted landfills for permanent containment. However, as noted in Section 2.2.3, should any removed material constitute "principal threat" wastes, which is not anticipated, those wastes would be segregated and transported off-site for treatment and disposal, as appropriate.

Reduction of Mobility: TD 1 would result in the reduced mobility of PCBs by permanently containing the removed sediments and soils within off-site permitted landfill(s). Once disposed of, these materials would be isolated from surface water infiltration, leaching to groundwater, or otherwise mobilizing.

Reduction of Volume: TD 1 would not reduce the volume of PCB-containing material.

9.1.7 Short-Term Effectiveness

Evaluation of the short-term effectiveness of TD 1 has included consideration of the short-term impacts that this alternative would have on the environment (in terms of both ecological effects and increases in GHG emissions), on local communities and communities along the truck transportation corridor, and on the workers involved in the disposition activities. For TD 1, short-term impacts are those that would occur over the duration of off-site disposal of removed materials.

Impacts on the Environment – Ecological Effects

Implementation of TD 1 could have short-term effects on the environment if there were accidental releases of PCB-containing sediments or soils from trucks transporting the materials to the off-site landfill(s). Reasonable and appropriate controls would be implemented to minimize the potential for releases during transportation activities, such as the use of lined and tarped trucks. The establishment of truck loading and equipment decontamination procedures would further reduce the potential for releases and exposure related to loading and unloading.

Carbon Footprint – GHG Emissions

As described in Section 5.6 and Appendix M, an estimate has been developed of the carbon footprint composed of GHG emissions anticipated to occur through off-site disposal of removed sediments and soils in permitted landfills during implementation of TD 1. That estimate was based on the range of potential removal volumes requiring off-site transport and disposal, with the lower bound based on the combination of sediment and floodplain alternatives with the lowest *in situ* volume (SED 3 and FP 2 – 191,000 cy) and the upper bound based on the combination with the highest *in situ* volume (SED 8 and FP 7 – 2.9 million cy).

The total carbon footprint associated with TD 1 has been estimated to range from 19,000 tonnes to 290,000 tonnes of GHG emissions, based on the range of removal volumes. Of this total, the GHG emissions associated with direct emission sources (primarily transportation of sediment and soil to landfill) range from approximately 16,000 tonnes to 250,000 tonnes, while the GHG emissions calculated for off-site emissions (primarily refinement of diesel fuel for use in transportation of sediments and soils to off-site permitted landfills) range from approximately 2,600 tonnes to 40,000 tonnes. The range of total GHG emissions estimated for this alternative is equivalent to the annual output of 3,600 to 55,400 passenger vehicles.

Impacts on Local Communities and Communities Along Transport Routes

TD 1 would result in short-term impacts to the local communities along the River and the transportation routes. These short-term effects would consist primarily of increased truck traffic, with resultant noise and emissions, and the potential for traffic accidents. Truck traffic to transport material removed from the River or floodplain would persist for the duration of the project. To estimate the relative short-term impacts related to such truck traffic, it was assumed that 20-ton trucks (approximate 16-cy capacity) would be used to transport material off-site for disposal. To calculate the number of truck trips necessary, the *in situ* removal volumes were bulked by 20% and converted to tons.[484] Using these

[484] A bulking factor was applied to represent the *ex situ* volume following the anticipated expansion of excavated materials once they are removed from *in situ* conditions.

assumptions, the number of truck trips would range from approximately 15,900 truck trips to transport 191,000 *in situ* cy of material a total of 9,340,000 miles (including return trips) for alternatives SED 3 and FP 2 (average of 2,000 truck trips annually) to approximately 243,000 truck trips to transport 2.9 million *in situ* cy of material a total of 142,664,000 miles (including return trips) for alternatives SED 8 and FP 7 (average of 6,100 truck trips annually). This additional traffic would increase the likelihood of accidents, noise levels, and emissions of vehicle/equipment exhaust and nuisance dust to the air. Transportation would be conducted in accordance with applicable Department of Transportation (DOT) guidelines and regulations, which would minimize short-term risks. However, compliance with those regulations cannot eliminate the possibility of accidents or impacts from noise and emissions.

Appendix N includes an analysis of potential accident risks from the increased truck traffic that would be associated with the treatment/disposition alternatives. For TD 1, this analysis focuses on the increased truck traffic that would be necessary to transport materials to off-site disposal facilities. Risk estimates from increased truck traffic were made for the range of truck trips described above These estimates were also based on an assumed split between TSCA-regulated and non-TSCA materials, as described in Appendix N. Based on the lower and upper bounds of the truck trip estimates, this analysis indicates that the increased truck traffic associated with TD 1 would result in an estimated 4.39 to 67.05 non-fatal injuries due to accidents during the project (average of 0.55 to 1.68 non-fatal injuries per year), with a probability of 99% to 100% of at least one such injury, and an estimated 0.21 to 3.14 fatalities from accidents during the project (average of 0.03 to 0.08 fatalities per year), with a probability of 19% to 96% of at least one such fatality.

<u>Potential Measures to Avoid, Minimize, or Mitigate Short-Term Environmental and Community Impacts</u>

Several actions would be taken in an attempt to avoid, minimize, or mitigate the negative short-term environmental and community impacts associated with TD 1. Engineering controls and BMPs would be implemented, to the extent practical and as needed, to reduce detrimental effects from implementation of TD 1 on the environment and local communities. Some potential BMPs that would likely be implemented during operation include, but are not limited to, the following:

- Use of lined and tarped trucks;
- Proper vehicle maintenance;
- Limiting truck idling;

- Use of dust control measures and good housekeeping practices in loading areas and on unpaved roads;
- Limiting traffic on unpaved roadways;
- Inspection of trucks prior to entering public roadways to identify and, if necessary, remove any accumulated soil on the exterior of the trucks;
- Implementation of equipment decontamination procedures;
- Avoidance of truck loading operations at night except where necessary and minimization of such activities on weekends and holidays;
- Efforts to avoid travel through densely populated areas where practical; and
- Where such travel is necessary, implementation of measures to ensure the safety of the impacted communities (e.g., traffic control, consultation with local public officials).

Despite the implementation of these measures, however, some short-term impacts from TD 1 would be inevitable.

Risks to Remediation Workers

Since TD 1 involves off-site transportation and disposal of the staged excavated/dredged materials, the risks to workers would consist solely of risks to the truck drivers and to the employees of the off-site disposal facilities, rather than to on-site remediation workers. As such, no quantitative evaluation has been made of the risks to remediation workers for TD 1.

9.1.8 Implementability

9.1.8.1 Technical Implementability

The technical implementability of TD 1 has been evaluated in terms of the following factors:

General Availability of Technology: At present, there are a number of existing permitted TSCA and solid waste landfills that are believed to have the required capacity to accept all of the material removed during implementation of the sediment and floodplain alternatives. However, the time to implement TD 1, and therefore the time over which landfill space is needed, would be dependent upon the sediment and floodplain alternatives selected by EPA and could range from approximately 5 years to 52 years, as noted above. Given the potential volume of materials that could require disposal and the potential length of time required to implement TD 1, it is possible that, under the larger sediment and floodplain removal alternatives, current off-site landfill capacity would be exhausted before the remediation was complete. Further, given the potential difficulties associated with expansion of such facilities, it is uncertain whether the capacity needed for the disposal of sediments/soils from such removal alternatives would be available in the future. These uncertainties would be reduced or even eliminated to the extent that the removal volume and duration of the underlying alternatives are reduced.

Ability To Be Implemented: Material is routinely transported to off-site permitted landfills. Regulations are in place governing the transport of such materials as well as the design and operation of landfills to enable effective containment of waste materials. As noted previously, a number of the sediment remedial alternatives are estimated to take more than 20 years to complete, including SED 8 at over 50 years. To implement TD 1, sufficient landfill capacity must be available at the time material is being removed from the Site, which for many of the sediment alternatives is currently uncertain.

Reliability: As noted previously, landfill disposal is commonly used to dispose of soils and sediments containing PCBs. State and federal regulations governing the operation of off-site permitted landfills promote long-term reliability and effectiveness.

Availability of Space for Support Facilities: As noted in the evaluations of the sediment and floodplain soil alternatives (Sections 6 and 7, respectively), sufficient space is expected to be available to construct the access roads and staging areas needed to support the sediment and soil removal activities.

Availability of Equipment, Materials, and Personnel: Equipment, materials, and personnel necessary to load and transport soil/sediment to off-site permitted landfills are considered readily available.

Ability to Monitor Effectiveness: Under TD 1, no OMM would be necessary at the site, since the material would all be transported to off-site landfills.

9.1.8.2 Administrative Implementability

The evaluation of the administrative implementability of TD 1 has included consideration of regulatory requirements, the need for access agreements, and coordination with government agencies.

Regulatory Requirements: Implementation of TD 1 would require meeting the requirements of applicable federal, state, and local rules and regulations relating to the off-site transport and disposal of the sediments and soils. Such requirements would be met.

Access Agreements: Implementation of TD 1 would not require GE to obtain access permission since materials would be transported off-site for disposal.

Coordination with Agencies: Both prior to and during implementation of TD 1, GE would need to coordinate with EPA, as well as state and local agencies, to provide as-needed support with public/community outreach programs and to fulfill the requirements for transporting material to the off-site permitted landfills. GE would also have to provide required notice to environmental agencies in any state where a receiving landfill is located.

9.1.9 Cost

The range of estimated total costs to implement TD 1 is $55 M to $832 M (not including costs associated with sediment or floodplain soil removal). The low end of this range is based on the transport and disposal of dewatered and stabilized materials generated by a combination of SED 3 and FP 2 (approximately 191,000 *in situ* cy). The high end of the range represents the estimated costs for the transport and disposal of dewatered and stabilized materials generated by SED 8 and FP 7 (approximately 2.9 million *in situ* cy). An assumed bulking factor (20% by volume) and drying agents (10% by weight to account for the potential need for stabilization prior to transport) were included in the sediment volumes used to develop the cost estimates. The cost estimates assume that the removed materials would be segregated based on TSCA classification as described in Section 3.1.5, and that no additional material stabilization activities beyond what was included and discussed in the analysis of sediment and floodplain soil alternatives would be needed prior to transport. There are no capital costs associated with TD 1. Annual operations costs associated with transportation of the materials would be approximately $7 M to $21 M. There are no post-construction monitoring and maintenance costs associated with TD 1. The following summarizes the total project costs estimated for TD 1.

TD 1	Minimum Est. Cost	Maximum Est. Cost	Description
Total Capital Cost	$0	$0	N/A
Total Operations Cost	$55 M	$832 M	Total cost for the transport and off-site disposal of removed materials at an off-site permitted facility(ies)
Total Post-Construction Monitoring and Maintenance Cost	$0	$0	N/A
Total Cost of Alternative	$55 M	$832 M	Total cost of TD 1 in 2010 dollars

The range of total estimated present worth costs for TD 1, which was developed using a discount factor of 7% and an anticipated overall duration of 10 to 52 years,[485] is $40 M to $220 M. More detailed cost estimate information and assumptions for each of the treatment/disposition alternatives are included in Appendix Q.

9.1.10 Overall Protection of Human Health and the Environment – Conclusions

As explained in Section 9.1.2, the evaluation of whether TD 1 would provide overall protection of human health and the environment draws upon the evaluations under several other Permit criteria, discussed in prior sections, as well as other factors relevant to the protection of health and the environment. The key considerations relevant to this criterion are discussed below.

General Effectiveness: Landfill disposal is commonly used to dispose of soils and sediments containing PCBs. State and federal regulations governing the siting and use of off-site permitted landfills promote long-term reliability and effectiveness. TD 1 would provide permanent disposal of the PCB-containing sediments and soils. However, as the volume of materials requiring disposal and the length of time necessary to do so increase, the more uncertainty would exist as to whether off-site permitted facilities would have the necessary capacity available for the disposal of these materials at all potentially relevant times in the future.

Compliance with ARARs: As discussed in Section 9.1.4, ARARs are not relevant to the off-site transport and disposal of the sediments and soils, since those activities would take place largely away from the River. The off-site transport and disposal activities would comply with all applicable federal, state, and local laws and regulations.

Human Health Protection: TD 1 would provide human health protection through disposal of the removed PCB-containing materials in off-site permitted landfills. Implementation of this alternative would not have any significant long-term or short-term adverse effects on human health at the site. However, it would result in some short-term safety risks due to a substantial increase in truck traffic to transport excavated and dredged materials from the site.

Environmental Protection: Implementation of TD 1 would have no long-term or short-term adverse impacts on ecological habitats at the site. However, it could have some short-term

[485] This range is based on the estimated overall duration of the lowest cost/lowest volume combination (SED 3 and FP 2) to that of the highest cost/highest volume combination (SED 8 and FP 7). Note that the lower bound of this range is different from the combination with the shortest duration, which is the combination of SED 10 and FP 9, with an estimated duration of 5 years.

impacts if there were accidental releases of PCB-containing materials from trucks during transport to the off-site disposal facilities. In addition, it could result in a significant amount of GHG emissions, depending on the volume of excavated sediments and soils to be transported off-site for disposal. The lower that removal volume, the lower the GHG emissions.

Summary: Based on the foregoing considerations, TD 1 would provide overall protection of human health and the environment.

9.2 Evaluation of Local Disposal in CDF (TD 2)

9.2.1 Description of Alternative

Alternative TD 2 would involve the placement of dredged sediments in a CDF or CDFs located within a waterbody. A CDF is an engineered structure consisting of dikes or other structures that extend above an adjacent water surface and enclose a disposal area for containment of dredged sediments. Containing the dredged material effectively isolates it from the adjacent waters or land (USACE and EPA, 2004). CDFs are typically constructed within a waterbody at locations selected to receive materials from as wide an area of the waterbody as possible while transporting the material over as short a distance as practical. Three objectives inherent in the design and operation of CDFs are to: (1) provide adequate storage capacity for the dredged sediments; (2) capture the solids within the CDF; and (3) control contaminant releases. The basic guidance for design, operation, and management of CDFs can be found in various engineering manuals issued by the USACE (1983, 1987, 2003a, 2003b). These manuals were developed for CDFs used for spoils of navigational dredging, but the same concepts have been applied to the use of a CDF for the disposal of material resulting from environmental remediation projects.

For purposes of the Revised CMS Report, it has been assumed that only hydraulically dredged sediments would be placed in a CDF. (Hydraulic dredging removes sediments in the form of a slurry, which can then be pumped into a CDF, unlike mechanically dredged sediments which require additional handling/processing steps prior to disposal.) As noted in Section 6, hydraulic dredging has been assumed in Reaches 5C and 6 for sediment alternatives SED 6 and SED 7, in Reaches 5C, 6, 7, and 8 for SED 8, and in Reach 5C, the Reach 5 backwaters, Reach 6, and Reach 8 for SED 9. Further, the use of a CDF requires that a location or locations be identified in the Housatonic River basin where relatively large open water areas exist, preferably not within the main channel flow and preferably in close proximity to areas where larger volumes of sediments would be hydraulically removed, since direct filling with hydraulically dredged sediments is the most efficient means of using a CDF. Based on these criteria, three locations were identified as potential locations for a

CDF: a portion of Woods Pond (see Figure 9-1) and two large backwaters, BWL_07 and BWL_09 (see Figure 9-2). Given these locations, TD 2 could be used only for hydraulically dredged sediments from Reaches 5C and 6 under alternatives SED 6 through SED 9. Because of these limitations, another treatment/disposition alternative would be necessary for other removed sediments and for floodplain soil. Thus, TD 2 could not be the only treatment/disposal alternative selected for the Rest of River.

With regard to the three potential CDF locations, the southeastern portion of Woods Pond contains an area with water depths up to 17 feet, which could provide significant storage capacity for sediments dredged from Reaches 5C and 6. This "deep hole" in Woods Pond is separated from the main flow channel by a relatively shallow water zone, which makes it a favorable location for sediment disposal. Furthermore, the sediments in that area, which would otherwise be subject to removal under alternatives SED 6 through SED 9, could remain in place, thereby increasing the efficiency of those alternatives and somewhat reducing associated dredging volumes, time, dredging-related impacts, and costs. The three identified backwater areas would provide a similar function, although the volume of sediment that could be contained in those backwaters would be smaller as the water depths in these areas are much shallower.

The primary advantage of an in-water CDF is the ability to handle large volumes of water (generated through the hydraulic dredging process) while containing the sediment and associated contaminants. To achieve this, the CDF or CDFs would be created by isolating a portion of Woods Pond and/or the backwater areas from the main channel using sealed sheetpiles and then constructing a soil berm around the land-side perimeter of the area. Hydraulically dredged sediment would be pumped into the confined area where the sediments would settle out of suspension and consolidate, while the excess water would filter through the permeable soil berms and return to the River. As the water passes through the permeable soil berms, the solids would be filtered out and contained within the CDF.

The filter core of the permeable berms would be constructed using fine to medium sand and filter fabric. This material can be placed at a 2:1 slope and supported along the slopes by gravel or crushed stone. The berm would be constructed in lifts, with larger armor stone placed along the outer slopes as the berm is raised. The guidelines for CDF design presented in the U.S. Army Corps of Engineers Engineering Manual for the Engineering and Design of Confined Disposal of Dredged Material (USACE, 1987) specify that, during filling, a minimum of 2 feet of height should be assumed for freeboard (i.e., the available storage capacity between the top of the water surface and the top of the adjacent perimeter berm) in addition to a minimum average ponding depth of 2 feet. Further, for purposes of this Revised CMS Report, the final consolidated sediment fill height in the CDF has been assumed to be 3.5 feet (or less if the sediments can all be disposed of in the selected CDF location to a lesser height). Based on the combination of that height with the 4-foot combined height requirement for freeboard and ponding during the filling process, the top of the sheetpile wall and berms would need to be 7.5 feet above the mean water elevation in Woods Pond and the backwaters during filling (or correspondingly less if the sediment fill height is less than 3.5 feet). This berm and sheetpile wall height would provide sufficient capacity to accommodate the sediment/water slurry and allow sufficient surface area for the water to seep through the berms during placement of the dredged materials. Once the capacity of the CDF(s) is reached and the sediment has consolidated, the berm and sheeting elevations would be lowered to the extent practicable, and the CDF(s) would be closed through the construction of an 18-inch soil cover over the consolidated sediments. The surface of the CDF(s) would then be planted with appropriate vegetation depending on final design elevations and site-specific conditions.

To determine the appropriate capacity for the CDF(s), the volume of sediment that would be hydraulically dredged in Reaches 5C and 6 has been estimated for alternatives SED 6, SED 7, SED 8, and SED 9. Those volumes are:

- SED 6 – 300,000 cy;
- SED 7 – 385,000 cy;
- SED 8 – 1,240,000 cy; and
- SED 9 – 509,000 cy.

These sediment removal volumes would be reduced to account for the sediments within the footprint of the CDF(s) that would remain in place.

<u>Potential CDF Configurations for SED 6, SED 7, SED 8, and SED 9</u>

Several potential configurations exist for construction of CDFs in Woods Pond and the backwaters identified above. In Woods Pond, two options that have been evaluated are to place the sheetpile wall at locations A or B, as shown on Figure 9-1. The corresponding confined areas would cover 17 and 36 acres, respectively. In the backwaters, CDFs could be constructed within the areas shown on Figure 9-2. The corresponding confined areas for backwaters BWL_07 and BWL_09 are 23.8 acres and 8.5 acres, respectively.

Based on the estimated volumes and potential configurations described above, conceptual locations for CDF(s) have been selected for SED 6, SED 7, SED 8, and SED 9 as described below:

SED 6: Under SED 6, the estimated sediment removal volume for Reaches 5C and 6 is 300,000 cy. It is assumed that these hydraulically dredged sediments would be placed in a CDF in Woods Pond within the area encompassed by sheetpile location A. The sediment volume targeted for removal within the footprint of that CDF location is 7,000 cy. Since that sediment would not have to be dredged, the net volume of sediment to be hydraulically dredged and placed in the Woods Pond CDF would be 293,000 cy. This would fill the CDF location to a final elevation approximately 5 feet above the mean surface water elevation (including the thickness of the final cover).

SED 7: Under SED 7, the estimated sediment removal volume for Reaches 5C and 6 is 385,000 cy. It is assumed that these hydraulically dredged sediments would be placed in two CDFs – one within the area of Woods Pond encompassed by sheetpile location A, and the other in backwater BWL_09. The sediment volumes within those footprints, which would otherwise be targeted for removal under SED 7, are 12,000 cy in the CDF portion of Woods Pond and 2,000 cy in backwater BWL_09. Since those sediments would not have to be dredged, the net volume of sediment to be hydraulically dredged and placed in these CDFs would be 371,000 cy. This volume would fill the Woods Pond CDF and the backwater BWL_09 CDF to a final elevation of approximately 5 feet above the mean surface water elevation, including the thickness of the final covers.

SED 8: Under SED 8, the estimated sediment removal volume for Reaches 5C and 6 is 1,240,000 cy. It is assumed that these hydraulically dredged sediments would be placed in two CDFs – one within the area of Woods Pond encompassed by sheetpile location B, and the other in backwater BWL_07. The sediment volumes within those footprints, which would otherwise be targeted for removal under SED 8, are 347,000 cy and 94,000 cy, respectively. Since those sediments would not have to be dredged, the net volume of sediment to be hydraulically dredged and placed in these CDFs would be approximately 800,000 cy. This volume would fill the Woods Pond CDF and the backwater BWL_07 CDF to a final elevation of approximately 5 feet above the mean surface water elevation, including the thickness of the final covers.

SED 9: Under SED 9, the estimated sediment removal volume for Reaches 5C and 6 is 509,000 cy. It is assumed that these hydraulically dredged sediments would be placed in a CDF in Woods Pond within the area encompassed by sheetpile location B. The sediment volume targeted for removal within the footprint of that CDF location under SED 9 is 111,000 cy. Since that sediment would not have to be dredged, the net volume of sediment to be hydraulically dredged and placed in the Woods Pond CDF would be 398,000 cy. This would fill the CDF location to a final elevation approximately 3.5 feet above the mean surface water elevation (including the thickness of the final cover).

Remedial Approach

The following summarizes the general remedial approach (and associated assumptions) related to the implementation of TD 2. It should be noted that while details on the CDF configuration, construction, operation, and closure are provided in this description for purposes of the evaluations in the CMS, the specific methods and CDF components for implementation of this alternative would be determined during the design process based on engineering considerations and site conditions.

Site Preparation: The first step in implementing TD 2 would be clearing and grubbing along the shore as necessary for access, followed by the construction of access roads and staging areas. It has been assumed that there would be no water treatment plant associated with the CDF(s) because the permeable berms would allow for passive dewatering of the hydraulically dredged sediments.

Sheetpile Cutoff Wall and Permeable Berm Construction: The second step in implementing TD 2 would be the construction of the CDF(s), including driving a sealed sheetpile wall along the water side of the CDF(s) to isolate the CDF area(s) from the main channel, followed by construction of a permeable soil berm around the land-side perimeter. In both Woods Pond and the backwaters, the sheetpile would be installed using water-based construction techniques from a barge, and the soil berm would be constructed from the shore using conventional land-based equipment. Water flowing through the berm would be directed back to the River through a perimeter diversion ditch with additional filter dams installed, if needed.

CDF Operations: Once the CDF(s) are constructed, the hydraulically dredged sediment would be pumped to the CDF(s) as a slurry via piping connected to the dredge. Booster pump stations would be placed along the length of the pipe, as necessary, to allow the sediment to stay in suspension before reaching the CDF. Passive dewatering would be accomplished in the CDF(s) using gravity settling and filtration through the permeable berms. A minimum freeboard would be maintained at all times.

For purposes of this Revised CMS Report, it has been assumed that dredging would be conducted for 9 months per year. During the remaining 3 months of each year, consolidation of the sediments placed in the CDF would occur. Depending on the sediment alternative that is selected, hydraulic dredging of Reaches 5C and 6 is expected to be performed for an estimated period of approximately 3 years (for SED 9) to 20 years (for

SED 8).[486] At the completion of sediment removal activities, it could take several months for the dewatered sediment to become firm enough to support the low ground-pressure equipment that would be used to place the cover on the CDF. Additional measures such as installation of wick drains and/or a surface drainage system combined with surcharge loading could promote consolidation of the sediment prior to cover placement.

Operations Monitoring and Maintenance: Monitoring and maintenance would be performed during CDF operations. These activities would include routine air and surface water monitoring for PCBs. They would also include visual monitoring of the dredge discharge pipe, the booster pumps, the sheetpiles, the permeable berms, and the perimeter diversion ditch to promote the integrity and proper functioning of these components.

Engineering/Institutional Controls: During construction and operation of the CDF(s), access restrictions would be established, such as installation of fencing and signs. Following construction, deed restrictions would be put in place to prohibit interference with the CDF(s) and restrict future use.

Final Cover Installation: Once all hydraulically dredged sediments have been placed and consolidated in the CDF, an 18-inch soil cover would be constructed over the area. Following placement, the CDF would be planted with appropriate vegetative species.

Flood Storage Compensation: Construction of the CDF(s) in Woods Pond and/or the backwaters would permanently reduce the existing flood storage capacity in those areas (by an amount ranging from 164,600 cy if SED 6 were selected to 580,800 cy for SED 8). As discussed further in Section 9.2.4, provision of some flood storage compensation may be required to minimize the impact of the CDF(s) on the elevation and extent of a large flood event. However, it would not be feasible to provide complete flood storage compensation for the loss of flood storage capacity caused by the CDF(s), due to the large volume of flood storage capacity required and the lack of any suitable places to obtain that volume of compensation at the appropriate elevations/areas without creating other adverse effects on

[486] Note that the alternative with the shortest duration of hydraulic dredging (SED 9) is not the same as the alternative with the smallest dredging volume (SED 6). For the evaluations in this section that are based on hydraulic dredging volumes, the latter alternative is used to represent the lower end of the range. In addition, quantitative evaluations based on active disposal operations (e.g., risks to workers) are based on the assumed years of operation, rather than overall duration. The years of operation represent the number of years during which dredged materials would be actively being pumped into the CDF(s). For TD 2, the assumed years of operation for evaluations based on volume range from approximately 6 years based on SED 6 (the smallest-volume alternative) to approximately 20 years based on SED 8.

the river or floodplain. If this alternative were selected, GE would discuss with EPA the need for and feasibility of obtaining such flood storage compensation.

Long-Term Post-Closure Monitoring and Maintenance: A long-term monitoring and maintenance plan would be developed and implemented following closure of the CDF(s). It is anticipated that this plan would provide for long-term groundwater monitoring (five locations assumed per CDF), visual inspections and maintenance of the facility components, continuation and maintenance of access restrictions (e.g., fences), and appropriate deed restrictions on the land. For purposes of the cost estimates provided in this Revised CMS Report, it has been assumed that this long-term program would consist of monitoring and inspections for a period of 100 years. Specifically, the monitoring components for TD 2 have been assumed to include long-term groundwater monitoring and visual inspections of the facility components and access restrictions (e.g., fences). It has been assumed that the long-term groundwater monitoring and visual inspections would be conducted annually for the 100-year monitoring and maintenance period.

Maintenance activities for TD 2 would be performed to promote the reliability and effectiveness of the CDF, and would be conducted as necessary based on the results of the monitoring activities described above. Maintenance activities for TD 2 could include the following activities: periodic repairs to the CDF berms and cover; re-seeding or maintenance of vegetation in cover areas; and maintenance and repair of the fences and signs.

Restoration of Affected Areas: Under TD 2, support areas outside the CDF area that are disturbed by the construction or operation of the facility would be restored to the extent practicable. For the area within or adjacent to the footprint of the CDF(s), the final restoration would be dependent on the final design elevations and site-specific conditions. It should be noted that while the final elevations have been assumed to be 5 feet above the mean surface water elevation in Woods Pond and the backwaters, consolidation of the sediment and underlying materials may alter the final elevation and ultimately have an effect on the restoration options for the CDF location(s).

Note Regarding Evaluations

As previously noted, since the CDF(s) would be used only for the disposition of hydraulically dredged sediments from Reaches 5C and 6 under SED 6 through SED 9, another treatment/disposition alternative would be needed for all other removed sediments, as well as for excavated floodplain soil. The evaluations presented below for TD 2 are limited to the use of the CDF(s) for the hydraulically dredged sediments described above, and do not cover the disposition of the remaining materials, with the exception of the cost estimates. As such, those evaluations (excluding the cost evaluation) are not directly comparable to the evaluations of the other treatment/disposition alternatives. The cost estimates, however, have taken into account the costs for off-site disposal of the sediments that would removed from other reaches under SED 6 through SED 9, as well as excavated floodplain soil, as discussed in Section 9.2.9.

9.2.2 Overall Protection of Human Health and the Environment – Introduction

As discussed in Section 9.1.2, the evaluation of whether a treatment/disposal alternative would provide overall human health and environmental protection relies heavily on the evaluations under several other Permit criteria – notably, long-term effectiveness and permanence (including long-term adverse impacts), short-term effectiveness, and compliance with ARARs. For that reason, the evaluation of whether TD 2 would be protective of human health and the environment is presented at the end of Section 9.2 so that it can take account of the evaluations under those other criteria.

9.2.3 Control of Sources of Releases

Placement of PCB-containing sediments removed from Reaches 5C and 6 into CDF(s) would minimize the potential for those PCB-containing materials to be released and transported within the River or onto the floodplain in the future. The CDF(s) would be designed to permanently contain the dredged sediments. Since the CDF(s) would be constructed adjacent to the main channel of the River, the berms, sheeting, and cover would be designed to withstand high flow events. This would help ensure that the materials remain in place. A long-term monitoring and maintenance program would be implemented for the CDF(s) to promote long-term reliability and effectiveness of the structure(s).

Research on dredged material has shown there is a potential for some loss of contaminants from CDFs (USACE and EPA, 2004; Myers et al., 1996). The greatest potential for contaminant loss is via the effluent pathway (i.e., seepage through the berms) during filling operations. Research has also shown, however, that most organic contaminants are tightly bound to the sediment particles and not readily released in a soluble form. This is especially true for PCBs. A CDF that retains a high percentage of sediment particles will therefore be effective in containing the associated contaminants (USACE, 1978). Monitoring and control of this pathway would help control the potential for effluent releases from the CDF(s).

Several studies have been conducted to evaluate losses of contaminants during placement of hydraulically dredged sediments in CDFs (EPA, 1996). Hoeppel et al. (1978) studied influent and effluent samples from nine CDFs (four on the Atlantic coast, two on the Gulf coast, one on the Pacific coast, one in the Great Lakes, and one inland site). This study showed that most chemical constituents in dredged material were associated with the solid fraction, and that the efficiency of contaminant containment during filling operations was directly related to the efficiency of solids retention. For PCBs, very efficient containment was observed when adequate solids retention was maintained. Lu et al. (1978) carried out similar studies at the Grassy Island CDF in the Detroit River in Michigan and at the Pinto Island CDF in Mobile Bay, Alabama. At the Grassy Island CDF, the retention efficiency for PCBs was very close to the total solids retention (99.7%) and at the Pinto Island CDF, PCB retention efficiencies for Aroclors 1242, 1254, and 1260 were 96%, 97%, and 99%, respectively. Similarly, Myers (1991) measured PCB congener concentrations in influent and pond water in the Saginaw CDF in Michigan and found that the containment efficiency for PCBs was 99.82%.

There is also a potential for PCB releases to the air via volatilization during filling. The New Bedford Harbor CDF was covered with a floating cover to address such volatilization (Foster Wheeler Environmental Corporation, 2001; EPA, 2005g). A similar floating cover could be used during the implementation of TD 2 if PCB volatilization controls were deemed necessary.

Since the CDF(s) would not be designed with an impermeable cover or bottom liner, water could enter the CDF(s), and the potential would exist for leachate (and possibly dissolved-phase PCBs) to exit the CDF into the underlying groundwater, although, as noted above, PCBs are not readily released in a soluble form. It is also possible that the CDF cover could be damaged by ice or flooding, resulting in the release of PCB-containing materials from the CDF(s). However, the cover system would be designed to withstand impacts from ice and flooding, which would help ensure that the materials remain in place. A long-term monitoring and maintenance program would be implemented for the CDF(s) to promote long-term reliability and effectiveness of the structure(s).

9.2.4 Compliance with Federal and State ARARs

The potential ARARs identified by GE for TD 2 in accordance with directions from EPA are listed in Tables T-2.a through T-2.c in Appendix C. The potential chemical-specific ARARs presented in Table T-2.a include the federal and state water quality criteria for PCBs. Since the CDF(s) would be separated from the River via sheetpiles and berms, it is not expected that placement or presence of the PCB-containing sediments in the CDF(s) would have an appreciable impact on the water column PCB concentrations in the River and thus on attainment of the water quality criteria.

The potential location-specific and action-specific ARARs for TD 2 are listed in Tables T-2.b and T-2.c in Appendix C.[487] Review of those ARARs indicates that TD 2 could be designed and implemented to achieve certain of those ARARs, but that there are some potential ARARs that would require specific EPA approval or would not be met. These include the following:

- The in-water CDF(s) would not meet all of the substantive requirements of EPA's TSCA regulations for a chemical waste landfill (40 CFR § 761.75). Thus, it would be necessary to obtain from EPA a determination that the CDF(s) meet(s) the substantive criteria for a waiver of some of those requirements under 40 CFR § 761.75(4) or risk-based approval under 40 CFR § 761.61(c).

- Several potential ARARs – including EPA's and the U.S. Army Corps of Engineers' regulations under Section 404 of the Clean Water Act (40 CFR Part 230, 33 CFR Parts 320-323), the federal Executive Order for Wetlands Protection (E.O. 11990), the Massachusetts water quality certification regulations for discharges of dredged or fill material into waters (314 CMR 9.06), and the Massachusetts Wetlands Protection Act regulations (310 CMR 10.53(3)(q)) – require that there be no practicable alternative with less adverse impact on the aquatic ecosystem or wetlands. Thus, EPA would have to waive these requirements under CERCLA and the NCP.

- As discussed in Table T-2.b, EPA's and the U.S. Army Corps of Engineers' regulations under Section 404 of the Clean Water Act and the Massachusetts Wetlands Protection Act regulations (310 CMR 10.53(3)(q)) may require the provision of flood storage compensation for the loss of flood storage capacity resulting from the CDF(s). If applicable, those requirements would not be met because provision of complete flood storage compensation would not be feasible due to the large volume of flood storage capacity required and the lack of any suitable places to obtain that volume of compensation at the appropriate elevations/areas without creating other adverse effects on the river or floodplain. Thus, if these requirements are ARARs, EPA would have to waive them under CERCLA and the NCP as technically impracticable to meet or on some other ground.

- Both the Massachusetts water quality certification regulations (314 CMR 9.06) and the Massachusetts Wetlands Protection Act regulations (310 CMR 10.59) prohibit projects that would adversely affect the state-designated Estimated Habitat of state-listed rare

[487] For the reasons discussed in Section 2.1.3, a number of these regulatory requirements do not constitute ARARs for the Rest of River remedial action, but are listed in these tables as potential ARARs per EPA's direction.

wildlife species. This requirement would not be met because the backwater CDF area(s) and a portion of the Woods Pond CDF are within state-designated Estimated Habitat of state-listed wildlife species. Thus, if these regulations are ARARs, EPA would need to waive this requirement as technically impracticable to meet or on some other ground.

- The in-water CDF would not meet a number of other substantive siting and design requirements of the Massachusetts water quality certification regulations relating to the use of an in-water CDF for dredged material (314 CMR 9.07(8)). These include the prohibition on such confined disposal facilities within an ACEC. They also include the requirements that the CDF(s) have an impervious cover and prevent run-on from a 25-year storm – which the CDF(s) would not meet since they would not be intended to prevent any infiltration of precipitation or run-on water into the CDF(s). These requirements would thus also need to be waived as technically impracticable to meet or on some other ground.

- TD 2 would also not meet the requirement of MESA and its implementing regulations (310 CMR 10.23) that a project not result in a "take" of a state-listed species.[488] Thus, if that requirement is an ARAR, it would also need to be waived as technically impracticable to meet or on some other ground.

In addition to the potential ARARs discussed above, EPA's regulations under RCRA and the Massachusetts hazardous waste regulations establish detailed requirements for facilities that treat, store, or dispose of material that constitutes a hazardous waste under the RCRA criteria.[489] Based on prior experience at other portions of this Site (e.g., the sediments addressed during remediation of the 1½-Mile Reach), it is not anticipated that the sediments to be placed in the CDF(s) would constitute such hazardous waste (see Section 6.3.4 above). However, representative TCLP testing would be conducted during design to confirm that. We have considered whether, in the unlikely event that particular sediments to be placed in the CDF(s) should constitute hazardous waste under RCRA criteria, the CDF(s) would meet the applicable federal and state hazardous waste management

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[488] The MESA evaluations in Appendix L indicate that TD 2 would involve a take of state-listed species, with the number depending on the area(s) used for CDF(s), as discussed in Section 9.2.5.3. The MESA regulations contain a provision authorizing the Director of the MDFW to permit a take of a state-listed species under certain conditions (321 CMR 10.23). However, as discussed in Section 5.4, this provision does not constitute an ARAR for the Rest of River remedial action.

[489] As noted above, although wastes with PCB concentrations $\geq$ 50 mg/kg are listed hazardous wastes in Massachusetts, the Massachusetts hazardous waste regulations exempt facilities that manage such wastes so long as such facilities comply with EPA's TSCA regulations (310 CMR 30.501(3)(a)). The other relevant criteria under those state regulations for determining whether materials constitute hazardous waste are the same as those under EPA's RCRA regulations.

requirements. It appears that the CDF(s) would be covered by EPA's Area of Contamination (AOC) policy (EPA, 1995) which excludes from the RCRA land disposal restrictions and other RCRA technical requirements the movement of wastes (including disposal) within an overall area that includes discrete areas of generally dispersed contamination. It also appears that the CDF(s) would likely be exempt from the state requirements governing disposal of hazardous waste.[490] However, in the event that the AOC policy and/or the state exemptions were found not to apply, the CDF(s) would not meet some of the substantive requirements of EPA's RCRA regulations and the Massachusetts hazardous waste regulations for a hazardous waste disposal facility.[491] In that case, EPA would need to waive those requirements as technically impracticable to meet or on some other ground.[492]

9.2.5 Long-Term Reliability and Effectiveness

An assessment of long-term reliability and effectiveness of TD 2 has included an evaluation of the magnitude of residual risk, the adequacy and reliability of the alternative, and any potential long-term adverse impacts associated with the alternative on human health or the environment.

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[490] The Massachusetts hazardous waste regulations exempt dredged material that is placed in a confined disposal facility pursuant to 314 CMR 9.07(8) and managed in accordance with a state water quality certification and the requirements of a permit under § 404 of the Clean Water Act (310 CMR 30.104(3)(f)). In addition, the Massachusetts Contingency Plan (MCP) provides that the on-site disposal of hazardous waste as part of a remedial action under the MCP (which would include the Rest of River remedial action due to the MCP's "adequately regulated" provisions) is exempt from the State's hazardous waste regulations unless the MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).

[491] For example, the CDF(s) would not be constructed with the double liner/leachate collection system required by EPA's RCRA regulations for hazardous waste surface impoundments (40 CFR § 264.221, 264.301), which would be inconsistent with the purpose of the CDF(s) to act as filtration systems that allow water to pass through permeable berms. In addition, the CDF(s) would not meet many of the location and design requirements of the state hazardous waste management regulations – e.g., the requirements that hazardous waste surface impoundments or landfills not be located within the 500-year floodplain or within wetlands (310 CMR 30.701(6), 30.705(6)), that there can be no disposal of hazardous waste into waterbodies (310 CMR 30.706), and that surface impoundments or landfills have double liners (310 CMR 30.612(1), 30.622(1)).

[492] It should be noted that the Massachusetts site assignment regulations for solid waste facilities (310 CMR 16.00) and solid waste management regulations (310 CMR 19.00) would not apply to the CDF(s) because 310 CMR 19.013(2) exempts from those regulations remedial actions conducted pursuant to the MCP and, as noted above, the Rest of River remedial action would constitute a remedial action under the MCP by virtue of the MCP's "adequately regulated" provisions (310 CMR 40.0111).

9.2.5.1 Magnitude of Residual Risk

The CDF, once covered, would isolate the PCB-containing sediments from direct contact with human and ecological receptors, mitigating the potential for long-term exposure of those receptors to those sediments. Although the CDF(s) would not be constructed in the main channel of the River, it/they would be designed to withstand high flow events. However, the potential would exist for portions of a CDF to be compromised and for material in the CDF to be released back to the River or the adjacent floodplain. Further, since the CDF(s) would not include an impermeable cover or bottom liner, the potential would exist for leachate (and possibly dissolved-phase PCBs) to migrate to groundwater. Periodic visual inspections would be conducted to confirm the integrity of the sheetpile, cover, and berms, which would be repaired in the event that any damage or erosion was identified. Seepage of PCBs from the CDF(s) to the underlying groundwater would be monitored through a periodic groundwater monitoring program. A long-term monitoring and maintenance program would be implemented to promote long-term reliability and effectiveness, and institutional controls such as deed restrictions would further limit the potential for human exposure and help maintain the long-term effectiveness of this alternative.

9.2.5.2 Adequacy and Reliability of Alternative

Evaluation of the adequacy and reliability of TD 2 has included an assessment of the factors discussed below.

Use of Technology under Similar Conditions

In-water CDFs have been used to dispose of dredged sediments containing PCBs at several environmental dredging sites. For example, CDFs have been used for disposal of PCB-containing sediment at the Commencement Bay Nearshore/Tideflats Superfund Site in Tacoma, Washington, the Channel/Shelter Island Diked Facility in Saginaw Bay, Michigan, and Waukegan Harbor in Illinois, as described below:

- The Commencement Bay Site consists of several waterways where sediments containing PCBs, PAHs, and metals were placed into CDFs. Sediments from various waterways at that site were placed into three different CDFs. All three of these CDFs have permeable berms and clean sediment caps (EPA, 2004f).

- The Channel/Shelter Island Diked Facility in Saginaw Bay, Michigan, was constructed to hold contaminated sediments dredged from the Saginaw River for navigation purposes. A two-year study was conducted to evaluate facility performance in confining contaminants associated with dredged sediments. The objective of the study was to determine whether contaminants were transported through dike walls and whether biota in the surrounding environment exhibited increased exposure to the contaminants from the transport of contaminants through the dike wall. Biomonitoring/bioassessment and modeling approaches were used. Water, biota, and sediments were collected from inside and outside of the diked facility during active dredging and pumping operations. Results from both years indicated that only a negligible amount of PCBs was transported through the dike wall. The study determined that the dike wall performed well in confining PCBs (http://www.epa.gov/med/grosseile_site/cdf.html).

- At the Waukegan Harbor Site, approximately 30,000 cy of PCB-containing sediments were disposed of in a CDF constructed in a boat slip within the harbor (http://www.epa.gov/glnpo/aoc/waukegan.html).

In-water CDFs have been selected at other sites as well. For example, for the Kinnickinnic River Environmental Restoration Project in Milwaukee, Wisconsin, the selected remedy calls for dredging up to 170,000 cy of PCB-containing sediments and placing them in a CDF constructed by USACE (http://dnr.wi.gov/org/water/wm/sms/kkriver/index.html). At the Port of Portland, Oregon, the selected remedy calls for placement of sediments containing PAHs, PCBs, pesticides, metals, and other contaminants in a CDF that is being designed at the mouth of an existing slip in the Willamette River (http://yosemite.epa.gov/R10/CLEANUP.NSF/sites/T4)

Overall Effectiveness and Reliability

TD 2 would provide long-term effectiveness by permanently isolating the hydraulically dredged PCB-containing sediments in a covered CDF, so that human and ecological receptors are not exposed to those materials. As noted above, in-water CDFs have been used to dispose of dredged sediments at a number of environmental remediation sites, and this technology has been shown to be both effective and reliable.

A breach in the berms, the sheetpiles, or the final vegetated soil cover of the CDFs could occur due to damage caused by floods or ice. However, regular monitoring and inspections, as described previously in Section 9.2.1, would limit the potential release from any of these locations and repairs would be conducted as provided below. Thus, OMM activities would promote the long-term stability of the facility.

Reliability of Operation, Monitoring, and Maintenance Requirements/Availability of Labor and Materials

A combination of OMM techniques would be implemented during and after active use of the CDF(s). As described in Section 9.2.1, it is anticipated that the long-term OMM program would include groundwater monitoring, inspections, maintenance of the facility components, and appropriate deed restrictions on the land. Labor and materials needed to perform the OMM activities are expected to be readily available. Similar OMM programs have been implemented to monitor and maintain CDFs at other sites identified above. It is expected that this program would provide a reliable means of determining that the CDF(s) continue to contain and isolate the PCB-containing sediments over the long term.

Technical Component Replacement Requirements

The technologies that comprise TD 2 are expected to be effective at isolating the dredged sediments from the surrounding environment. OMM activities would be implemented to monitor the effectiveness of the CDF and provide for early detection should a breach occur. If damage were observed, repairs could be made using readily available labor and materials.

9.2.5.3 Potential Long-Term Adverse Impacts on Human Health or the Environment

The evaluation of potential long-term adverse impacts of TD 2 on human health or the environment has included an assessment of several components, as described below.

Potentially Affected Populations

Under TD 2, the PCB-containing sediments placed in the CDF(s) would be isolated from human and ecological receptors. The potential for exposure of such receptors to those sediments would be further limited by the institutional controls and monitoring and maintenance program described above.

Implementation of TD 2 would alter the habitat type in the area(s) of the CDF(s), and thus affect the types of biota which reside and use the areas. The most dramatic impacts would occur from the conversion of areas which currently support aquatic life to an upland environment. Further discussions of the long-term impacts associated with TD 2 are provided below.

Long-Term Ecological Impacts

A primary long-term ecological impact from TD 2 would be the removal of open water and deep marsh habitat in Woods Pond and the backwater areas, as well as certain surrounding upland and wetland forested habitats, from productive use by the wildlife species that currently use them. Specific impacts would depend on the CDF location selected, as discussed below.

Woods Pond: The placement of an in-water CDF in Woods Pond would have a permanent impact on the aquatic habitat afforded by that area, with the extent of the impact dependent on the size of the CDF. The loss of a portion of the Pond would have a direct impact on the benthic invertebrate community by effectively eliminating a substantial area of benthic habitat. Placement of the CDF in Woods Pond would eliminate the deepest portion of the Pond, and thus eliminate the only area of deeper water for fish and other aquatic organisms. Deeper areas can offer thermal refugia for fish, but in lakes or impoundments with abundant macrophyte growth, these deeper areas often contain low dissolved oxygen levels in summer, resulting in a reduced role as thermal refugia. Loss of deep water in Woods Pond would therefore represent a loss of habitat; but with expected low oxygen in deep water, current summer habitat quality is limited.

Creation of a CDF in Woods Pond would also impact the shoreline of the Pond and adjacent wetlands, including red maple swamp habitats. The addition of sediment in the CDF would elevate the topography in the area (approximately 5 feet above existing surface elevation) and convert these wetland habitats to uplands. Impacts to surrounding wetlands would also occur due to the construction of access roads and/or support areas for the CDF. These impacts would reduce available bank and shoreline which are used by shorebirds (e.g., spotted sandpiper and great blue heron), as well as reptiles such as painted turtles and northern water snakes. The loss of wetland habitat would impact a variety of wildlife species, particularly birds which use the forested and shrubby edges as perch and nesting locations.

In addition, the construction of access roads and/or support areas would impact the surrounding forested habitats through the removal of trees and other vegetation. Once cleared, it is anticipated that these habitats would not approach current conditions for at least 50-100 years after restoration is complete. The removal of native vegetation in these areas would provide new substrate conducive for invasive species that favor disturbed areas. The CDF also has the potential to alter the hydrology of the community types surrounding the Pond through increased seasonal flooding and changes in runoff conditions.

The forested habitat surrounding both the smaller (17-acre) and the larger (34-acre) CDF configurations in Woods Pond is mapped as Priority Habitat for two state-listed species, the bur oak and the mustard white butterfly. That habitat would be affected by the construction of access roads and/or support areas and from altered hydrology in the area. These impacts could result in a take of these species, although that is uncertain since these species do not use open water habitats (see MESA assessments in Appendix L). The habitat surrounding the larger (34-acre) configuration also contains Priority Habitat for two additional state-listed species, the common moorhen and the wapato. Due to the impacts on that habitat, the CDF activities would result in a take of the common moorhen and the wapato (see MESA assessments in Appendix L).

Backwaters: Placement of a CDF in one of the backwater areas identified above would likewise have adverse long-term ecological impacts. These backwater areas have water levels deep enough to provide open water habitat for most of the year, and shallow enough to support rooted aquatic plant growth over a substantial portion of their bottom. The lack of current in the backwater areas, except during flood events, affects backwater habitat features and provides a unique aquatic habitat, which many species favor. Reduced flow velocities and increased substrate deposition typically results in more abundant aquatic plants in backwater areas compared to the river. Mud flats in these areas are more extensive during dry periods. A CDF within one of these backwaters would effectively eliminate the availability of the backwater habitat for use by wildlife. Various reptile species, including snapping turtle, eastern painted turtle and northern water snake, prefer these backwater habitats, and these areas serve as breeding habitat for amphibians such as green frog and bullfrog. Reptiles and amphibians also use these habitats to regulate body temperatures and rehydrate during the summer. Persistently inundated wetlands like these are important for a variety of bird species, including wood duck, great blue heron, green heron, marsh wren, and red-winged blackbirds. The wading birds prefer this type of open water with minimal current, as do common backwater plants such as pickerelweed and arrowhead, which are important food sources for a variety of birds and mammals. The open connection to the river provides for movement of fish between habitats, facilitating higher fish diversity through more varied habitat conditions.

In addition to direct impacts to backwater habitat, the surrounding floodplain would be impacted by the construction of access roads and/or support areas and through hydrologic changes associated with changes in elevation (approximately 5 feet above existing surface elevations) within the backwater. The habitat surrounding BWL_07 is diverse and contains forested, shrub swamp and emergent wetlands. The forested habitat surrounding BWL-09 consists primarily of black ash-red maple-tamarack calcareous seepage swamp and transitional floodplain forests. These forested habitat types have a State Rank of S2, indicating that there are few remaining acres of this habitat in Massachusetts or that the habitat is very vulnerable to extirpation in Massachusetts.

The backwaters and surrounding areas are also mapped as Priority Habitat for a variety of state-listed species. Specifically, both candidate backwater areas include mapped Priority Habitat for common moorhen, arrow clubtail, zebra clubtail, mustard white butterfly, and wapato; and BWL_07 (as well as a very small portion of BWL_09) also contains Priority Habitat for the bald eagle. In addition, the habitats surrounding these backwaters are mapped as Priority Habitat for the state-listed bur oak and Gray's sedge and, for BWL_07, American bittern. The construction of a CDF would have long-term impacts on most of these Priority Habitats, either directly or through the construction of access roads and/or support areas, as well as altered wetland hydrology. In fact, the creation of a CDF in either backwater would eliminate the habitat for the common moorhen and wapato entirely in this area. As shown in the MESA assessments in Appendix L, the CDF-related activities would result in a take of common moorhen, arrow and zebra clubtails, wapato, and, in BWL_07, bald eagle and American bittern; and they could also result in a take of mustard white, bur oak, and Gray's sedge.

Long-Term Impacts on Aesthetics and Recreational Use

Construction of an in-water CDF(s) would cause long-term impacts to the aesthetics of the area. The aesthetic view of a previously undisturbed area would be permanently lost and the area in the vicinity of the CDF(s) could lose appeal to recreational users such as canoeists and hikers. From the River, one would see the sheetpile walls installed along the River-side of the CDFs. Rather than open water and/or large tracts of wetland vegetation, one would see an elevated mound of soil which would be covered with vegetation.

TD 2 would also impact areas used for canoeing and fishing. The impacted areas would no longer be useable for these recreational activities since they would be converted from aquatic to upland environments.

Long-Term Impacts on River Hydrology and Flood Storage Capacity

Construction of CDF(s) in Woods Pond and/or the backwaters would reduce the existing flood storage capacity, with losses during a 100-year storm event of 164,600 cy if SED 6 were selected to 580,800 cy for SED 8. Assuming that it would not be feasible to provide compensatory flood storage capacity elsewhere in Reaches 5C and 6 (as discussed above), an increase in the surface water elevation (of unknown magnitude) would be anticipated during high flow events. While the "deep hole" in Woods Pond and/or the backwaters where the CDF(s) would be constructed are not part of the main flow channel of the River, localized impacts to the hydraulics of the River would be expected during certain high flow events.

Potential Measures to Mitigate Long-Term Adverse Impacts

Under TD 2, the cover of the CDF would be seeded/planted with native upland herbaceous vegetation. A maintained upland meadow habitat is anticipated to be sustained in these areas. Support areas outside of the CDF that are disturbed by construction or operation activities, such as materials staging areas and access roads which are no longer needed, would be subject to restoration measures. Temporary fill material would be removed, and the areas would be tilled or scarified to improve the surface soils. In an effort to prevent erosion and encroachment from invasive species, the support areas would be reseeded with a wetland seed mix or a rapidly establishing native upland grass seed depending on the community type which was impacted. Native trees and shrubs would be planted with species type and plant spacing based upon the desired restored community type.

As previously mentioned in Section 9.2.1, the implementation of OMM activities and institutional controls would help minimize the potential for a release from and exposure to PCBs present in the CDFs.

9.2.6 Reduction of Toxicity, Mobility, or Volume

The degree to which TD 2 would reduce the toxicity, mobility, or volume of PCBs is discussed below.

Reduction of Toxicity: TD 2 would not include any treatment processes that would reduce the toxicity of the PCBs in the removed sediment. However, if material is encountered during dredging that would constitute "principal threat" waste (e.g., free NAPL, drums of liquid waste), which is not anticipated, that material would be segregated and transported off-site for treatment and disposal, as appropriate.

Reduction of Mobility: TD 2 would result in reduced mobility of PCBs by permanently containing the PCBs in the removed sediments within the CDF(s).

Reduction of Volume: TD 2 would not reduce the volume of PCB-containing material.

9.2.7 Short-Term Effectiveness

Evaluation of the short-term effectiveness of TD 2 has included consideration of the short-term impacts of implementing this alternative on the environment (in terms of both ecological effects and increases in GHG emissions), on local communities (as well as communities along truck transport routes), and on the workers involved in the disposition activities. As noted previously, implementation of TD 2 would include site preparation, CDF construction, placement and consolidation of the hydraulically dredged sediments, and construction of a vegetated soil cover once consolidation is complete. For TD 2, short-term impacts are those that would occur during the performance of these activities.

Impacts on the Environment – Ecological Effects

The short-term effects on the environment resulting from implementation of TD 2 would include the destruction of the habitat and destruction or displacement of the aquatic biota residing in the portions of Woods Pond and either of the two backwaters where the CDF(s) would be constructed. In addition, short-term effects would include impacts to the adjacent floodplain and upland areas disturbed during construction of the supporting access roads and staging areas. Birds, mammals, reptiles, and amphibians would be affected by the habitat disruption associated with implementation of this alternative.

Carbon Footprint – GHG Emissions

As described in Section 5.6 and Appendix M, an estimate has been developed of the carbon footprint composed of GHG emissions anticipated to occur through construction and consolidation of hydraulically dredged sediments into a CDF(s) during the implementation of TD 2. That estimate was based on the range of volumes of hydraulically dredged sediments that could be placed in CDF(s), with the lower bound based on SED 6 (300,000 cy) and the upper bound based on SED 8 (1.24 million cy).

Based on this range of removal volumes, the total carbon footprint associated with TD 2 has been estimated to range from 2,700 tonnes to 8,800 tonnes of GHG emissions. Of this total, the GHG emissions associated with direct emission sources (primarily construction activities and transportation activities) range from approximately 1,700 tonnes to 6,700 tonnes, while the GHG emissions calculated for off-site emissions (primarily refinement of diesel fuel and steel sheeting manufacturing) range from approximately 1,000 tonnes to 2,100 tonnes. The range of total GHG emissions estimated for this alternative is equivalent to the annual output of 500 to 1,700 passenger vehicles.

Impacts on Local Communities and Communities Along Truck Transport Routes

Implementation of TD 2 would also result in short-term impacts to the local communities along Reaches 5C and 6. These short-term effects would include increased noise levels from operation of dredges and booster pumps during construction and filling activities. Truck traffic to deliver sheetpile and berm materials would increase substantially during the initial stages of the project, and also to deliver cover materials for closure.

The increased truck traffic would affect not only local communities but also areas along the routes used to transport materials to the site for implementation of TD 2 (i.e., for construction and closure of the CDF[s]). Assuming that 16-ton trucks would be used to transport such materials to the site, the number of truck trips for the implementation of TD 2 would range from approximately 5,550 truck trips (average of approximately 930 truck trips annually) for SED 6 to approximately 19,540 truck trips (average of approximately 980 truck trips annually) for SED 8. The trucks would travel a total of 277,000 miles for SED 6 and 977,000 miles for SED 8, including return trips. (Note that these truck trip estimates do not account for the off-site transport of removed sediments and floodplain soils that would not be placed in the CDF[s].) This additional traffic would increase noise levels, vehicle emissions, and the potential for traffic accidents.

Appendix N includes an analysis of potential accident risks from such increased truck traffic. These risk estimates were based on a range of potential sizes of the CDF(s), which would depend on the volumes of material to be disposed of in the CDF(s). Based on the lower and upper bounds of this range, this analysis indicates that this increased truck traffic would result in an estimated 0.13 to 0.46 non-fatal injuries due to accidents (average of 0.02 non-fatal injury per year for both the lower and upper bounds), with a probability of 12% to 37% of at least one such injury, and an estimated 0.01 to 0.02 fatalities from accidents (average of 0.001 fatality per year for both the lower and upper bounds), with a probability of 1% to 2% of at least one such fatality.

Potential Measures to Avoid, Minimize, or Mitigate Short-Term Environmental and Community Impacts

Several actions would be taken in an attempt to avoid, minimize, or mitigate the negative short-term environmental impacts from construction and operation of the CDF(s). The facility would be constructed in as small an area as necessary, so as to minimize the amount of habitat disturbed. Engineering controls and BMPs would be implemented, to the extent practical and as needed, to reduce detrimental effects from construction and operation of the CDF on the environment and local communities. Some potential BMPs that may be implemented during construction and operation of the CDF(s) include, but are not limited to, use of the following:

- Stormwater management engineering controls and BMPs, including:
  - Hay or straw bales; and
  - Silt fences and curtains;

- Utilization of good housekeeping practices at the CDF(s);

- Proper equipment and vehicle maintenance;

- Avoidance of CDF construction and operation at night except where necessary and minimization of such activities on weekends and holidays; and

- Performance of routine air monitoring during CDF construction and operation in accordance with a project-specific air monitoring plan.

Despite the implementation of these measures, however, some short-term impacts from TD 2 would be inevitable.

Risks to Remediation Workers

Implementation of TD 2 would also result in health and safety risks to site workers. Construction, operation, and closure of the CDF(s) are estimated to involve 73,100 to 259,500 man-hours over the assumed 6 to 20 years of operation (based on SED 6 to SED 8). Appendix N includes an analysis of potential accident-related risks to workers from implementation of TD 2, with estimates based on the above range of years of operation.[493] Based on the lower and upper bounds of this range, this analysis indicates that implementation of TD 2 would result in an estimated 0.70 to 2.50 non-fatal injuries to workers (average of 0.12 to 0.13 average annual non-fatal injuries), with a probability of 50% to 92% of at least one such injury, and an estimated 0.01 to 0.03 worker fatalities (average of 0.0012 to 0.0013 average annual fatalities), with a probability of 1% to 3% of at least one such fatality.

9.2.8 Implementability

9.2.8.1 Technical Implementability

The technical implementability of TD 2 has been evaluated in terms of the following factors:

General Availability of Technology: The labor, materials, and equipment needed to implement TD 2 are considered readily available. As noted previously, construction would include driving sheetpile along the water side of the CDF and constructing the permeable soil berm around the land-side perimeter. In Woods Pond and the backwaters, the sheetpile would be installed using water-based construction techniques from a barge, and the soil berm would be constructed from the shore using conventional land-based equipment. Once the support facilities are in place, the hydraulically dredged sediment would be pumped as a slurry via piping extending from the dredge to the CDF, and once filled, the CDF would be covered with soil and vegetated.

Ability To Be Implemented: CDFs are routinely constructed and operated by USACE as a means to contain dredged materials in the Great Lakes and other areas. CDFs have also been constructed and operated at some environmental remediation sites, as described in Section 9.2.5.2. However, as also noted previously, given the size of the assumed CDFs, it is expected that existing flood storage capacity would be lost through implementation of TD 2. In this situation, as discussed in Section 9.2.4, substantive regulatory requirements

[493] As noted in Appendix N, these estimates slightly underestimate the worker site accident risks since the labor hours on which they are based do not include service support hours.

might affect the ability to construct a CDF(s) sufficiently large to hold the sediment volumes that would be subject to hydraulic dredging in Reaches 5C and 6 under alternatives SED 6 through SED 9.

Reliability: Experience at other sites indicates that, if properly designed, the CDF could be a reliable means of containing sediments dredged from Reaches 5C and 6. A discussion of CDF use at other sites was provided in Section 9.2.5.2. Technical manuals from EPA and the USACE are available which provide technical and design considerations that would help promote the reliability of a CDF in containing the dredged sediments (EPA, 2005d; USACE, 1983, 1987, 2003a & b).

Availability of Space for Facilities: The preliminary engineering analysis described in Section 9.2.1 has shown that the deep hole in Woods Pond and/or one of the two designated backwaters could be used for the construction of in-water CDFs to permanently contain hydraulically dredged sediment from Reaches 5C and 6 of the River for SED 6, SED 7, SED 8, or SED 9.

Availability of Equipment, Materials, and Personnel: As noted above, equipment, materials, and personnel necessary to construct access roads and staging areas, and to construct, operate, and monitor CDFs are considered readily available.

Ease of Conducting Additional Corrective Measures: As noted previously, if damage to the berm or the final vegetated soil cover of the CDF(s) were observed during monitoring, repairs could be made using readily available labor and materials. Ease of implementation would be directly related to the location of the damage and the extent of the necessary corrective measures.

Ability to Monitor Effectiveness: The effectiveness of TD 2 would be determined over time through implementation of readily available monitoring techniques, including periodic inspections of the facility components and periodic groundwater sampling. Additionally, during construction, filling, and consolidation activities, air and surface water monitoring and visual inspections of CDF components would be performed. The operations and post-closure monitoring programs assumed for purposes of the CMS are summarized in Section 9.2.1 and were developed based on programs proposed for CDFs by EPA and USACE (1983, 1987, 2003a & b).

9.2.8.2 Administrative Implementability

The evaluation of the administrative implementability of TD 2 has included consideration of regulatory requirements, need for access agreements, and coordination with government agencies.

Regulatory Requirements: Implementation of TD 2 would be an "on-site" activity for purposes of the permit exemption set forth in Section 121(e) of CERCLA and Paragraph 9.a of the CD. As such, no federal, state, or local permits or approvals would be required. However, this alternative would be required to meet the substantive requirements of applicable regulations that are designated as ARARs (unless waived). An evaluation of compliance with potential ARARs for construction and operation of the CDF(s) is included in Tables T-2a through T-2c in Appendix C and was summarized in Section 9.2.4.

Access Agreements: Implementation of TD 2 would require GE to obtain permanent access to the locations selected for the CDFs and any permanent associated support facilities. In addition, access agreements would be needed for the temporary use of other areas to support construction and operation of the facility until those activities are completed. Where access is needed to state land, it should be possible to obtain, since the Commonwealth agreed in the CD to provide access for the response actions required by the CD. However, access agreements may also be needed with other property owners. If GE should be unable to obtain access agreements with particular property owners, GE would request EPA's assistance.

Coordination with Agencies: Both prior to and during implementation of TD 2, GE would need to coordinate with EPA, as well as state and local agencies to provide as-needed support with public/community outreach programs.

9.2.9 Cost

The range of estimated total costs to implement TD 2 is $100 M to $510 M (not including the cost of the sediment and floodplain soil removal activities). Since the CDF(s) would be used only for hydraulically dredged sediments from Reaches 5C and 6 under SED 6 through SED 9, the cost estimates have also included costs for disposition of the remaining sediments under those alternatives, as well as costs for disposition of floodplain soil. For purposes of the Revised CMS Report, it has been assumed that those remaining materials would be transported to off-site facilities for disposal. Specifically, the low end of the cost range for TD 2 represents the estimated costs for: (a) the construction, operation, closure, and post-closure of CDFs containing hydraulically dredged sediments from Reaches 5C and 6 for SED 6; and (b) off-site disposal of the remaining sediments (not hydraulically dredged) for SED 6, as well as floodplain soils for FP 2 (a total of approximately 280,000 *in situ* cy). The upper end of the range represents the estimates costs for: (a) construction, operation, closure, and post-closure of CDFs containing hydraulically dredged sediments from Reaches 5C and 6 for SED 8; and (b) off-site disposal of the remaining sediments (not hydraulically dredged) for SED 8, as well as floodplain soils for FP 7 (a total of approximately 1.7 million *in situ* cy).

The capital costs associated with this range of estimated volumes (which include construction and closure of the CDF[s]) are $6.5 M to $20 M as determined by the size and number of the CDF(s). Annual operations costs estimated for the placement of sediments in the CDF(s) are approximately $1.2M, resulting in a total operations cost of approximately $6.8 M to $25 M. Annual post-closure monitoring and maintenance costs related to the CDF range from approximately $200,000 to $400,000 per year, resulting in total post-closure monitoring and maintenance costs of approximately $12 M to $20 M. The total off-site transport and disposal costs for materials that would not be placed in the CDF range from approximately $75 M to $445 M. The following summarizes the total costs estimated for TD 2.[494]

TD 2	Minimum Est. Cost	Maximum Est. Cost	Description
Total Capital Cost	$6.5 M	$20 M	Total cost for engineering, labor, equipment, materials associated with construction, and closure
Total Operations Cost	$6.8 M	$25 M	Total operations cost for placement of sediments
Total Post-Closure Monitoring and Maintenance Cost	$12 M	$20 M	Total cost for performance of the 100-year post-closure Monitoring and Maintenance Program
Total Off-Site Transport and Disposal Cost	$75 M	$445 M	Total costs associated with the off-site disposal of sediments and/or floodplain soils not placed in the CDF
Total Cost for Alternative	$100 M	$510 M	Total cost of TD 2 in 2010 dollars

The range of total estimated present worth costs for TD 2, which was developed using a discount factor of 7%, an assumed overall duration of 21 to 52 years (based on the total estimated durations of SED 6 to SED 8),[495] and a post-closure OMM period of 100 years, is

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[494] It should be noted that since the lower end of the cost range for TD 2 is based on the CDF costs plus off-site disposal costs for SED 6 (along with FP 2), it is not comparable to the lower ends of the cost ranges for the other treatment/disposition alternatives, which are based on costs for materials that would be removed under SED 3 (a lesser volume) (plus FP 2). The upper end of the cost range for TD 2, however, is comparable to the upper ends of the cost ranges for the other treatment/disposition alternatives.

[495] Note that, although the CDF would be open only while sediments are being hydraulically dredged, the present worth of this alternative has been assessed over the range of total durations **of** the underlying sediment alternatives (including both hydraulic and non-hydraulic excavation), as the cost estimates include costs for disposition of the mechanically excavated sediments and floodplain soil as well as hydraulically dredged sediments. Note also that the lower bound of this range is based on the estimated overall duration of the lowest cost/lowest volume sediment alternative that could involve use

approximately $46 M to $131 M. More detailed cost estimate information and assumptions for each of the treatment/disposition alternatives are included in Appendix Q.

9.2.10 Overall Protection of Human Health and the Environment – Conclusions

As explained in Section 9.2.2, the evaluation of whether TD 2 would provide overall protection of human health and the environment draws upon the evaluations under several other Permit criteria, discussed in prior sections.

General Effectiveness: As discussed in Section 9.2.5, TD 2 would provide long-term effectiveness by permanently isolating the hydraulically dredged PCB-containing sediments in a covered CDF(s), so that human and ecological receptors are not exposed to those materials. OMM activities would promote the long-term stability of the facility.

Compliance with ARARs: As discussed above in Section 9.2.4, review of the potential ARARs for TD 2 indicates that TD 2 could be designed and implemented to meet certain of those ARARs, but that a number of federal and state regulatory requirements would require a specific EPA approval or finding or would not be met. To the extent that the latter requirements constitute ARARs and apply to the CDF(s), those that would not be met by TD 2 would need to be waived by EPA as technically impracticable (or on some other ground) under CERCLA and the NCP.

Human Health Protection: The use of CDF(s) would provide human health protection by permanently isolating the PCB-containing sediments placed in the CDF(s) from human receptors. In addition, implementation of this alternative would not be expected to have any significant long-term or short-term adverse impacts on human health given the engineering/institutional controls and monitoring/maintenance program that would be implemented as part of TD 2.

Environmental Protection: The CDF(s) would provide protection for ecological receptors by permanently isolating the PCB-containing sediments placed in the CDF(s) from those receptors. At the same time, the placement of an in-water CDF in Woods Pond and/or one of the two backwaters would have a permanent impact on the environment by removing the aquatic habitat in the area of the CDF(s) and impacting the surrounding wetland and upland communities, including the Priority Habitats of a number of state-listed species. Construction of the CDF(s) would also produce long-term impacts on the natural appearance of the area, with the degree of impact dependent on the size and number of the

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of a CDF (SED 6), rather than the shortest-duration alternative that could involve use of a CDF (SED 9 at 14 years).

CDF(s). In addition, construction of a CDF in Woods Pond and/or the backwaters would permanently reduce the existing flood storage capacity in those areas. Assuming that sufficient flood storage compensation could not be obtained, an increase in the surface water elevation would be expected in these areas during high flow events.

Summary: Based on the above considerations, TD 2 would provide overall protection of human health by permanently isolating PCB-containing sediment from human receptors. However, because construction of the CDF(s) would have significant adverse environmental impacts in Woods Pond and/or the backwaters by permanently altering the aquatic habitat and the flood storage capacity of the area(s) where the CDF(s) would be located, TD 2 would not meet the standard of providing overall protection of the environment.

9.3 Evaluation of Local Disposal in On-Site Upland Disposal Facility (TD 3)

9.3.1 Description of Alternative

Implementation of TD 3 would involve the permanent disposition of removed sediment/soil at an Upland Disposal Facility constructed in close proximity to the River, but outside the 500-year floodplain. The removed sediment and soil would be loaded into trucks at the staging areas, covered, and transported over on-site and local roadways to a nearby Upland Disposal Facility.

Three potential locations for an Upland Disposal Facility have been identified to date. These sites are located near Woods Pond, Forest Street in Lee, and Rising Pond (referred to, respectively, as the Woods Pond, Forest Street, and Rising Pond Sites) and are shown on Figures 9-3, 9-6, and 9-9, respectively. The Upland Disposal Facility would be designed and constructed at one or more of these locations for the disposition both of materials that contain PCB concentrations under 50 mg/kg and those that contain PCB concentrations at or above 50 mg/kg and thus would be subject to substantive TSCA requirements.

As discussed above, the range of potential volumes of sediments and floodplain soils that could be removed from the River and floodplain under the array of sediment and floodplain soil alternatives discussed in Sections 6 and 7 extends from 191,000 *in situ* cy, based on a combination of SED 3 and FP 2, to 2.9 million *in situ* cy, based on a combination of SED 8 and FP 7. However, due to variations in the size, configuration, and topography of the three potential locations, the maximum estimated disposal capacity is different for each location. For each of the three potential locations, Table 9-1 shows the overall approximate property size, estimated minimum and maximum disposal capacities, and the following acreage information for the minimum and maximum volume estimates: land area that would be required for an Upland Disposal Facility, including set-back and buffer areas that would not be disturbed; the size of the facility's operational footprint (i.e., the area that would be disturbed for waste disposal plus access roads, material staging areas, and other ancillary facilities, but excluding set-back and buffer areas); and the size of the actual landfill area that would be used for permanent waste disposal.

Table 9-1 – Summary of Estimated Disposal Capacities and Approximate Land Requirements for Potential Upland Disposal Facility Locations

Location (Configuration)	Property Size	Disposal Capacity	Land Area Required	Operational Footprint Size	Landfill Size
Woods Pond (Minimum)	75 acres	191,000 cy	53 acres	25 acres	6 acres
Woods Pond (Maximum)	75 acres	2.0 million cy	75 acres	61 acres	18 acres
Forest Street (Minimum)	195 acres	191,000 cy	115 acres	42 acres	10 acres
Forest Street (Maximum)	195 acres	1.0 million cy	193 acres	95 acres	34 acres
Rising Pond (Minimum)	106 acres	191,000 cy	62 acres	27 acres	4 acres
Rising Pond (Maximum)	106 acres	2.9 million cy	101 acres	84 acres	44 acres

As shown in the above table, for combinations of sediment and floodplain alternatives involving disposal of volumes up to approximately 1.0 million cy, all three disposal site options would be sufficient. For combinations of sediment and floodplain alternatives involving the disposal of a greater volume, a disposal location that has sufficient capacity to handle that volume or a combination of two disposal locations could be utilized. However, to simplify the evaluations in this section of the Revised CMS Report, these evaluations have considered the minimum and maximum disposal capacity, as well as the minimum and maximum operational footprint (i.e., the area that would be disturbed), at each of these locations. Since the maximum estimated disposal capacity is different for each location, the evaluations of the maximum disposal scenario in this section are site-specific and not comparable among locations.

The general remedial approach (and associated assumptions) for implementation of TD 3 are discussed below. While a description of the configuration, construction, operation, and closure of the Upland Disposal Facility is provided in this Revised CMS Report for evaluation purposes, the specific methods and components of this alternative (if selected) would be determined during the design process based on more detailed engineering considerations and site investigations.

Site Selection and Procurement: The first step in implementing TD 3 would be to select a site (or sites) on which to construct the Upland Disposal Facility. As noted above, three locations have been identified to date as potential locations for an Upland Disposal Facility Each of these locations is relatively close to the River (to facilitate transfer of sediments to it), but is situated outside the 500-year floodplain and has either limited or no sensitive habitats or could be configured to avoid or minimize the impacts on such habitats. GE owns or has a right to acquire the necessary portions of each of these sites.

The natural communities within the three potential disposal sites were classified using a combination of aerial photographic interpretation and review of Massachusetts GIS mapping. The natural communities, current land use, and estimated acreages for each disposal site are described below.

Woods Pond Site: The Woods Pond Site is a 75-acre parcel located immediately south of Woods Pond, as shown on Figure 9-3. The current land use includes a portion of an active sand and gravel quarry and construction area, an inactive portion of the sand and gravel quarry (now a disturbed field), and a wooded area. The property is bounded to the north by Valley Street and Woods Pond, to the south by the Town of Lee's sanitary landfill and commercial property, to the west by an active sand and gravel quarry, and to the east by Woodland Road, low density residential properties, open pasture, and undeveloped forest. Depending on the quantity of material to be disposed of, approximately 25 to 61 acres would be used for the development and operation of the Upland Disposal Facility (see operational footprint in Table 9-1). If this site is selected, the specific location and configuration of the disposal facility within this property would be determined during design. For the purposes of this Revised CMS Report, the conceptual layouts and configurations of the Upland Disposal Facility at this site are shown on Figures 9-4 and 9-5.

Currently, approximately 40 acres (53%) of the overall property at this site consist of an area that is currently or was previously used as a sand and gravel mining facility. This previously altered area contains all or portions of four small man-made ponds (which would not appear to constitute regulated waterbodies or wetlands) totaling approximately 1.1 acre in size. An overhead electrical transmission line easement runs generally north-south through the property; the land in this easement area also consists of previously altered land and accounts for an additional approximately 8 acres on the property. The remaining portions of the property are undeveloped and consist of approximately 27 acres of upland forest and 0.4 acre of shrub swamp habitat. The shrub swamp is located in the northeastern portion of the site and would be located within the maximum operational footprint but outside of the minimum operational footprint of an Upland Disposal Facility at this site.

Forest Street Site: The Forest Street Site is approximately 195 acres in size[496] and is located in Lee, MA, approximately 1 mile south of Interstate 90 and 1 mile east of the Housatonic River, as shown on Figure 9-6. This site is generally bounded to the north and east by Goose Pond Brook, Forest Street, low-density residential housing, and undeveloped forest; to the south by undeveloped forest; and to the west by undeveloped forest and a utility corridor. Immediately to the east and adjacent to the property is a former industrial facility that includes an abandoned mill building and two closed landfills. Depending on the quantity of material to be disposed of, approximately 42 to 95 acres would be used for the development and operation of the Upland Disposal Facility (see operational footprint in Table 9-1). If this site is selected, the specific location and configuration of the disposal facility within this property would be determined during design. For the purposes of this Revised CMS Report, the conceptual layouts and configurations of the Upland Disposal Facility at this site are shown in Figures 9-7 and 9-8.

This property is largely forested, with upland forest comprising 192 acres (98%) of the overall property and the remainder consisting of approximately 1.8 acres of cleared open land and 1.5 acres of wooded coniferous swamp in the southern portion of the site. The site has areas of steep topography with slopes ranging from 15% to 45%. The identified minimum and maximum operational footprints for an Upland Disposal Facility at this site would not affect any wetlands habitat (see Figures 9-7 and 9-8). However, the maximum operational footprint would require construction of a new road crossing of Goose Pond Brook along the east side of the site to provide access from Forest Street (see Figure 9-8).

Rising Pond Site: The Rising Pond Site is located adjacent to, and west of, Rising Pond, as shown on Figure 9-9. The site is bounded to the north and east by the Housatonic River/Rising Pond; to the south by an open field/construction stockpile area, undeveloped forest and commercial property; and to the west by Van Duesenville Road, residential property, cropland, and commercial property. The site consists of three separate lots owned by GE, totaling approximately 106 acres in size. Depending on the quantity of material to be disposed of, approximately 27 to 84 acres would be used for development and operation of the Upland Disposal Facility (see operational

[496] This acreage includes an approximately 3-acre easement outside the property boundary that would be granted by the current property owner.

footprint in Table 9-1). If this site is selected, the specific location and configuration of the disposal facility within this property would be determined during design. For the purposes of this Revised CMS Report, the conceptual layouts and configurations of the Upland Disposal Facility at this site are shown on Figures 9-10 and 9-11.

The property is largely forested, with an access road across the southern portion of the site, a small area of cleared land on the southeast portion of the site, and a small area of cropland at the extreme southern end of the site. Topography on the site is relatively flat with slopes ranging from 0 to 8%. Approximately 102 acres (96%) of the overall property are covered by upland forest consisting of mixed hardwood and coniferous forest communities. An area of open land approximately 3.3 acres in size is located along the southern portion of the property. A small area (approximately 0.5 acre) of forested wetland is present on the southwestern edge of the site, and would be impacted by the maximum (but not the minimum) operational footprint of the Upland Disposal Facility (see Figures 9-10 and 9-11).

Site Preparation: Site preparation activities would include clearing and grubbing vegetation, followed by the earth work necessary to prepare the site for landfill construction. Construction of the landfill at the Woods Pond Site under the minimum volume scenario would be largely confined to the current/former sand and gravel quarry portion of the site. Under the maximum volume scenario, construction of the landfill would impact active and inactive portions of the sand and gravel quarry area, a portion of upland forested habitat, a linear utility easement, and a portion of the small (0.4 acre) shrub swamp wetland. The Forest Street and the Rising Pond Sites consist primarily of upland forest, which would be cleared in varying amounts for the landfill construction at these sites under both the minimum and maximum volume scenarios; no wetlands would be affected by the landfill construction at either of these sites. Site preparation would also include building the necessary infrastructure, including access roads and support facilities.

Landfill Construction: A base liner and sidewall system would be constructed to hold the removed materials at the Upland Disposal Facility. During construction of the landfill, a base liner would be installed over a re-graded surface. For purposes of this Revised CMS Report, it was assumed that the base liner system would include 6 inches of fill on top of a double liner system (which would include two composite liners), a double leachate collection system (which would include piping and a granular drainage layer above each liner), and two layers of geocomposite material (Figure 9-12).[497] The landfill would be

[497] A single granular drainage layer with collection piping would be placed on top of a single layer of geocomposite, which would be placed on top of a single composite liner. These layers would then be repeated to make up the final base liner system.

constructed with sloped surfaces that would allow for precipitation to drain to appropriate collection points, and would include other appropriate stormwater management features, including surface water diversion berms, stormwater detention basins, and drainage swales.

As discussed further below, it is assumed that construction of the landfill would be performed sequentially in a series of cells, such that individual smaller units or cells would be constructed, operated, and closed within the confines of the entire facility.

Upland Disposal Facility Operations: Once the necessary infrastructure, access roads, and support facilities are in place, trucks would transport the dewatered sediment/soil to the landfill, which would be segregated into 3-acre cells to efficiently manage the materials. The dewatered sediment/soil would be placed in approximate 2-foot-thick lifts within the cells and compacted prior to placing the next lift. A temporary "daily" cover would be placed over the active portions of the facility at the end of each work day to minimize: (1) the amount of precipitation entering the consolidated materials to limit generation of leachate; and (2) airborne dust. Once the consolidation material within a cell reaches the maximum design height, an interim cover would be installed over that material. The final cover would be installed in phases, as described in the Final Cover Installation section below.

It is anticipated that the construction and operation of the landfill would be performed in a series of cells, such that individual smaller units or cells would be constructed, operated, and closed within the confines of the entire facility. For purposes of evaluation in this Revised CMS Report, it has been assumed that approximately 3 acres would be open and operating at a given time.

The volume of leachate generated was assumed to be similar to that generated at the GE-Pittsfield On-Plant Consolidation Areas (OPCAs). At the resulting estimated rate of leachate generation (150,000 gallons per month), construction of an on-site water treatment facility was not considered to be cost-effective. Instead, it was assumed that the leachate would be collected and temporarily stored in on-site tanks and transported via a 5,000-gallon water truck on an as-needed basis to GE's Building 64G water treatment facility at its Pittsfield plant for treatment and discharge. Building 64G has a maximum treatment capacity of approximately 700 gallons per minute, and thus has sufficient excess capacity to accommodate the anticipated leachate volumes associated with the operation of the landfill. The travel distances to the Building 64G water treatment facility would be approximately 10 miles for the Woods Pond Site, approximately 15 miles for the Forest Street Site, and approximately 20 miles for the Rising Pond Site. As such, travel distance for the water truck would not be a limiting factor. The option to construct an on-site treatment facility will be retained as a possible approach to be considered during design if TD 3 is selected.

Operations Monitoring and Maintenance: Monitoring and maintenance would be performed during facility operations. For purposes of this Revised CMS Report, it has been assumed that these activities would include daily air monitoring for particulate matter (during facility operations) and monthly air monitoring for PCBs, as well as semi-annual groundwater monitoring of upgradient and downgradient wells. It would also include periodic leachate collection and treatment/disposal, stormwater management, routine inspections, and maintenance of the stormwater diversion berms, stormwater detention basins, and drainage swales.

The total duration over which the placement of removed materials in the Upland Disposal Facility would occur would depend on the selected sediment and floodplain remediation alternatives. This time period would range from approximately 5 years (the duration of SED 10, the shortest sediment alternative) to 52 years (the duration of SED 8, the longest alternative), assuming that any floodplain remediation would also be completed within those same time frames.[498]

Engineering/Institutional Controls: During construction and operation of the Upland Disposal Facility, access restrictions would be established (i.e., fencing, signs) to prevent unauthorized access to the area. The fences and signs would remain following closure of the facility. In addition, deed restrictions would be established to prohibit interference with the Upland Disposal Facility and to prevent a future change in use of that area.

Final Cover Installation: Sediments and soils would be placed and compacted in 3-acre cells within the landfill. An interim cover would be installed over the consolidated material once the material within a cell reaches the maximum design height, to reduce infiltration of precipitation. The final cover would be installed over areas of completed consolidation, based on surface drainage, consolidation material operations, and constructability. For purposes of this Revised CMS Report, it was assumed that the final cover system would include (from bottom to top): a 6-inch-thick soil grading layer, a geosynthetic clay liner, a flexible membrane liner, a geosynthetic drainage layer, an 18-inch-thick soil protection

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[498] Note that the combination of sediment and floodplain alternatives with the shortest duration (SED 10 and FP 9) is not the same as the combination with the smallest volume (SED 3 and FP 2). For the evaluations in this section that are based on removal volumes, the latter combination is used as the basis for the lower end of the range. In addition, quantitative evaluations that assess active disposal operations (e.g., truck trips, traffic accident risks, risks to workers) are based on the assumed years of operation, rather than overall duration. The years of operation represent the number of years during which materials removed from the River and floodplain would be actively being disposed of (i.e., excluding years when the only activities being conducted under the sediment and floodplain alternatives would be capping, backfilling, or restoration activities). For TD 3, the assumed years of operation range from approximately 8 years based on the volume of SED 3 and FP 2 (the smallest-volume combination) to approximately 19 to 40 years based on the maximum capacity of a disposal facility at the location in question.

layer, and a 6-inch-thick soil layer on the top. The landfill cover would be planted with herbaceous vegetation

<u>Long-Term Post-Closure Monitoring and Maintenance</u>: A post-closure long-term monitoring and maintenance program would be implemented for the Upland Disposal Facility. For purposes of this Revised CMS Report, it has been assumed that this program would include performance of long-term upgradient and downgradient groundwater and stormwater runoff monitoring, as well as inspection and maintenance activities. The monitoring components for TD 3 have been assumed to include groundwater monitoring at 10 and 20 locations for the minimum- and maximum-sized facilities, respectively. The inspection and maintenance activities would focus on the cover system and other associated components, including the surface water drainage system, the leachate management system, fences, and warning signs. Maintenance and/or repairs would be performed as necessary. Leachate treatment/disposal would also be performed on a routine basis. Appropriate deed restrictions would be maintained on the land. For purposes of this Revised CMS Report, it has been assumed that this long-term monitoring and maintenance program would last for 100 years, with visual inspections and groundwater monitoring conducted twice annually in the first five years after closure and then once a year for the remainder of the 100-year period.

<u>Restoration of Other Affected Areas</u>: Support areas outside the landfill that are disturbed by the construction or operation of the facility, such as materials staging areas and access roads that are no longer needed after closure, would be restored to their pre-existing conditions to the extent practicable. This would include the removal of any materials brought in during construction to temporarily improve the surface for equipment. The surface soil in these areas would be prepared (e.g., by scarification or tilling) before being reseeded with a rapidly establishing native grass seed mix to prevent erosion. Additional woody plantings would be installed if necessary, based on the habitat community present prior to construction. For example, replanting of support areas constructed within upland forest habitats (such as at the Rising Pond and Forest Street Sites) could include the planting of native trees similar to those established in the surrounding upland forest. However, as discussed in prior sections, it would take at least 50 to 100 years to restore all the functions of a mature upland forest community. Restoration of the quarry/field area at the Woods Pond Site would likely consist of establishing grassland habitat.

9.3.2 Overall Protection of Human Health and the Environment – Introduction

As discussed in Section 9.1.2, the evaluation of whether a treatment/disposal alternative would provide overall human health and environmental protection relies heavily on the evaluations under several other Permit criteria – notably, long-term effectiveness and permanence (including long-term adverse impacts), short-term effectiveness, and compliance with ARARs. For that reason, the evaluation of whether TD 3 would be protective of human health and the environment is presented at the end of Section 9.3 so that it can take account of the evaluations under those other criteria.

9.3.3 Control of Sources of Releases

Placement of PCB-containing sediments and soils into an Upland Disposal Facility located outside the 500-year floodplain would effectively and permanently isolate those materials from being released into the environment and transported within the River or onto the floodplain. The components of the facility described in Section 9.3.1, including the double base liner system, the double leachate collection system, and the cover system, would be designed to prevent releases from the Upland Disposal Facility to the surrounding environment; and the facility would be operated and would be monitored and maintained (both during and after operation) to ensure that it continues to isolate the PCB-containing materials within the landfill.

9.3.4 Compliance with Federal and State ARARs

The potential ARARs identified by GE for TD 3 in accordance with directions from EPA are listed in tables in Appendix C. As directed by EPA, separate tables have been prepared for the Woods Pond Site (Tables T-3.a through T-3.c), the Forest Street Site (Tables T-3.d through T-3.f), and the Rising Pond Site (Tables T-3.g through T-3.i). No chemical-specific ARARs have been identified for TD 3, although several guidances to be considered are listed in Tables T-3.a, T-3.d, and T-3.g.

Review of the potential location-specific and action-specific ARARs listed in these tables indicates that implementation of TD 3 at any of the identified locations would achieve certain of those ARARs, but that there are some potential ARARs that would or may require a specific EPA approval or finding or that would or may not be met.[499] Those potential ARARs are discussed below.

<u>TSCA Requirements</u>

EPA's regulations under TSCA establish certain technical requirements for chemical waste landfills used for disposal of PCBs, including siting, design, operation, and monitoring requirements (40 CFR § 761.75(b)). Any of these requirements may be waived by EPA

[499] For the reasons discussed in Section 2.1.3, a number of these regulatory requirements do not constitute ARARs for the Rest of River remedial action, but are listed in these tables as potential ARARs per EPA's direction.

based on a finding that that requirement is not necessary to protect against an unreasonable risk of injury to health or the environment (40 CFR § 761.75(c)(4)). In addition, the regulations allow EPA to provide a risk-based approval of an alternate method of disposal of PCB remediation waste if EPA finds that such method will not pose an unreasonable risk of injury to health or the environment (40 CFR § 761.61(c)).

Construction and operation of an Upland Disposal Facility at any of the above-identified locations would meet all the siting, design, and operation requirements of § 761.75, with a few qualifications or exceptions. First, while the existing soils at each of these locations would not meet requirements in § 761.75(b)(1) regarding the permeability and characteristics of the existing soil, the facility would be constructed with a synthetic membrane liner with equivalent low permeability, as allowed under § 761.75(b)(2) (with EPA approval) in places where the existing soil does not have the characteristics specified in § 761.75(b)(1). Second, all of these sites would likely not meet one or more of the requirements of § 761.75(b)(3) relating to hydrologic conditions (e.g., that the bottom of the liner must be at least 50 feet from the historical high water table, that groundwater recharge areas should be avoided, and that there be no hydraulic connection between the site and a surface waterbody). These hydrological issues would be investigated during design. However, even if those requirements were not met, the Upland Disposal Facility would have a double liner and leachate collection system (as discussed further below) to prevent impacts to groundwater (and ultimately to surface water), as well as a groundwater monitoring network to ensure that groundwater is not impacted during or after operations. In addition, construction of an Upland Disposal Facility at the Forest Street Site would not meet the requirement of § 761.75(b)(5) that a landfill be located in an area of low to moderate relief to minimize erosion and landslides or slumping. However, the facility would have engineered measures in place to reduce the potential for occurrence of these conditions. Such measures would, as necessary, include slope benching or terracing, berm buttressing and intermittent erosion breaks/sediment traps.

Under the TSCA regulations, even if one or more of these specific requirements in § 761.75(b) were not met, the Upland Disposal Facility would comply with the TSCA regulations through an EPA determination that the facility meets the substantive criteria for a waiver of those requirement(s) under § 761.75(c)(4) or for a risk-based approval of the facility location and design under § 761.61(c) – i.e., that the facility would not pose an unreasonable risk of injury to health or the environment. For the Building 71 On-Plant Consolidation Area (OPCA) at the GE Facility (which was authorized to receive TSCA-regulated materials), EPA specifically determined in the CD, pursuant to § 761.61(c), that use of that landfill would not pose an unreasonable risk of injury to health or the environment (CD Appendix D). Moreover, in other cases involving on-site landfills, EPA has waived specific locational requirements of § 761.75(b) such as those identified above, pursuant to § 761.75(c)(4), based upon a determination that, even without meeting them, the landfill would not present an unreasonable risk of injury to health or the environment.[500] Given the safeguards to be built into the Upland Disposal Facility, such a finding would be warranted here.

Requirements Relating to Wetlands, Waterbodies, and Priority Habitat

As discussed in Section 9.3.1, all of the identified sites for an Upland Disposal Facility are located outside the floodplain of the Housatonic River, and the identified configurations for such a facility at all these sites would not contain or affect any regulated waterbodies, wetlands, or other resource areas under the Massachusetts Wetlands Protection Act with the following exceptions:

(1) The maximum (but not minimum) operational footprint for an Upland Disposal Facility at the Woods Pond Site contains the small (0.4 acre) shrub swamp, which may or may not meet the jurisdictional prerequisites for a regulated wetland under federal or state law (an issue that would be investigated during design).

(2) The maximum operational footprint for an Upland Disposal Facility at the Forest Street Site would require construction of an access road that would involve building a new crossing of a small stream in the southern portion of the site (Goose Pond Brook); and it would also be located within the 100-foot buffer zone of that stream. In addition, portions of both the minimum and maximum operational footprints would be within the 200-foot Riverfront Area of Goose Pond Brook (a jurisdictional resource area under the Massachusetts Wetland Protection Act).

(3) The maximum (but not minimum) operational footprint for an Upland Disposal Facility at the Rising Pond Site would impact a small (0.5-acre) forested wetland which may or may not meet the jurisdictional prerequisites for a regulated wetland under federal or state law. Further, should the adjacent section of Rising Pond be determined to constitute a river under the Massachusetts Wetlands Protection Act, a portion of the 200-foot Riverfront Area would be impacted by the maximum (but not the minimum) operational footprint.

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[500] See, e.g., Record of Decision (ROD) for the Field Brook Site, Operable Unit IV, in Ashtabula, Ohio (EPA, 1997b); ROD for Paoli Rail Yard (EPA, 1992b); ROD for the King Highway Landfill – Operable Unit 3 of the Allied Paper/Portage Creek/Kalamazoo River Site (EPA, 1998b); ROD Amendment for Norwood PCB Site (EPA, 1996b); ROD for Berkley Products Company Dump Site (EPA, 1996c); ROD for Picillo Farm Site (EPA, 1985). See also OU-13 ROD for the Oak Ridge Reservation (U.S. Department of Energy [USDOE], 1999; concurred in by EPA).

As shown in the relevant ARARs tables for TD 3 at these locations (in Appendix C), to the extent that the operational footprint for any of these facilities would impact a regulated wetland, waterbody, or other jurisdictional resource area, the potentially applicable requirements would include one or more of the following: EPA's and the Corps of Engineers' regulations under Section 404 of the Clean Water Act (40 CFR Part 230, 33 CFR Parts 320-323); the federal Executive Order for Wetlands Protection (E.O. 11990); the Massachusetts water quality certification regulations for discharges of dredged or fill material into waters of the U.S. (314 CMR 9.06); and the Massachusetts Wetlands Protection Act regulations (310 CMR 10.53(3)(q)). Those requirements provide that there must be no practicable alternative with less adverse impact on the aquatic ecosystem or wetlands and that appropriate and practicable steps must be taken to minimize or mitigate any adverse effects on such areas. Thus, if those requirements constitute ARARs, EPA would have to find that there is no practicable alternative to the construction and use of the Upland Disposal Facility at the site in question and that this project would include practicable steps to minimize or mitigate harm to such resources, or else it would need to waive these requirements under CERCLA and the NCP. In addition, there are a few other requirements of these regulations that might not be met.[501]

The identified configurations for an Upland Disposal Facility at the Woods Pond and Forest Street Sites (including both the minimum and maximum configurations) would not impact any Priority Habitat for state-listed species under MESA.[502] According to the 2010 NHESP mapping, the overall property at the Rising Pond Site contains 47 acres of mapped Priority Habitat for the state-listed wood turtle, and the maximum (but not minimum) operational footprint would affect a portion (approximately 25 acres) of that habitat. As shown in the

[501] Notably, the maximum (but not minimum) operational footprint for an Upland Disposal Facility at the Rising Pond Site would affect the Estimated Habitat of a state-listed wildlife species (the wood turtle), and thus the prohibition in the Massachusetts water quality certification regulations and the Massachusetts Wetlands Protection Act regulations on projects with such an effect would not be met. In addition, in the event that the implementation of TD 3 were not considered a "limited project" under 310 CMR 10.53(3)(q), it might not meet some of the other applicable requirements of the Massachusetts Wetlands Protection Act regulations at the Forest Street or Rising Pond Site – e.g., the prohibition on loss of > 5000 square feet of bordering vegetated wetlands (if any) and/or the requirement to maintain a 100-foot-wide area of undisturbed vegetation along the river in a Riverfront Area (subject to certain exceptions) – depending on the size of the operational footprint and other factors.

[502] For the Woods Pond Site, the 2010 NHESP mapping shows no Priority Habitat within the site (although Priority Habitat adjoins the site on its northwest corner), and the 2008 NHESP mapping showed a small portion (0.8 acre) of Priority Habitat within the site. However, under both sets of mapping, neither the minimum nor the maximum operational footprint of the disposal facility would impact any Priority Habitat. For the Forest Street Site, only 2008 NHESP mapping is available. It shows 0.7 acre of Priority Habitat in the northern portion of the site, but neither the minimum nor the maximum operational footprint of the disposal facility would impact that area.

MESA assessment for the wood turtle in Appendix L, the development of the facility within the maximum operational footprint would involve a take of the wood turtle. Thus, under this scenario, if MESA and its implementing regulations constitute an ARAR, their prohibition on a take of a state-listed species would need to be waived as technically impracticable to meet.[503]

Requirements Under RCRA and State Hazardous Waste Regulations

EPA's regulations under RCRA establish detailed and rigorous requirements for facilities that treat, store, or dispose of material that constitutes a hazardous waste under those regulations (40 CFR Part 264). The Massachusetts hazardous waste regulations likewise impose detailed and rigorous requirements on facilities that treat, store, or dispose of materials that constitute hazardous waste on the same grounds.[504] However, under the MCP, the on-site disposal of contaminated media constituting hazardous waste as part of a remedial action is exempt from the State's hazardous waste regulations unless the MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).[505]

As discussed above, based on prior experience at other portions of the Housatonic River and floodplain, it is not anticipated that the sediments and soils that would be removed from the River, riverbanks, and floodplain in the Rest of River area would constitute characteristic hazardous waste under RCRA or the Massachusetts hazardous waste regulations (see Section 6.3.4). Thus, it is not expected that the EPA RCRA regulations and Massachusetts hazardous waste regulations would apply to the Upland Disposal Facility. However, representative TCLP testing of the sediments and soils subject to removal would be conducted during design to confirm that result. We have considered whether, in the unlikely event that the TCLP testing should show that particular sediments or soils to be placed in the Upland Disposal Facility would constitute hazardous waste, the Upland Disposal Facility

503 The MESA regulations contain a provision authorizing the Director of the MDFW to permit a take of a state-listed species under certain conditions (321 CMR 10.23). However, as discussed in Section 5.4, this provision does not constitute an ARAR for the Rest of River remedial action.

504 As noted above, although wastes with PCB concentrations $\geq$ 50 mg/kg are listed hazardous wastes in Massachusetts, the Massachusetts hazardous waste regulations exempt facilities that manage such wastes so long as such facilities comply with EPA's TSCA regulations (310 CMR 30.501(3)(a)), which the Upland Disposal Facility would do. Hence, the discussion here relates to materials that would constitute hazardous waste on other grounds, which are the same as those under EPA's RCRA regulations.

505 For purposes of the ARARs evaluation herein, it is assumed that the Rest of River remedial action would constitute a remedial action under the MCP by virtue of the MCP's "adequately regulated" provisions (310 CMR 40.0111). In such a case, the MCP provides (in section 40.0033(5)) that, if the MDEP does not issue a written notification that the remedial action must comply with the state hazardous waste regulations, the remedial action shall be considered a remedial action initiated by the MDEP, which is exempt from those regulations under 310 CMR 30.801(11).

at each of the above-identified locations would meet the substantive requirements of those regulations.[506]

For the federal RCRA regulations, in the unlikely event that some sediments or soils to be placed in the Upland Disposal Facility are found to constitute RCRA hazardous waste, that facility would meet the substantive technical requirements for a hazardous waste landfill, including the design, operating, groundwater protection, closure, and post-closure requirements for such a landfill. This is because, as a conservative measure, the facility would be designed to meet the technical requirements for a RCRA landfill, including the requirements for a double liner/leachate collection system (40 CFR § 264.301), even though it is not expected that those requirements would apply.

With respect to the RCRA land disposal restrictions (40 CFR Part 268), it is again not expected that these restrictions would apply, since it is anticipated that any sediments and soils to be placed in the Upland Disposal Facility would either not constitute hazardous waste at all or would meet alternate standards for contaminated soil in 40 CFR § 268.49,[507] which allow land disposal without treatment if the material has concentrations of the relevant constituents less than 10 times the Universal Treatment Standards. However, if some excavated materials were nevertheless considered to be subject to the treatment requirement in these regulations, that requirement would not be met, because alternative TD 3 would not involve treatment. In that case, either the treatment requirement could be waived by EPA under CERCLA and the NCP as technically impracticable to meet, or those specific materials would have to be sent elsewhere for treatment and disposal. A waiver would be justified from a protectiveness standpoint, since: (a) in the unlikely event that these restrictions applied, that would be due to certain non-PCB constituents (e.g., metals); and (b) EPA eliminated such non-PCB constituents from detailed evaluation in its HHRA and ERA.

Finally, with respect to the state hazardous waste regulations, even if some materials to be placed in the Upland Disposal Facility were found to constitute hazardous waste under those regulations (on grounds other than containing PCBs $\geq$ 50 mg/kg), the facility would be

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[506] In this regard, it does not appear that EPA's Area of Contamination (AOC) policy would apply to the facility at any of the identified locations. Under that policy, the movement and disposition of hazardous waste within an overall area of dispersed contamination would not constitute "placement" of such waste and would not trigger the technical RCRA design and operating requirements or the RCRA land disposal restrictions. However, each of the identified potential locations for an Upland Disposal Facility is located outside the overall area of PCB contamination. Thus, in this evaluation, we have assumed that the AOC policy would not apply.

[507] For purposes of the provisions of Part 268, including these alternate standards, the definition of soil in 40 CFR § 268.2(k) would include sediments.

exempt from those regulations under the above-described MCP exemption unless the MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)). In the unlikely event that some materials did constitute such hazardous waste and the MCP exemption did not apply, the Upland Disposal Facility at each of the potential locations identified above would meet the substantive requirements of the regulations for a hazardous waste landfill, including the location, design, operating, groundwater protection, closure, and post-closure requirements for such a landfill, with a few potential exceptions relating to the location of the facility, as described below.

The state hazardous waste regulations provide that a hazardous waste landfill may not be located within 1000 feet of an existing private drinking water well or within the groundwater flow path of such a well, or within the flow path of groundwater supplying a "potential private underground drinking water source," or on land overlying or within the flow path of a "potential public underground drinking water source" (310 CMR 30.704, 703(4) 30.010).[508] Review of available information indicates that, at the Woods Pond Site, the disposal facility would be within 1000 feet of an existing drinking water well in an adjacent campground and would potentially not meet some of the other locational requirements mentioned above – issues that would be investigated during design. For the Rising Pond and Forest Street Sites, it is unknown at this time whether a landfill would meet all of the above-mentioned requirements relating to actual or potential private or public underground drinking water sources – which are matters that would be investigated during design. To the extent that any of these hazardous waste requirements were found to apply and could not be met at the selected landfill location, GE would seek a waiver of such requirement(s) from EPA on the ground of technical impracticability.[509]

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[508] A "potential private underground drinking water source" is defined as a groundwater source that is capable of sustaining a yield of between 2 and 100 gallons per minute [gpm] of drinking water and has less than 10,000 mg/L of TDS, unless it is economically or technologically impractical to render that water fit for human consumption. A "potential public underground drinking water source" is defined as a groundwater source that is capable of sustaining a yield of 100 gpm or more of drinking water and has less than 10,000 mg/L of TDS, unless it is economically or technologically impractical to render that water fit for human consumption.

[509] It should be noted that the Massachusetts site assignment regulations for solid waste facilities (310 CMR 16.00) and solid waste management regulations (310 CMR 19.00) would not apply to the Upland Disposal Facility because 310 CMR 19.013(2) exempts from those regulations remedial actions conducted pursuant to the MCP and, as noted above, the Rest of River remedial action would constitute a remedial action under the MCP by virtue of the MCP's "adequately regulated" provisions (310 CMR 40.0111).

9.3.5 Long-Term Reliability and Effectiveness

An assessment of long-term reliability and effectiveness of TD 3 has included an evaluation of the magnitude of residual risk, the adequacy and reliability of the alternative, and any potential long-term adverse impacts associated with the alternative on human health or the environment.

9.3.5.1 Magnitude of Residual Risk

TD 3 would include the disposal of PCB-containing sediments/soils removed from the Rest of River in an Upland Disposal Facility, located outside the 500-year floodplain of the Housatonic River. The materials placed in this facility would be isolated from underlying soils and groundwater and from surface receptors, which would prevent contact by human and ecological receptors with those materials. Erosion control measures would be installed to minimize the risk of erosion during operations, and the long-term monitoring and maintenance program would address potential erosion over the long term. Since the potential for erosion at the Forest Street Site is higher than at the Woods Pond or Rising Pond Sites due to its steeper topography, more extensive engineering/erosion controls would be necessary at the Forest Street Site. Additionally, engineering/institutional controls, such as signs, fencing, and deed restrictions, would be in place to further limit the potential for human exposure after construction and closure of the facility.

9.3.5.2 Adequacy and Reliability of Alternative

Evaluation of the adequacy and reliability of TD 3 has included an assessment of the factors discussed below.

<u>Use of Technology under Similar Conditions</u>

Landfill disposal is commonly used as a remedy component for removed soil and sediment containing PCBs. Disposal facilities with leachate collection and impermeable base liner and cover systems have been constructed and used as part of a final remedy for a number of sediment sites containing PCBs, including the Upper ½ and 1½ Mile Reaches of the Housatonic River; the Alcoa Grasse River Study Area in Massena, New York; the Ormet Corporation Site in Hannibal, Ohio; the Allied Paper/Portage Creek/Kalamazoo River Superfund Site in Kalamazoo, Michigan; the Bennington Municipal Sanitary Landfill in Bennington, Vermont; the Fields Brook Site in Ashtabula, Ohio; and the River Raisin at the Ford Outfall in Monroe, Michigan. In addition, consolidation of dredged sediments into an upland disposal facility was selected as part of the remedy for the Onondaga Lake Site in Syracuse, New York, and more recently for the removal and on-site consolidation of approximately 2.5 million cy of dredged coal ash released to a nearby embayment at the

Tennessee Valley Authority (TVA) Kingston Superfund Site in Roane County, Tennessee. While the designs differ based on location-specific factors, the general landfill components and objectives are similar to those assumed for TD 3.

Overall Effectiveness and Reliability

The capacity of the Upland Disposal Facility would depend on the location selected for the facility. As discussed in Section 9.3.1, maximum estimated design capacities for such a facility at the three identified sites are approximately 1.0 million cy at the Forest Street Site, 2.0 million cy at the Woods Pond Site, and 2.9 million cy at the Rising Pond Site. Therefore, for disposal volumes up to approximately 1.0 million cy, there would be three site options for constructing an on-site disposal facility; while for greater disposal volumes, a disposal location that has sufficient capacity to handle that volume or a combination of two disposal locations would be used.

At any of the potential locations, the Upland Disposal Facility would be constructed outside the 500-year floodplain with appropriate double liner, cover, and double leachate collection systems. As a result, implementation of TD 3 would be an effective and reliable means of permanently disposing of the removed sediments and soils.

Reliability of Operation, Monitoring, and Maintenance Requirements

A combination of OMM techniques would be implemented during and after active use of the Upland Disposal Facility, as described in Section 9.3.1. Once constructed, periodic mowing of the cap would help maintain the cap integrity by limiting the growth of trees and shrubs. During operations and following closure, collected leachate would be temporarily stored in on-site tanks and transported, as needed, to GE's water treatment facility in Pittsfield (although as described above, the option of constructing an on-site water treatment facility would be considered during design). Periodic visual inspections would be conducted to identify any areas of erosion or damage to the cap. Groundwater and stormwater runoff would be monitored to confirm the long-term effectiveness of TD 3. Maintenance activities at the facility would include, as necessary, periodic repairs to the cap, including cleaning and repair of the stormwater conveyance and collection system and re-seeding of the cover areas; maintenance of vegetation along the perimeter of the facility; and maintenance and repair of the fences and signs. Such monitoring and maintenance techniques are commonly applied at other landfill sites, and are considered a reliable means of ensuring long-term protection against exposure to the contained materials within the facility. Labor and materials needed to perform the OMM activities are expected to be readily available.

Technical Component Replacement Requirements

TD 3 would be effective at isolating the excavated/dredged sediment and soil from the surrounding environment. The impermeable base liner and cap system would permanently contain the soil/sediment. OMM activities would be implemented to monitor the effectiveness of the facility.

In the unlikely event that the cap or liner system required repair, an assessment would be conducted to determine the type and methods of repair. The effort required would depend on the nature and extent of the deficiency. Risks posed to site workers performing maintenance activities would be mitigated through development and implementation of a facility-specific health and safety plan.

9.3.5.3 Potential Long-Term Adverse Impacts on Human Health or the Environment

The evaluation of potential long-term adverse impacts of TD 3 on human health or the environment has included an assessment of several components, as described below.

Potentially Affected Populations

Under TD 3, the PCB-containing sediments and soils placed in the Upland Disposal Facility would remain in place permanently. The presence of bottom liner and cap systems would isolate those materials and prevent contact by human and ecological receptors with those materials, and implementation of engineering/institutional controls and a monitoring and maintenance program would ensure the long-term integrity and effectiveness of the facility. Hence, this alternative would not have an adverse effect on human health. The ecological populations affected by the implementation of TD 3 would depend upon the type of habitat present at the location selected for construction of the facility. The potential long-term impacts of TD 3 on biota and their habitat are discussed further below.

Long-Term Adverse Ecological Impacts

The primary long-term ecological impact from TD 3 would be the removal of habitat from productive use by the wildlife species that currently inhabit the selected site. Since any of the potential locations for the facility would be outside of the 500-year floodplain of the River and away from wetlands (with a few possible minor exceptions, discussed above[510]),

510 As noted above, the maximum (but not minimum) operational footprints would affect a 0.4-acre shrub swamp at the Woods Pond Site and a 0.5-acre forested wetland at the Rising Pond Site, and would require an access crossing of Goose Pond Brook at the Forest Street Site.

placement of the facility would largely avoid long-term impacts to those types of habitats and the species that inhabit them and would thus reduce the potential for significant long-term ecological impacts. Otherwise, specific impacts would depend on the location selected for the Upland Disposal Facility as well as the final disposal volume. The potential impacts associated with the minimum and maximum disposal volume scenarios developed for each site are discussed below.[511] The acreages considered in the below discussion represent the operational footprints that would be directly impacted by the facility and its operations (as listed in Table 9-1 in Section 9.3.1).

Woods Pond Site: The Woods Pond Site consists primarily of active and inactive portions of a sand and gravel facility, with smaller areas composed of an upland pine-mixed hardwood forest, a small shrub swamp, and an overhead electric utility corridor.

- Minimum Operational Footprint: The operational footprint for an Upland Disposal Facility at this site under the minimum volume scenario (approximately 191,000 cy) covers approximately 25 acres. Most of this area (more than 21 acres) consists of previously disturbed land that is currently used as a sand and gravel quarry or was formerly used for such purposes and now consists of heavily disturbed fields and overhead utility easements. Since this area has little habitat value, there would be no significant long-term ecological impacts in this area. The remainder of the operational footprint consists of 3.4 acres of upland forest. The clearing of this 3.4-acre area would involve the removal of all trees, shrubs, and herbaceous vegetation, displacing wildlife which use this habitat. Where such clearing work would occur within support areas (e.g., materials staging areas, access roads) that would no longer be needed after closure, the areas would be replanted, although, as discussed previously, it would take at least 50 to 100 years for a replanted upland forest to return to its current mature condition. While the capped landfill itself plus any areas needed to support it after closure would be permanently altered, this area consists mainly of previously disturbed land, with only a small portion consisting of upland forest habitat (0.2 acre within the landfill). In short, the impacts of an Upland Disposal Facility under this scenario on upland forest habitat would affect only a very small portion of this overall habitat type in and near the Rest of River area.

- Maximum Operational Footprint: The operational footprint for an Upland Disposal Facility at the Woods Pond Site under the maximum volume scenario (approximately 2.0 million cy) covers approximately 61 acres. The majority of this area (approximately

[511] As discussed above, the maximum volume scenarios for these three sites are not the same. They are 1.0 million cy for the Forest Street Site, 2.0 million cy for the Woods Pond Site, and 2.9 million cy for the Rising Pond Site.

38 acres) consists of previously disturbed land that is currently operated as a sand and gravel quarry or was formerly used for such purposes and now consists of heavily disturbed fields and overhead utility easements. Since this area has little habitat value, there would be no significant long-term ecological impacts in this area. The remainder of the operational footprint includes roughly 21 acres of upland forest and the small (0.4-acre) shrub swamp. Again, the clearing of these areas would involve the removal of all trees, shrubs, and herbaceous vegetation, displacing wildlife which use these habitats. Where this work would occur within support areas that would no longer be needed after closure, the areas would be restored to the extent practicable; but it would take at least 50 to 100 years for a replanted upland forest to return to its current mature condition. The capped landfill itself (which would include approximately 5 acres of upland forest and 0.1 acre of the shrub swamp) and the support areas that are needed for it after closure would be permanently altered. While much of this area consists of previously disturbed land, it includes some upland forest habitat and a small portion of the shrub swamp habitat, which would be permanently lost for wildlife use. Even under the maximum operational footprint, however, the impacted forest and shrub swamp habitats would constitute only very small portions of these habitats in and near the Rest of River area.

Forest Street Site: The Forest Street Site is composed primarily of upland pine-mixed hardwood forest.

- Minimum Operational Footprint: The operational footprint for an Upland Disposal Facility at this site under the minimum volume scenario (approximately 191,000 cy) covers approximately 42 acres. Development of an Upland Disposal Facility under this footprint would require the clearing of approximately 41 acres of upland forest and involve the removal of all trees and associated biomass, all snags and downed woody debris, and all shrubs and herbaceous vegetation in the cleared area. Where this work would occur within support areas (e.g., materials staging areas and access roads) that would no longer be needed after closure, the areas would be replanted. However, as discussed previously, it would take at least 50 to 100 years for a replanted upland forest to return to its current mature condition. Moreover, the capped landfill itself, which would include 9 acres of upland forest, and the support areas that are needed for it after closure would be permanently altered. The permanent elimination of upland forest in this area would result in the loss of habitat for interior forest wildlife, including individual birds and mammals that currently use the forested habitat located at this site. The remaining portion of the operational footprint (approximately 1.5 acres) consists of cleared open field and disturbed land. The minimum operational footprint at this site would not impact the coniferous wooded swamp located on the property.

- Maximum Operational Footprint: The operational footprint for an Upland Disposal Facility at the Forest Street Site under the maximum volume scenario (approximately 1.0 million cy) covers approximately 95 acres. Development of an Upland Disposal Facility under this footprint would require the clearing of approximately 93 acres of upland forest. Ecological impacts to the forested habitat would be similar in nature to those described above for the minimum volume footprint but would cover a greater area. The remaining portion of the operational footprint consists of cleared open field and disturbed land (approximately 1.5 acres). The maximum operational footprint at this site would not impact the coniferous wooded swamp on the property.

Rising Pond Site: The Rising Pond Site consists primarily of upland coniferous and mixed hardwood forest.

- Minimum Operational Footprint: The operational footprint for an Upland Disposal Facility at this site under the minimum volume scenario (approximately 191,000 cy) covers approximately 27 acres, virtually all of which consist of upland forest habitat. Development of an Upland Disposal Facility under this footprint would thus involve the clearing of those 27 acres, including removal of all trees and associated biomass, all snags and downed woody debris, and all shrubs and herbaceous vegetation in the cleared area. Where this work would occur within support areas (e.g., materials staging areas and access roads) that would no longer be needed after closure, the areas would be replanted. However, as discussed previously, it would take at least 50 to 100 years for a replanted upland forest to return to its current mature condition. Moreover, the capped landfill itself, which would include 5 acres of upland forest, and the support areas that are needed for it after closure would be permanently altered. Again, the permanent elimination of upland forest in this area would result in the loss of habitat for interior forest wildlife, including individual birds and mammals that currently use this area of forest located along the Housatonic River corridor. This footprint would not impact the mapped Priority Habitat for the state-listed wood turtle.

- Maximum Volume Footprint: The approximate area of the Rising Pond Site that would be used for an Upland Disposal Facility under the maximum volume footprint (approximately 2.9 million cy) covers approximately 84 acres. Development of an Upland Disposal Facility under this footprint would require the clearing of approximately 80 acres of upland forested habitat and 0.5 acre of forested swamp habitat. Ecological impacts to the upland forested habitat would be similar to those described above for the minimum volume footprint but would cover a greater area. Impacts to the small forested swamp would occur within the development area and reduce the habitat diversity of the area, particularly for amphibian and reptile species (such as the eastern American toad and the northern black racer). The remaining portion of the development area (approximately 4 acres) would be constructed on previously disturbed open land used as roadways, open land, and cropland. The development area under this maximum footprint would overlap into approximately 25 acres of mapped Priority Habitat for the state-listed wood turtle on the eastern portion of the site. Wood turtles inhabit forested habitat for foraging during the spring and summer and also use open undeveloped upland habitat for nesting in the late spring/early summer. The construction of the Upland Disposal Facility under this footprint would reduce suitable available habitat for this species and would constitute a take of this species under MESA (see MESA assessment for wood turtle in Appendix L).

The long-term impacts discussed above would be localized primarily to the discrete development area where the Upland Disposal Facility would be located.

Long-Term Impacts on Aesthetics

The long-term impacts on aesthetics from the construction of an Upland Disposal Facility depend on the location and current use of the area. While the Upland Disposal Facility would be capped and vegetated, the presence of the facility, as well as the need to construct and maintain roads and stormwater structures at the site, could have a permanent impact on the aesthetics of the area, depending on the location selected for the facility. For example, at the Forest Street Site, construction of the Upland Disposal Facility would create an opening in the dense forested hillside that could be visible from some vantage points; and at the Rising Pond Site, the facility would result in the permanent visible loss of forest land. Again, however, these impacts would be localized in the area of the facility. At the Woods Pond Site, the aesthetic impacts would be less, since the facility would be constructed in large part in a disturbed area that is or was used for sand and gravel operations; and although some trees in the forested area would be removed, the trees along Woodland Road would be left in place to shield the landfill to a degree from surrounding properties. In fact, following closure of the facility, the presence of the capped surface with herbaceous vegetation would improve in the appearance of this area over its current condition.

Potential Measures to Mitigate Long-Term Adverse Impacts

Measures would be implemented to mitigate the potential long-term adverse impacts associated with the implementation of TD 3. As previously mentioned in Section 9.3.1, the implementation of OMM activities and engineering/institutional controls would minimize the potential for a release from and exposure to PCBs present in the Upland Disposal Facility. Placement of the disposal facility outside of the 500-year floodplain and away from or with minimal impacts on wetlands would avoid or minimize long-term impacts to those types of habitats. Following completion of operations, the facility surface would be restored with an herbaceous vegetative cover, and the adjacent disturbed areas would be restored to the type of habitat that previously existed there.

9.3.6 Reduction of Toxicity, Mobility, or Volume

The degree to which TD 3 would reduce the toxicity, mobility, or volume of PCBs is discussed below.

Reduction of Toxicity: This alternative would not include any treatment processes that would reduce the toxicity of the PCBs in the removed sediments and soils. However, leachate collected in the leachate collection system would be temporarily stored in on-site tanks and transported, as needed, to GE's water treatment facility in Pittsfield. (As discussed earlier in this section, construction of an on-site water treatment facility would be considered during design.) In addition, although it is not anticipated, if any free NAPL, drums of liquid waste, or the like are removed from the River or floodplain, that waste would not be placed in the Upland Disposal Facility, but would be segregated and transported off-site for treatment and disposal, as appropriate.

Reduction of Mobility: TD 3 would result in the reduced mobility of PCBs by permanently containing the PCBs in the sediment and soil removed from the River and floodplain within the Upland Disposal Facility. Once placed within that facility, these materials would be isolated from surface water infiltration, leaching to groundwater, or otherwise mobilizing.

Reduction of Volume: TD 3 would not reduce the volume of PCB-containing material.

9.3.7 Short-Term Effectiveness

Evaluation of the short-term effectiveness of TD 3 has included consideration of the short-term impacts of implementing this alternative on the environment (in terms of both ecological effects and increases in GHG emissions), on local communities (both near the facility as well as communities along truck transport routes), and on the workers involved in the disposition activities. For TD 3, short-term impacts are those that would occur during the construction and operation of the Upland Disposal Facility and associated closure.

Impacts on the Environment – Ecological Effects

The short-term effects on the environment resulting from implementation of TD 3 would include the destruction of the habitat and destruction or displacement of the wildlife residing in the location selected for construction of the Upland Disposal Facility. In addition, short-term impacts would occur in the adjacent areas disturbed during construction of the supporting access roads and staging areas. Specific impacts would depend on the location selected for the facility. As discussed above, the placement of the Upland Disposal Facility outside of the 500-year floodplain and away from or with minimal impacts to wetlands would avoid or minimize impacts to those types of habitats and the biota that inhabit them. For the three potential locations for the facility, considering both their minimum and maximum operational footprints,[512] the short-term ecological effects would be as follows:

For a facility located at the Woods Pond Site, the short-term ecological effects would consist primarily of the loss of forested habitat within the operational footprint of the facility and, for the maximum volume scenario only, the limited shrub swamp habitat within the operational footprint. It is estimated that the construction of an Upland Disposal Facility and associated facilities at this site under the maximum volume scenario would result in the clearing and use of 21 acres of upland forested habitat and 0.4 acre of shrub swamp habitat. This clearing would prevent the use of those areas by the birds, mammals, reptiles, and other wildlife that use those habitats. However, since the remaining portion of the operational footprint (approximately 38 acres) would be situated on previously altered land that is or was used for sand and gravel quarry operations (as well as on a utility right-of-way), the overall short-term ecological impacts would be limited. Under the minimum volume scenario, most of the operational footprint (more than 21 of 25 acres) would consist of the previously altered land, where no significant adverse ecological effects would occur; and the clearing of other habitats would be reduced to 3.4 acres of forested upland habitat.

For a facility located at the Forest Street Site, the short-term ecological effects would consist primarily of the loss of upland forest habitat within the operational footprint of the facility. It is estimated that the development of an Upland Disposal Facility and associated facilities at this site would result in the clearing and use of a total of 41 to 93 acres of such forested habitat. This clearing would prevent the use of those areas by the birds, mammals, reptiles, and other wildlife that use that forested habitat. Erosion and sedimentation would be a particular concern on this site due to the steep slopes and the presence of the adjacent Goose Pond Brook. While short-term adverse ecological impacts would occur for all volume scenarios, the extent of those impacts would directly correlate to the volume of waste to be disposed of and thus the size of the operational footprint.

For a facility located at the Rising Pond Site, the short-term ecological effects would consist primarily of the loss of forest habitat within the operational footprint of the facility. It is estimated that the construction of an Upland Disposal Facility and associated facilities at this site would result in the clearing and use of a total of 27 to 80 acres of forested upland habitat and 0.5 acre of forested swamp habitat (maximum footprint only). This clearing

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512 Note again that the maximum operational footprints at these three locations are based on different disposal volumes.

would prevent the use of those areas by the birds, mammals, reptiles, and other wildlife that use that forested habitat. The extent of these impacts would directly correlate to the volume of waste to be disposed of and thus the size of the operational footprint. In addition, the maximum operational footprint at this site would impact approximately 25 acres of mapped Priority Habitat for the state-listed wood turtle; this would reduce foraging and potential nesting habitat for the wood turtle and may result in mortality of individual animals. Impacts on this Priority Habitat would not occur under the minimum operational footprint.

<u>Carbon Footprint – GHG Emissions</u>

As described in Section 5.6 and Appendix M, estimates of the carbon footprint composed of GHG emissions anticipated to occur through the implementation of TD 3 – i.e., the construction and use of an Upland Disposal Facility for removed sediments and soils – have been developed for the time frame over which this alternative would be implemented. These estimates have been made for the minimum and maximum volume scenarios at each of the three identified sites. The estimates for those three sites differ due to differences in transport distance from the areas of removal, and the maximum estimates differ further due to differences in the maximum volumes subject to disposal.

The estimates of total GHG emissions for TD 3 range from 5,500 to 22,000 tonnes at the Woods Pond Site, 14,000 to 52,000 tonnes at the Forest Street Site, and 9,800 to 61,000 tonnes at the Rising Pond Site. However, as noted above, the only one of these individual sites that could accommodate the full upper-bound volume of removed materials (2.9 million cy based on SED 8 and FP 7) is the Rising Pond Site.[513] In these circumstances, the overall range of total GHG emissions for TD 3 is considered to extend from 5,500 tonnes (based on the minimum volume at the Woods Pond Site) to 61,000 tonnes (based on the maximum volume at the Rising Pond Site).

Of these totals, the GHG emissions associated with direct emission sources (primarily construction activities, tree removal, and associated mulch decay/sequestration of the vegetation) range from approximately 5,000 tonnes to 56,000 tonnes, while the off-site GHG emissions (primarily refinement of diesel fuel and excavation of disposal facility cap and liner materials) were calculated to range from approximately 460 tonnes to 4,500 tonnes. The range of total GHG emissions estimated for this alternative is equivalent to the annual output of 1,100 to 11,700 passenger vehicles.

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[513] As noted above, a combination of disposal sites could also be used for the upper-bound volume. However, separate estimates of GHG emissions have not been made for such combinations.

Impacts on Local Communities and Communities Along Truck Transport Routes

Implementing TD 3 would also result in short-term impacts to the local communities. These short-term effects would include increased truck traffic and noise from construction. Truck traffic to deliver construction materials, equipment, and sediments/soils to the Upland Disposal Facility would persist for the duration of the project. This additional traffic and equipment would increase the likelihood of noise levels and the emissions of vehicle/equipment exhaust and nuisance dust to the air. These factors would especially affect any residents and businesses located in the immediate vicinity of the Upland Disposal Facility.

The increased truck traffic would affect both local communities and areas along the routes used to transport construction materials to the site for construction and closure of the Upland Disposal Facility. The impacts on local communities would be different for the three potential locations. Although the number of truck trips from the removal areas to the disposal sites would not differ among the three sites, the distances from the removal areas would vary.

- The Woods Pond Site is approximately 0.3 miles south of the PSA, which is the area where most of the sediment and soil removal activities would occur. If TD 3 were implemented at the Woods Pond Site, truck traffic from the PSA would primarily be routed along Woodland Road and East Street.

- The Forest Street Site is approximately 3.9 miles away from the PSA. Although the Forest Street Site is located in Lee, trucks would bypass the downtown area to the extent practicable. Truck traffic from the PSA to the Forest Street Site would be expected to travel predominantly on Woodland Road, East Street, and Mill Street.

- The Rising Pond Site is approximately 14 miles by road south of the PSA. Truck traffic from the PSA to the Rising Pond Site would likely travel through Lenox and Stockbridge.

For comparability with the other treatment/disposition alternatives, an estimate has been made of the number of off-site truck trips that would be involved in implementation of TD 3 (i.e., excluding the local truck trips for transporting excavated materials from the temporary staging areas to the Upland Disposal Facility). Based on a range of potential facility sizes, which would depend on the volume of material to be disposed of in the facility (from a combination of SED 3 and FP 2 to a combination of SED 8 and FP 7), and assuming that 16-ton trucks would be used to transport construction materials to the site, the total numbers of off-site truck trips to transport construction materials to the site for construction and closure of the Upland Disposal Facility are shown in Table 9-2. The total number of vehicle miles that these trucks would travel would range from approximately 73,000 miles (for the Woods Pond Site) to approximately 269,000 miles (for the Rising Pond Site), including return trips.

Table 9-2 – Estimated Import Truck Trips for TD 3

Import Truck Trips	Woods Pond Site	Forest Street Site	Rising Pond Site
Lower-Bound Volume	1,451 (180)	6,175 (770)	1,456 (180)
Upper-Bound Volume	3,267 (110)	67,983 (3,580)	5,387 (130)

Notes:

1. Truck trips estimated assuming 16-ton capacity trucks for importing material and equipment to the site.
2. The number in parenthesis represents average annual truck trips.

Appendix N includes an analysis of potential accident risks from increased truck traffic for each of the three potential locations. This analysis was based on the off-site truck trips to transport construction materials to the site for construction and closure of the Upland Disposal Facility, as shown in Table 9-2.[514] These estimates have been made for the minimum and maximum volume scenarios at each of the three identified sites. This analysis indicates that the increased truck traffic to implement TD 3 would result in the following estimated non-fatal injuries due to accidents and fatalities from accidents:[515]

- For a facility at the Woods Pond Site, an estimated 0.03 to 0.08 total non-fatal injuries (average of 0.00 to 0.003 non-fatal injuries per year), with a probability of 3% to 7% of at least one such injury, and an estimated 0.002 to 0.004 total fatalities (average of 0.0002 to 0.0001 fatalities per year), with a probability of 0.2% to 0.4% of at least one such fatality;

- For a facility at the Forest Street Site, an estimated 0.15 to 1.60 total non-fatal injuries (average of 0.018 to 0.084 non-fatal injuries per year), with a probability of 14% to 80% of at least one such injury, and an estimated 0.007 to 0.07 total fatalities (average of 0.0008 to 0.0039 fatalities per year), with a probability of 0.7% to 7% of at least one such fatality;

[514] The risks associated with transport of excavated materials from the staging areas to the Upland Disposal Facility have been evaluated as part of risks to workers, discussed below.

[515] Note again that, due to differences in the maximum volume estimates for each site, the maximum injury and fatality estimates for these three sites are not comparable.

- For a facility at the Rising Pond Site, an estimated 0.03 to 0.13 total non-fatal injuries (average of 0.004 to 0.003 non-fatal injuries per year), with a probability of 3% to 12% of at least one such injury, and an estimated 0.002 to 0.01 total fatalities (average of 0.00025 fatalities per year for both the minimum and maximum scenarios), with a probability of 0.2% to 1% of at least one such fatality

<u>Potential Measures to Avoid, Minimize, or Mitigate Short-Term Environmental and Community Impacts</u>

Several actions would be taken in an attempt to avoid, minimize, or mitigate the negative short-term environmental impacts from construction and operation of the Upland Disposal Facility. The facility would be constructed in as small an area as necessary, so as to minimize the amount of habitat disturbed. Engineering controls and BMPs would be implemented, to the extent practical and as needed, to reduce detrimental effects from construction and operation of the disposal facility on the environment and local communities. Some potential BMPs that would likely be implemented during construction include, but are not limited to, the following:

- Stormwater management engineering controls and BMPs at the Upland Disposal Facility, including (as appropriate):
  - Hay or straw bales;
  - Silt fences;
  - Grass channel and water quality swale with a pretreatment device (e.g., sediment forebay with a check dam);
  - Constructing the landfill in a series of smaller cells, which would be capped once filled; and
  - Compacting sediments and soils and covering them with a temporary (daily) cover and then with an interim cover once the material in a given cell reaches the maximum design height;

- Air quality management (dust suppression) engineering controls and BMPs:
  - Inspection of trucks prior to entering public roadways to identify and, if necessary, remove any accumulated soil on the exterior of the trucks;
  - Implementation of equipment decontamination procedures;
  - Use of lined and tarped trucks;
  - Use of dust control measures, as needed, at the disposal facility and on unpaved roadways;
  - Constructing the landfill in a series of smaller cells, which would be capped once filled; and

- o Compacting sediments and soils and covering them with temporary (daily) cover and then with an interim cover once the material in a given cell reaches the maximum design height;

- Proper equipment and vehicle maintenance;
- Limitations on truck idling;
- Utilization of good housekeeping practices at the disposal facility;
- Avoidance of truck transport and disposal facility construction and operations at night except where necessary, and minimizing such activities on weekends and holidays;
- Efforts to avoid truck traffic through densely populated areas where practical;
- Where such travel is necessary, implementation of measures to ensure the safety of the impacted communities (e.g., traffic control, consultation with local public officials);
- Performance of routine air monitoring during facility construction and operation, as appropriate, in accordance with a project-specific air monitoring plan; and
- Groundwater monitoring to minimize or mitigate potential detrimental effects of the operation of the Upland Disposal Facility on the affected communities.

Risks to Remediation Workers

Implementation of TD 3 would also result in health and safety risks to site workers during the construction, filling, and closure of the Upland Disposal Facility. Implementation of this alternative is estimated to involve approximately 305,800 to 1,836,000 man-hours over a range of 8 to 40 years of operation. Appendix N includes an analysis of potential accident-related risks to workers from implementation of TD 3, including the risks to industrial truck drivers transporting excavated materials from the staging areas to the Upland Disposal Facility, based on the assumed years of operation for an Upland Disposal Facility at each site and using worker fatality and injury information from the Bureau of Labor Statistics.[516] This analysis indicates that implementation of TD 3 would result in the following estimated non-fatal injuries and fatalities to workers:

[516] As noted in Appendix N, these estimates slightly underestimate the worker site accident risks since the labor hours on which they are based do not include service support hours.

- For a facility at the Woods Pond Site, an estimated 2.69 to 10.6 non-fatal injuries to workers (0.34 to 0.37 average annual non-fatal injuries) (with a probability of 93% to 100% of at least one such injury) and an estimated 0.02 to 0.08 worker fatalities (0.002 to 0.003 average annual fatalities) (with a probability of 2% to 8% of at least one such fatality);

- For a facility at the Forest Street Site, an estimated 2.92 to 7.23 non-fatal injuries to workers (0.36 to 0.38 average annual non-fatal injuries) (with a probability of 95% to 100% of at least one such injury) and an estimated 0.02 to 0.05 worker fatalities (0.003 average annual fatalities) (with a probability of 2% to 5% of at least one such fatality); and

- For a facility at the Rising Pond Site, an estimated 2.82 to 16.4 non-fatal injuries to workers (0.35 to 0.41 average annual non-fatal injuries) (with a probability of 94% to 100% of at least one such injury) and an estimated 0.02 to 0.11 worker fatalities (0.003 average annual fatalities) (with a probability of 2% to 11% of at least one such fatality).

9.3.8 Implementability

9.3.8.1 Technical Implementability

The technical implementability of TD 3 has been evaluated in terms of the following factors:

General Availability of Technology: The labor, materials, and equipment needed to implement TD 3 at any of the three potential locations are readily available. These include equipment, such as mechanical excavators and bulldozers, transport equipment such as trucks and conveyors, and other common landfill construction materials (i.e., geosynthetic clay liner, flexible impermeable membrane liner, leachate piping).

Ability To Be Implemented: Upland landfills are routinely constructed and operated as a means to contain contaminated material. It is anticipated that an Upland Disposal Facility could be constructed at any of the three potential locations using conventional construction methods, and that disposal operations for the excavated sediments and soils could likewise be performed using conventional equipment to place and compact the sediments and soils. Construction and operation of a disposal facility at the Forest Street Site would require a more complicated design than would a facility at either the Woods Pond or Rising Pond Site. This stems from the fact that specialized construction equipment and techniques would likely be required at the Forest Street Site due in part to its steep terrain and potentially shallow bedrock conditions.

Reliability: Experience at other sites indicates that an Upland Disposal Facility would be a reliable means of containing sediments and soils containing PCBs. A discussion of on-site landfill use at other sites was previously provided in Section 9.3.5.2.

Availability of Space for Facilities: The three potential locations are of sufficient size to support construction of an Upland Disposal Facility. The required size of the Upland Disposal Facility and any support areas would be developed based on the sediment and soil volumes for the selected remedy. At the Rising Pond Site, there are approximately 106 acres suitable for constructing an Upland Disposal Facility, which could contain a maximum soil/sediment volume of 2.9 million cy. The Woods Pond and Forest Street Sites are smaller – they would be able to hold maximum volumes of approximately 2.0 million cy and 1.0 million cy, respectively. As previously mentioned, for disposal volumes up to approximately 1.0 million cy, any of the identified sites could be used; and for disposal volumes greater than approximately 1.0 million cy, a disposal site that has sufficient capacity to handle the necessary volume or a combination of two disposal sites would be used.

Availability of Equipment, Materials, and Personnel: As noted above, equipment, materials, and personnel necessary to construct, operate, monitor, and maintain an Upland Disposal Facility at any of the three potential locations are readily available.

Ease of Conducting Additional Corrective Measures: Although the facility components are not expected to fail, if it should be determined during routine OMM activities that the cap, liner, or leachate collection systems are not providing adequate containment, an assessment would be conducted to determine the need for and methods of repair. The effort required would depend on the nature and extent of the deficiency. As noted previously, it is currently anticipated that repairs could be made using labor and materials that are readily available.

Ability to Monitor Effectiveness: The effectiveness of TD 3 at any of the three potential locations would be maintained over time through visual inspections and periodic groundwater and stormwater monitoring. The standard approaches for monitoring the effectiveness of TD 3 are considered proven and readily available.

9.3.8.2 Administrative Implementability

The evaluation of the administrative implementability of TD 3 has included consideration of regulatory requirements, need for access agreements, and coordination with government agencies.

Regulatory Requirements: Implementation of TD 3 would be an "on-site" activity for purposes of the permit exemption set forth in Section 121(e) of CERCLA and Paragraph 9.a of the CD. As such, no federal, state, or local permits or approvals would be required. However, this alternative would be required to meet the substantive requirements of applicable regulations that are designated as ARARs (unless waived). An evaluation of compliance with potential ARARs for construction and operation of an Upland Disposal Facility at the three potential locations is included in Tables T-3.a though T-3.i in Appendix C and was summarized in Section 9.3.4.

Access: GE is the current owner of the Rising Pond Site and has the right to acquire the Woods Pond and Forest Street sites. Thus, GE has or can obtain the right to permanent access to each site to construct and operate an Upland Disposal Facility. Upon site approval, it would be necessary for GE work with utility companies and other easement holders to ensure the appropriate site access to construct and operate the facility.

Coordination with Agencies: Both prior to and during implementation of TD 3 at any of the three potential locations, GE would need to coordinate with EPA, as well as state and local agencies to provide support with public/community outreach programs.

9.3.9 Cost

Estimated total costs to implement TD 3 have been calculated for each potential location, based on a range of disposal volumes. These costs represent the range of estimated labor, equipment, and materials costs for the construction, operation, closure, and post-closure care of an Upland Disposal Facility for the minimum and maximum volume scenarios at each of the three identified sites. The low-end volume is based on the combination of SED 3 and FP 2 (combined 191,000 *in situ* cy) for all three potential locations. The high-end volumes vary for the three sites based on the largest Upland Disposal Facility that can be constructed at each site and thus are not comparable – i.e., Forest Street Site's capacity is approximately 1.0 million cy, Woods Pond Site's capacity is 2.0 million cy, and Rising Pond Site's capacity is 2.9 million cy (which is equivalent to the combined *in situ* volume for SED 8 and FP 7). The estimated costs differ for the three potential locations for an Upland Disposal Facility, as described below. In addition, for each location, total estimated present worth costs were developed using a discount factor of 7%, an assumed overall duration ranging from 10 years (the estimated duration for SED 3 and FP 2)[517] to 19, 29, or 52 years

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[517] Note that the minimum duration for determining present worth costs (10 years) is different from the shortest possible duration for implementing sediment and floodplain alternatives (5 years, as discussed above), because the former is the estimated duration for the alternatives that involve the lowest removal volume and thus comprise the basis for the lower-bound cost estimate (SED 3 and FP 2).

(the estimated maximum durations of TD 3 for a disposal facility at the Forest Street, Woods Pond, and Rising Pond Sites, respectively, based on their disposal capacities), and a post-closure OMM period of 100 years. More detailed information and assumptions underlying these cost estimates for each of the potential locations for an Upland Disposal Facility are included in Appendix Q.

Cost Estimate for TD 3 at Woods Pond Site

The total costs to implement TD 3 at the Woods Pond Site range from $42 M to $125 M (not including costs associated with sediment and floodplain soil removal activities), with the low end based on the combination of SED 3 and FP 2 (191,000 cy) and the high end based on a maximum capacity of approximately 2.0 million cy. The capital costs (which include construction and closure of the Upland Disposal Facility) range from $17 M to $48 M. Annual operations costs estimated for the transport to and placement of sediments and soils in the Upland Disposal Facility range from $1.2 M to $1.9 M per year, resulting in total operations costs of approximately $9 M to $55 M. The range of annual monitoring and maintenance costs assumed to be incurred after closure of the Upland Disposal Facility are approximately $250,000 to $361,000 per year, resulting in total post-closure monitoring and maintenance costs of approximately $16 M to $22 M. The following summarizes the total costs estimated for implementation of TD 3 at the Woods Pond Site.

TD 3 – Woods Pond Site	Minimum Est. Cost	Maximum Est. Cost[1]	Description
Total Capital Cost	$17 M	$48 M	Total cost for engineering, labor, equipment, materials associated with construction, and closure
Total Operations Cost	$9 M	$55 M	Total operations cost for placement of sediments and soils
Total Post-Closure Monitoring and Maintenance Cost	$16 M	$22 M	Total cost for performance of the 100-year post-closure monitoring and maintenance program
Total Cost for Alternative	$42 M	$125 M	Total cost for TD 3 in 2010 dollars

[1] Maximum estimated cost is based on an Upland Disposal Facility with a maximum capacity of 2.0 million cy.

The range of total estimated present worth cost (developed as described above) for implementation of TD 3 at the Woods Pond Site is approximately $21 M to $45 M.

Cost Estimate for TD 3 at Forest Street Site

The total costs to implement TD 3 at the Forest Street Site range from $53 M to $141 M (not including costs associated with sediment and floodplain soil removal activities), with the low end based on the combination of SED 3 and FP 2 (191,000 cy) and the high end based on a maximum capacity of approximately 1.0 million cy. The capital costs (which include construction and closure of the Upland Disposal Facility) range from $28 M to $84 M. Annual operations costs estimated for the transport to and placement of sediments and soils in the Upland Disposal Facility range from $1.2 M to $1.8 M per year, resulting in total operations costs of approximately $9 M to $34 M. A range of annual monitoring and maintenance costs assumed to be incurred after closure of the Upland Disposal Facility are approximately $251,000 to $368,000 per year, resulting in total post-closure monitoring and maintenance costs of approximately $16 M to $23 M. The following summarizes the total costs estimated for implementation of TD 3 at the Forest Street Site.

TD 3 – Forest Street Site	Minimum Est. Cost	Maximum Est. Cost[1]	Description
Total Capital Cost	$28 M	$84 M	Total cost for engineering, labor, equipment, materials associated with construction, and closure
Total Operations Cost	$9 M	$34 M	Total operations cost for placement of sediments and soils
Total Post-Closure Monitoring and Maintenance Cost	$16 M	$23 M	Total cost for performance of the 100-year post-closure monitoring and maintenance program
Total Cost for Alternative	$53 M	$141 M	Total cost for TD 3 in 2010 dollars

[1] Maximum estimated cost is based on an Upland Disposal Facility with a maximum capacity of 1.0 million cy.

The total range of estimated present worth cost (developed as described above) for implementation of TD 3 at the Forest Street Site is approximately $29 M to $68 M.

Cost Estimate for TD 3 at Rising Pond Site

The total costs to implement TD 3 at the Rising Pond Site range from $36 M to $201 M (not including costs associated with sediment and floodplain soil removal activities), with the low end based on the combination of SED 3 and FP 2 (191,000 cy) and the high end based on the combination of SED 8 and FP 7 (combined 2.9 million cy). The capital costs associated with this range of estimated volumes (which include construction and closure of the Upland Disposal Facility) are $9.3 M to $67 M, as determined by the size of the Upland

Disposal Facility and associated appurtenances. Annual operations costs estimated for the transport to and placement of sediments and soils in the Upland Disposal Facility range from $1.5 M to $2.7 M per year, resulting in total operations costs of approximately $11 M to $110 M. Annual monitoring and maintenance costs assumed to be incurred after closure of the Upland Disposal Facility range from approximately $246,000 to $378,000 per year, resulting in total post-closure monitoring and maintenance costs of approximately $15 M to $24 M. The following summarizes the total costs estimated for implementation of TD 3 at the Rising Pond Site.

TD 3 – Rising Pond Site	Minimum Est. Cost	Maximum Est. Cost[1]	Description
Total Capital Cost	$9.5 M	$67 M	Total cost for engineering, labor, equipment, materials associated with construction, and closure
Total Operations Cost	$11 M	$110 M	Total operations cost for placement of sediments and soils
Total Post-Closure Monitoring and Maintenance Cost	$15 M	$24 M	Total cost for performance of the 100-year post-closure monitoring and maintenance program
Total Cost for Alternative	$36 M	$201 M	Total cost for TD 3 in 2010 dollars

[1] Maximum estimated cost is based on an Upland Disposal Facility with a maximum capacity of 2.9 million cy.

The range of total estimated present worth costs (developed as described above) for implementation of TD 3 at the Rising Pond Site is approximately $17 M to $49 M.

9.3.10 Overall Protection of Human Health and the Environment – Conclusions

As explained in Section 9.3.2, the evaluation of whether TD 3 would provide overall protection of human health and the environment draws upon the evaluations under several other Permit criteria, discussed in prior sections.

General Effectiveness: As discussed in Section 9.3.5, implementing TD 3 at any of the three potential locations would provide long-term effectiveness by permanently isolating the PCB-containing sediments and soils in an Upland Disposal Facility with appropriate liner, cover, and leachate collection systems. The materials placed in the facility would be isolated from underlying soils and groundwater and from surface receptors, which would prevent contact by human and ecological receptors with those materials. OMM activities for the Upland Disposal Facility would be conducted to ensure the long-term stability of the facility. In addition, access restrictions would prohibit interference with the facility or any change in land use and thus help maintain the long-term effectiveness of this alternative.

Compliance with ARARs: As discussed in Section 9.3.4, review of the potential ARARs for TD 4 indicates that implementation of TD 4 at any of the identified locations would meet certain of those ARARs, provided that any necessary determinations are obtained from EPA (e.g., a risk-based determination under EPA's TSCA regulations or, if necessary, a finding that there is no practicable alternative with less adverse impacts on wetlands or the aquatic ecosystem and that all practicable steps to minimize or mitigate such impacts would be employed). However, there is a limited number of potential ARARs that may not be met – e.g., the MESA prohibition on a take of a state-listed species under the maximum configuration at the Rising Pond Site, and certain federal or state hazardous waste requirements in the highly unlikely event that the materials to be placed in the Upland Disposal Facility should be found to constitute hazardous waste. If these requirements did apply and were considered ARARs, they would need to be waived as technically impracticable to meet or on some other ground.

Human Health Protection: An Upland Disposal Facility at any of the potential locations would provide protection of human receptors by permanently isolating the PCB-containing sediments and soils from those receptors. Access and deed restrictions would be employed to limit use of the site, and long-term monitoring and maintenance would be conducted to protect against future releases of and exposures to the contained PCBs. As such, TD 3 would provide protection of human health and would not be expected to cause long-term adverse impacts on human health.

Environmental Protection: An Upland Disposal Facility would provide protection of ecological receptors by permanently isolating the PCB-containing sediments and soils from those receptors. At the same time, implementation of TD 3 would result in the loss of the habitat within the footprint of the Upland Disposal Facility (plus adjacent areas for support facilities and transportation access). Since the Upland Disposal Facility would be placed outside of the 500-year floodplain of the River and away from or with minimal impacts on wetlands, it would not impact such sensitive habitats. The principal ecological impacts of interest would consist of the permanent loss of forested upland habitat in the area of the facility, with the consequent loss of the wildlife species that use that habitat. The extent of that loss would vary depending on the selected location for the facility and the size of the facility, as discussed below.

- At the Woods Pond Site, the minimum operational footprint of an Upland Disposal Facility would primarily affect disturbed land that is or was used for the long-term sand and gravel quarry operations (over 21 acres), with only a small amount of forested upland habitat (3.4 acres). Thus, under this scenario, no significant long-term adverse ecological impacts would be expected. The maximum operational footprint would affect a greater amount of upland forest habitat (21 acres), as well as a 0.4-acre shrub swamp, where the clearing would have long-term negative impacts on the ability of those areas to support wildlife. However, even under this scenario, the majority of the affected area (38 acres) consists of previously disturbed land for the sand and gravel quarry operations, and the impacted forest and shrub swamp habitats would constitute only very small portions of those overall habitats in and near the Rest of River area.

- At the Forest Street Site, the operational footprint of an Upland Disposal Facility would affect a larger amount of upland forest habitat – 41 to 93 acres. Such impacts would represent a substantial encroachment into existing areas of contiguous forested habitat, and would have negative impacts on the capacity of the forested area to support interior forest wildlife species, with the extent of those impacts dependent on the size of the facility. On the other hand, these impacts would be localized to the area of the Upland Disposal Facility, rather than extending throughout the Rest of River area.

- At the Rising Pond Site, the operational footprint of an Upland Disposal Facility would affect 27 to 80 acres of upland forest habitat (as well as a 0.5-acre forested wetland under the maximum operational footprint). Again, this clearing would have negative impacts on the capacity of the forested area to support forest wildlife species (with the extent of those impacts dependent on the size of the facility). Further, since the affected forested area is situated along the Housatonic River corridor, the clearing would fragment the forested corridor in that area. In addition, the maximum operational footprint at this site would affect a portion of mapped Priority Habitat for the state-listed wood turtle. Again, however, these impacts would be localized to the area of the disposal facility, rather than extending throughout the Rest of River.

Summary: Based on the above considerations, it is concluded that implementation of TD 3 at any of the potential locations would provide overall protection of human health and the environment.

9.4 Evaluation of Chemical Extraction (TD 4)

9.4.1 Description of Alternative

TD 4 involves treatment of the removed sediments and soils by chemical extraction. In general terms, chemical extraction is the process of mixing an extraction fluid/solvent with removed sediment and soil, so that PCBs in the sediment or soil are preferentially transferred into the extraction fluid. The resulting PCB-containing fluid is then treated or disposed of. The specific extraction fluid and the equipment and processes used to separate the extraction fluid from the treated sediment or soil vary and are vendor-specific. Although several vendors have historically developed and used various solvents and equipment with varying degrees of success, no commercially available chemical extraction processes for extracting PCBs from soils and sediments comparable to those from the Rest of River have been identified.

At EPA's request, a bench-scale study of chemical extraction was performed to more fully evaluate this alternative in the CMS. The BioGenesis^{SM} Soil Washing process was selected as the representative chemical extraction treatment technology, and a bench-scale study of this process was conducted in accordance with a work plan approved by EPA on July 31, 2007. The study was conducted during October and November 2007 using sediments and floodplain soils from the Rest of River area. A detailed description of the bench-scale study and its findings is provided in the Bench-Scale Treatability Study Report included as Appendix O to this CMS Report.

Section 9.4.1.1 describes the overall remedial approach based on the assumption that the BioGenesis^{SM} process would be used for chemical extraction if TD 4 were implemented. Section 9.4.1.2 then describes the results of the bench-scale study of the BioGenesis^{SM} process, as well as some implications for the use of that process at this site.

9.4.1.1 General Remedial Approach

This section summarizes the general remedial approach for implementation of TD 4, based on the assumption that the BioGenesis^{SM} process would be used. It should be noted that while details on facility configuration, construction, operation, and disposal are provided in this description for purposes of the evaluations in this Revised CMS Report, the specific methods and facility components for implementation of this alternative would be determined during the design process based on engineering considerations and site conditions.

Site Selection, Procurement, and Preparation: The first step in implementing TD 4 would be to select a site on which to construct the treatment facility. GE has identified such a site on GE-owned property along New Lenox Road (known as the former DeVos property). For purposes of this Revised CMS Report, it has been assumed that a chemical extraction unit with support areas (staging areas and access roads) would require approximately 5 acres. A potential 5-acre area within the above-referenced GE property is shown on Figure 9-13. While this area is located within the 100-year floodplain and, in part, within 200 feet of the River, it is outside the 1 mg/kg PCB isopleth and is also situated outside the 20-acre area on this property that is currently subject to an Agricultural Preservation Restriction. However, based on review of Massachusetts GIS wetlands mapping, the 5-acre area identified for this facility contains a small wetland, and the access road to this area from

New Lenox Road would cross an additional wetland.[518] In addition, as also shown on Figure 9-13, the area identified for this facility, like virtually all the floodplain within the PSA between the Confluence and Woods Pond Dam, is located within areas that have been designated by the NHESP of the MDFW as Priority Habitats and Estimated Habitats of state-listed species.

Site preparation activities would include clearing, grubbing, and the construction of site infrastructure. For purposes of the CMS, it has been assumed that this would include construction of an approximately 30,000-square-foot (sf) building to house the chemical extraction and water treatment facilities. For the purposes of the Revised CMS Report, it has been assumed that a treatment facility capable of treating 20 to 40 cy per hour (depending on the combined size of the selected sediment and floodplain alternatives) would be constructed for the processing of material. Additional facilities would include access roads and materials staging areas. Although most of these would already be in place as a component of the sediment and floodplain alternatives, the space for the building and additional staging area to manage both untreated and treated materials would be in addition to that needed for the selected sediment or floodplain alternatives.

Treatment Process: Once the facilities are in place, dredged/excavated materials would be transported to the treatment facility and staged for processing. The BioGenesis℠ Soil/Sediment Washing Technology is a patented process, which uses impact forces and proprietary chemicals to remove organic and inorganic contamination from soil and sediment particles. The technology is designed to treat both coarse-grained (sand- and gravel-sized) and fine-grained (silt- and clay-sized) materials. The BioGenesis℠ Soil/Sediment Washing Technology would involve a total of nine individual steps. A schematic diagram of the BioGenesis℠ Soil/Sediment Washing Process is presented on Figure 2-1 in the BioGenesis' Report included in Appendix O. The steps involved in this process are described in detail in that report and summarized briefly below.

1. Soil/Sediment Preparation – The initial step in the process involves preparation of the removed soil and sediment, screening of those materials, and storage of fine-grained materials before processing. Rocks and debris are removed, rinsed, and recycled or appropriately disposed. Coarse sand and gravel (> 1 mm) are separated from the fine-grained solids (< 1 mm) for treatment.

[518] As discussed further in Section 9.4.4, it is unknown whether these wetlands would meet the jurisdictional prerequisites for regulation under certain federal and state regulations such as those under the Clean Water Act. This issue would be investigated during design.

2. Attrition Scrubbing/Aeration – In this step, the coarse sands and gravels are treated using proprietary washing chemicals to reduce the affinity between the contaminants and the soil/sediment particles in an attrition scrubber. Aeration/flotation is then used to separate the lighter fine-grained silts/clays and the organic material from the washed coarse sand and gravel.

3. Bulk Organics Removal – In this step, the fine-grained solids (< 1 mm) from Step 1 and the wash water (containing silts, clays and organic material) from Step 2 are processed through a two-stage preprocessing step. The soil/sediment slurry is subjected to high-pressure water and then pumped to a series of hydrocyclones to concentrate the soil/sediment particles and remove the light naturally occurring organic material. At the end of this step, a significant portion of the naturally occurring organic material is removed from the system in an aqueous phase and the clumped soil/sediment particles are disaggregated.

4. Chemical Addition and Mixing - Next, proprietary chemicals (surfactants and defoamers) are added to the concentrated soil/sediment slurry, which is then pumped to a second preprocessor unit that utilizes high-pressure water to mix the washing chemicals with the soil/sediment particles and prepare them for Step 5.

5. Application of Collision Impact Forces – In this step, the soil/sediment slurry from Step 4 is pumped to the collision chamber where high-pressure water is used to create impact forces to strip the biofilm layer and adsorbed contaminants from the individual solid/sediment particles. At the end of this step, contaminants that were adsorbed to the individual solid particles, as well as the naturally occurring organic material and biofilm, are transferred to the aqueous phase.

6. Organic Contaminant Oxidation – In this step, hydrogen peroxide, a strong oxidizing agent, is added to the sediment slurry upstream of a cavitation/oxidation unit. In this unit, air bubbles created in the slurry implode and enhance the ability of hydrogen peroxide to oxidize and potentially destroy organic contaminants.

7. Solid/Liquid Separation – The solid/liquid separation step includes several devices (screens, hydrocyclones, and a centrifuge) operated in series to separate the solids into fractions with decreasing grain sizes. The treated soil/sediment solids separated from the aqueous phase are then temporarily stockpiled.

8. Wastewater Treatment – The liquid fraction from Step 7 contains inorganic and organic contaminants, naturally occurring organic material, and residual fine-grained soil/sediment particles containing elevated PCB concentrations. In Step 8, standard wastewater treatment processes are used to treat the contaminants in this wastewater

prior to discharge (if allowed under an applicable NPDES permit or other appropriate authorization) or disposal at a permitted off-site facility. Specifically, an appropriately sized thickener or other removal system for very fine-grained particles, capable of handling perhaps 50% of the total sediment plant feed, would need to be added. The water treatment sludge from this process must be disposed of.

9. Preparation for Disposition of Treated Solids – In this step, the coarse-grained treated solids from Step 2 (Attrition Scrubbing/Aeration) and the fine-grained solids from Step 7 (Solid/Liquid Separation) are re-combined into the treated soil/sediment. The treated soil/sediment retains some of the physical characteristics of the untreated soil/sediment (i.e., grain size distribution, mineralogy, etc.) without the naturally occurring organic material and contaminants. The ultimate disposition of the treated sediment/soil is dependent on the residual concentration of the material and regulatory requirements. (The implications of the bench-scale treatability study for disposition of this material are discussed in Section 9.4.1.2.)

For purposes of this Revised CMS Report, this alternative has been evaluated for the range of potential volumes of sediments and floodplain soils that could be removed from the River and floodplain under the array of sediment and floodplain soil alternatives discussed in Sections 6 and 7. Specifically, this range extends from a low of 191,000 *in situ* cy, based on a combination of SED 3 and FP 2 to a high of 2.9 million *in situ* cy, based on a combination of SED 8 and FP 7. The assumed duration for implementation of TD 4 consists of a range from the shortest to the longest – specifically, from 5 years (for the shortest-duration sediment alternative, SED 10) to 52 years (for the longest-duration alternative, SED 8), assuming that any floodplain remediation could be implemented within these same time periods.[519]

Restoration: Under TD 4, following completion of treatment operations, facility structures, staging areas, and access roads would be removed, and areas disturbed by the construction activities would be restored, to the extent practicable. The treatment system

[519] Note that the combination of sediment and floodplain alternatives with the shortest duration (SED 10 and FP 9) is not the same as the combination with the smallest volume (SED 3 and FP 2). For the evaluations in this section that are based on removal volumes, the latter combination is used as the basis for the lower end of the range. In addition, quantitative evaluations that assess active treatment or disposal operations (e.g., truck trips, traffic accident risks, risks to workers) are based on the assumed years of operation, rather than overall duration. The years of operation represent the number of years during which materials removed from the River and floodplain would be actively transported to and treated at the chemical extraction facility (i.e., excluding years when the only activities being conducted under the sediment and floodplain alternatives would be capping, backfilling, or restoration activities). For TD 4, the assumed years of operation range from approximately 8 years based on SED 3 and FP 2 (the smallest-volume combination) to approximately 40 years based on SED 8 and FP 7.

itself would be decontaminated, dismantled, and transported off site. Any fill material brought onto the site to support the facilities would be removed, and surface soils would be restored by tilling and scarification. An appropriate grassland seed mix would be sown and established over the disturbed area.

Post-Treatment Monitoring and Maintenance: Following restoration of the disturbed areas, monitoring and maintenance of the restored areas would be conducted. For purposes of this Revised CMS Report, it is assumed that this monitoring and maintenance would be conducted for 5 years following completion of restoration.

9.4.1.2 Bench-Scale Treatability Study

Bench-scale testing was performed to further evaluate the potential for chemical extraction to be used as a treatment for sediments and soils from the Rest of River, as requested by EPA. The BioGenesis^{SM} Soil and Sediment Washing Process (BioGenesis process) was selected as the representative chemical extraction treatment technology, and a bench-scale study of this process was conducted in October and November 2007 in accordance with a work plan developed by BioGenesis and approved by EPA on July 31, 2007. A detailed description of the testing and results is included in the BioGenesis Report included as Appendix O. An additional analysis of the data from this study, including a more detailed analysis of the potential for reuse of material treated by this process as backfill in the River or floodplain, has been conducted and is presented in Appendix P. A summary of the bench-scale testing and the additional analysis is provided here, and key findings as they pertain to the CMS evaluation are discussed, where relevant, under the individual evaluation criteria in the following sections.

Bench-scale testing was performed using the BioGenesis^{SM} process on three types of representative materials from the River and floodplain:

- Coarse-grained sediment (TS-SED-A) – Sediment collected from the beginning of Reach 5A, with PCB concentrations ranging from 63 to 80 mg/kg. TS-SED-A contained 23% gravel, 72.8% sand, and 4.2% silt and clay.
- Fine-grained sediment (TS-SED-B) – Sediment collected from the eastern shore of the headwaters of Woods Pond (Reach 6), with PCB concentrations ranging from 110 to 180 mg/kg. TS-SED-B contained 0.2% gravel, 14.1% sand, 67.6% silt and 18.1% clay.
- Fine-grained soils (TS-SO-A) – Soils collected from the floodplain of the River south of New Lenox Road, with PCB concentrations ranging from 45 to 55 mg/kg. TS-SO-A contained 0.1% gravel, 24.0% sand, 55.1% silt, and 20.8% clay.

As part of the bench-scale study, BioGenesis performed jar tests and optimization tests on TS-SED-A, TS-SED-B, and TS-SO-A in accordance with the Work Plan. Certain process steps described in Section 9.4.1.1 above were omitted by BioGenesis for the TS-SED-B and TS-SO-A during the bench-scale study to better accommodate the various material types.

In general, each material was tested three times using the optimized proportions of reagents and conditions determined from their respective jar tests. However, for TS-SED-A, material greater than 425 microns was processed once through the system and for TS-SED-B and TS-SO-A material greater than 850 microns was screened out as a waste. After the first treatment cycle, treated solids from the Solid/Liquid Separation step were recombined and processed two additional times and analyzed, and the mass balance calculations were repeated to evaluate the extent of any reductions in PCB concentrations associated with multiple processing cycles. Samples were collected before and after various steps of the process. Samples of wastewater were also collected following treatment activities. Samples were analyzed for PCB Aroclors and certain samples were also analyzed for PCB congeners and dioxins and furans. Samples were also collected and analyzed for grain size, TOC, TSS, and total dissolved solids (TDS) to provide additional information on the process.

The results of the bench-scale testing are presented in Tables 4-1 through 4-3 of the BioGenesis Report (provided as Appendix O). In summary, they show the following:

- In the fine-grained sediment (TS-SED-B), initial concentrations ranged from 110 to 180 mg/kg. The treated sediment was sampled in two grain size fractions. PCB concentrations in those treated sediments after the first treatment cycle were in the range of 16 to 21 mg/kg and 9 to 60 mg/kg, respectively, with overall weighted averages of 12 to 48 mg/kg in the combined material. Somewhat lower concentrations were obtained after additional treatment cycles, with overall weighted average PCB concentrations after the third treatment cycle of 11 to 18 mg/kg.

- In the fine-grained floodplain soil (TS-SO-A), initial concentrations ranged from 45 to 55 mg/kg. The treated soil was sampled in two grain size fractions. PCB concentrations in those treated soils after the first treatment cycle were in the range of 5 to 7 mg/kg and 7 to 44 mg/kg, respectively, with overall weighted averages of 7 to 19 mg/kg in the combined material. Somewhat lower concentrations were obtained after additional treatment cycles, with overall weighted average PCB concentrations after the third treatment cycle of 4 to 8 mg/kg.

- In the coarse-grained sediment (TS-SED-A), initial concentrations ranged from 63 to 80 mg/kg. The treated sediment was sampled in five grain size fractions. PCB concentrations in the treated sediments after the first treatment cycle were lower in the larger grain-size material (< 1 mg/kg to 2.8 mg/kg in the two largest grain-size fractions [> 425 microns]), intermediate in the intermediate grain-size fraction (~ 40 to 50 mg/kg), and highest in the two smallest grain-size fractions (55 to 143 mg/kg); and the overall weighted averages in the combined material ranged from 13 to 30 mg/kg. Lower concentrations were obtained after additional treatment cycles, with the overall weighted average PCB concentrations after the third treatment cycle ranging from 5 to 22 mg/kg. The material greater than 425 microns was only treated once, but was included in the calculations of the weighted concentration of all the treated sediment for the second and third treatment cycles to provide a complete data set for the purposes of calculating a final weighted average concentration for each treatment cycle.

EPA collected split samples of untreated and treated materials for PCB Aroclor analysis. As noted in Appendix O, the EPA split sample data correlated fairly well with the original sample results.

Selected samples were also analyzed for PCB congeners as well as dioxins and furans. On a sample-by-sample basis, the concentrations of total PCB congeners were comparable to the total PCB Aroclor concentrations. The concentrations of dioxins/furans and PCBs were generally lower in treated materials than in untreated materials. These data suggest that the process does not create dioxins or furans; however, as noted below, insufficient data were collected to provide definitive mass balance information for these compounds.

An evaluation of the effectiveness of the BioGenesis process, and especially of multiple treatment cycles using that process, is complicated by the loss of solids observed during the bench-scale testing, which resulted in a failure to complete a mass balance. A total of 11% to 40% of the initial mass was unaccounted for following the first treatment cycle and 23% to 60% of the solids were unaccounted for after three treatment cycles. The inability to achieve closure to the mass balance makes it difficult to fully understand the mechanism for treatment and, therefore, to evaluate effectiveness. BioGenesis has stated that the poor mass balance is attributable to the batch sequence process used for bench-scale testing. The limitations of the bench-scale equipment with regard to completing mass balance constitute one of the concerns raised in available literature for bench-scale studies performed by BioGenesis at other sites (see Appendix P, Section 4). Significant amounts of aqueous mixture and fine-grained particulate material remained in the equipment and piping between each piece of equipment used in the bench-scale process. Subsequent cleaning and rinsing of the lines between each run effectively removed these materials and prevented cross-contamination between runs. Because this rinse water was not representative of the treatment process, it was not analyzed and was disposed of separately. Therefore, the amount of solids and the PCBs associated with those solids could not be determined at bench scale. This would not be expected at full scale, since equipment would be operated in a continuous mode rather than in batch mode.

Examination of the data suggests that the effectiveness of the process may be largely a function of the removal of solids – specifically, how much of the higher-concentration, finer-grained material is removed from the material during successive treatment cycles – rather than dissolution-based removal of PCBs. If this is the case, additional treatment cycles would simply continue to remove more solids (which would be transferred to the wastewater), rather than reduce the PCB concentrations of the remaining solids. This possibility is consistent with the observation that the treated materials with the lowest concentrations (apart from the largest size fraction) did not show significant reductions in PCB concentrations between the second and third treatment cycles, indicating that additional treatment would not reduce concentrations further.

To allow treated materials to be reused as backfill, it is expected that the treatment process would have to reliably and consistently achieve PCB levels below 1 or 2 mg/kg in the materials, and even these concentrations may not be low enough to allow reuse in some areas, notably in the river bed. Indeed, to the best of our knowledge, EPA has not permitted the use of PCB-containing treated material as replacement fill for river sediments. Data from the bench-scale study show that the BioGenesis process will only treat material to certain plateau levels and that these plateau levels do not approach 2 mg/kg.

Based on the results discussed above, the BioGenesis^{SM} process did not reduce the PCB concentrations in the site-specific materials to an extent that would allow on-site reuse of the material. In general, the process was able to reduce the weighted average PCB concentrations in the combined treated solids materials to concentrations that ranged from 7 to 48 mg/kg after one treatment cycle. However, the individual results from the various outputs, and particularly the smaller grain-size fractions for the coarse-grained sediment, did not achieve these relatively low concentrations at bench scale. The disposal location(s) for treated materials from the BioGenesis^{SM} process that are not suitable for reuse following treatment would depend on a number of factors. For soils and sediments that contained initial PCB concentrations at or above 50 mg/kg prior to treatment, the ability to dispose of the treated material in a solid waste (non-TSCA-permitted) landfill would require an EPA determination that such disposal would satisfy the substantive requirements of EPA's TSCA regulations for a risk-based approval (40 CFR § 761.61(c)) (hereafter referred to as a "risk-based TSCA determination"). Given that the BioGenesis^{SM} process reduced the weighted average PCB concentrations in the combined solid materials to less than 50 mg/kg, it is possible that such a risk-based determination could be obtained for some or all of those materials. If such a determination is obtained, and assuming that the materials would not constitute hazardous waste under RCRA, the treated materials could be transported to a permitted solid waste disposal facility. One possible location for disposal of such chemically treated material from the Site could be Waste Management LLC's High Acres Landfill located in New York. Possible locations for disposal in Massachusetts, which would require prior approval by the MDEP and the disposal facility, could include the Fitchburg-Westminster, Southbridge, and Bourne Landfills. (Treated materials containing PCBs less than 2 mg/kg could be reused at these Massachusetts landfills per MDEP COMM-94-007 and COMM-97-001.) Other potential locations would be evaluated during design. Treated material for which such a risk-based determination is not obtained from EPA would be required to be disposed of at a TSCA-permitted landfill. One possible location for disposal of TSCA-regulated material could be Waste Management LLC's Model City Landfill located in New York. Other potential locations would be evaluated during design. For the purposes of this Revised CMS Report, it has been assumed that all the treated solid materials could be transported to and disposed of in an off-site non-TSCA solid waste landfill in accordance with a risk-based determination from EPA.

In addition to disposing of the treated material, it would be necessary to dispose of the PCB-containing sludge resulting from the wastewater treatment process described above. Since this PCB-containing sludge would most likely contain PCBs at concentrations over 50 mg/kg, it has been assumed that that material would need to be transported to and disposed of at a TSCA-permitted disposal facility.

9.4.2 Overall Protection of Human Health and the Environment – Introduction

As discussed in Section 9.1.2, the evaluation of whether a treatment/disposal alternative would provide overall human health and environmental protection relies heavily on the evaluations under several other Permit criteria – notably, long-term effectiveness and permanence (including long-term adverse impacts), short-term effectiveness, and compliance with ARARs. For that reason, the evaluation of whether TD 4 would be protective of human health and the environment is presented at the end of Section 9.4 so that it can take account of the evaluations under those other criteria.

9.4.3 Control of Sources of Releases

The chemical extraction process itself would not control sources of releases. However, as noted above, it is assumed that the treated PCB-containing sediments and soils would be transported to an off-site permitted landfill for disposal. Such disposal would effectively eliminate the potential for those PCB-containing materials to be released and transported within the River or onto the floodplain. Once placed in an off-site landfill and covered, the material would be permanently isolated from the environment. In the event that such material should be inadvertently released (e.g., from a spill during transport), it would have a lower PCB concentration that it would have if the material had not been treated.

In addition, the wastewater generated by the treatment process would be treated using conventional methods prior to discharge, and the sludge from that treatment process would be transported off-site for disposal, which would prevent future releases of that material (unless there were a spill during transport).

9.4.4 Compliance with Federal and State ARARs

The potential ARARs identified by GE for TD 4 in accordance with directions from EPA are listed in Tables T-4.a through T-4.c in Appendix C. No chemical-specific ARARs have been identified for TD 4, although several guidances to be considered are listed in Table T-4.a.

The potential location-specific and action-specific ARARs for TD 4 are listed in Tables T-4.b and T-4.c.[520] Review of those ARARs indicates that TD 4 could be designed and implemented to achieve certain of those ARARs, but that there are some potential ARARs that would require a specific EPA approval or finding or would not be met. These include the following:

- There are no specific TSCA regulations relating to chemical treatment of PCB-containing wastes. Hence, it would likely be necessary to obtain EPA's determination that the chemical extraction process meets the substantive criteria for a risk-based approval under 40 CFR § 761.61(c). (In addition, although requirements relating to off-site disposal are not ARARs, it should be noted, as mentioned above, that a risk-based TSCA determination from EPA would be needed to allow disposal of treated materials that originally contained PCBs $\geq$ 50 mg/kg in a non-TSCA landfill.)

- It is uncertain whether the small wetlands that would be affected by the construction and operation of a chemical treatment facility at the identified site (as described in Section 9.4.1.1) would constitute "waters of the United States" under EPA's and the Corps of Engineers' Section 404 regulations (40 CFR Part 230, 33 CFR Parts 320-323), as well as the Massachusetts water quality certification regulations (314 CMR 9.06), governing discharges of dredged or fill material into such waters (314 CMR 9.06). That issue would be investigated during design. If they do (and if these regulations are ARARs), these regulations would require that there be no practicable alternative with less adverse impact on the wetlands. In that case, EPA would have to find that there is no such practicable alternative to the selected location for the treatment facility or to waive these requirements under CERCLA and the NCP. In addition, the

[520] For the reasons discussed in Section 2.1.3, a number of these regulatory requirements do not constitute ARARs for the Rest of River remedial action, but are listed in these tables as potential ARARs per EPA's direction.

Massachusetts water quality certification regulations prohibit discharges that would adversely affect the Estimated Habitat of state-listed wildlife species. Since the treatment facility would be located within such habitat, that prohibition would not be met. Thus, EPA would need to waive that prohibition as technically impracticable to meet or on some other ground.

- It is also uncertain whether these wetlands would meet the definition of wetlands under the federal Executive Order for Wetlands Protection (E.O. 1190). If so (and if that order constitutes an ARAR), EPA would need to find, as required by that order, that there is no practicable alternative and that the project includes all practicable measures to minimize harm to wetlands, or else would need to waive those requirements. Similarly, if the federal Executive Order for Floodplain Management (E.O. 11988) constitutes an ARAR, EPA would need to find, as required by that order, that there is no practical alternative that would avoid impacts on the floodplain, or else waive that requirement.

- The Massachusetts Wetlands Protection Act regulations likewise require that there be no practicable alternative that would be less damaging to resource areas (310 CMR 10.53(3)(q)). Thus, if those regulations constitute an ARAR, EPA would have to find that there is no such practicable alternative, or else waive that requirement. Additionally, implementation of TD 4 at the former DeVos property would not meet the requirement of those regulations that implementation of the project not affect the Estimated Habitat of state-listed wildlife species (310 CMR 10.59). Accordingly, if that requirement constitutes an ARAR, EPA would need to waive it as technically impracticable to meet or on some other ground.[521]

- Implementation of TD 4 at the former DeVos property would also not meet the requirement of MESA and its implementing regulations (310 CMR 10.23) that a project not result in a “take” of a state-listed species.[522] Thus, if that requirement constitutes an ARAR, EPA would need to waive it as technically impracticable to meet or on some other ground.

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521 In addition, in the event that the implementation of TD 4 were not considered a “limited project” under 310 CMR 10.53(3)(q), it might not meet some of the other applicable requirements of the Massachusetts Wetland Protection Act regulations – e.g., the requirement to maintain a 100-foot-wide area of undisturbed vegetation along the river in a Riverfront Area (subject to certain exceptions).

522 The MESA evaluations in Appendix L indicate that implementation of TD 4 at the identified location would involve a take of at least three state-listed species. The MESA regulations contain a provision authorizing the Director of the MDFW to permit a take of a state-listed species under certain conditions (321 CMR 10.23). However, as discussed in Section 5.4, this provision does not constitute an ARAR for the Rest of River remedial action.

In addition to these requirements, as previously noted for TD 1, TD 2, and TD 3, it is not anticipated that the removed sediments and floodplain soils would constitute characteristic hazardous waste under RCRA and comparable state regulations. However, representative TCLP testing would be conducted to confirm that. In the unlikely event that any particular sediments or soils that would be subject to treatment should be determined to constitute such hazardous waste, it is anticipated that the facility components used for such waste would meet the substantive requirements of EPA's hazardous waste regulations under RCRA. With respect to state requirements, the treatment facility may be exempt from the Massachusetts hazardous waste regulations.[523] However, if it were determined that that exemption is not applicable, the facility at the identified location could not feasibly meet certain location standards set forth in those regulations for hazardous waste treatment/storage facilities (e.g., the requirements that waste piles used for such storage not be located within the 500-year floodplain and that there be a 200-foot buffer to the fenceline [310 CMR 30.701(6), 30.705(3)]), and might not meet certain design requirements of those regulations (e.g., the requirement that the waste pile liner must be at least 4 feet above the probable high groundwater table [310 CMR 30.641(1)(a)]).

If TD 4 were selected, GE would first determine whether any sediments or soils that would be subject to treatment would constitute hazardous waste. If so, GE would resolve with EPA the applicability of the state hazardous waste regulations to the treatment facility at the location selected for that facility. If such requirements were deemed applicable, GE would evaluate the available options, including: (a) exploring with EPA a waiver of any requirements that would be technically impracticable to meet; or (b) segregating such waste and disposing of it separately off-site.[524]

9.4.5 Long-Term Reliability and Effectiveness

An assessment of long-term reliability and effectiveness of TD 4 has included an evaluation of the magnitude of residual risk associated with implementation of the alternative, the adequacy and reliability of the alternative, and any potential long-term adverse impacts associated with the alternative on human health or the environment.

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[523] The MCP provides that the on-site treatment of hazardous waste as part of a remedial action under the MCP is exempt from the State's hazardous waste regulations unless the MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).

[524] In addition, if the treated material were found to constitute hazardous waste, it would need to be sent to a facility authorized to receive and dispose of such waste.

9.4.5.1 Magnitude of Residual Risk

As discussed previously, the bench-scale results of the BioGenesis^{SM} process indicate that the weighted average concentrations of PCBs in the combined treated solids materials would be reduced to concentrations that could range from 7 to 48 mg/kg. The treated materials would then be disposed of in an off-site landfill. For those materials which contain PCBs at or above 50 mg/kg prior to treatment, a risk-based TSCA determination from EPA would be required to dispose of those materials in a permitted solid waste (non-TSCA) landfill. As required by the regulations governing the landfills, the materials in the off-site permitted landfills would be isolated from underlying soils and groundwater and from surface receptors, which would prevent exposure by human and ecological receptors to those materials.

Minimal residual risks are anticipated in the location where the chemical extraction process is constructed and operated, since all operations would be performed within secured areas, and the staging areas and any residual PCBs associated with the operations would be removed following completion of the chemical extraction operations.

9.4.5.2 Adequacy and Reliability of Alternative

Evaluation of the adequacy and reliability of TD 4 has included an assessment of the factors discussed below. In this regard, it should be noted that this evaluation focuses primarily on the BioGenesis^{SM} process (the process selected to represent the chemical extraction process option in the CMS), largely based on the results from the bench-scale study using Rest of River sediments and soils.

<u>Use of Technology under Similar Conditions</u>

The use of chemical extraction for the treatment of PCBs in sediments and soils has not been demonstrated at full scale under conditions that could be considered typical of the sediment and floodplain alternative volumes or PCB concentrations present in the River. A full-scale demonstration using the BioGenesis^{SM} process at 40 cy/hr was completed using approximately 15,000 cy of sediment from NY/NJ Harbor and the Lower Passaic River (BioGenesis and MWH, 2009). That project, however, was not focused specifically on reducing concentrations of PCBs, and the PCB concentrations in sediments ranged from 0.044 to 0.52 mg/kg prior to treatment and from 0.049 to 0.385 mg/kg after treatment. The BioGenesis^{SM} process was also reportedly used at the BASF Chemical Site in Kearny, New Jersey, to process 19,000 cy of soil containing phthalates and PCBs at a processing rate of 10 tons/hr (Sontag, pers. comm., 2008). The PCB concentrations in soil ranged from 10 to 27 mg/kg before treatment and less than 0.49 mg/kg after treatment. The treated soil was placed on-site and the wastewater was treated on-site and then sent to a local publicly owned treatment works (POTW).

In addition to the BioGenesis^{SM} process, other chemical extraction systems have been developed and used on other projects; however, most are no longer commercially available. These processes are somewhat different from the BioGenesis^{SM} process in that they use organic solvents to extract the contaminants rather than the aqueous surfactants used in the BioGenesis^{SM} process. Also, as noted in the following examples of other chemical extraction processes, the volumes were relatively small and the concentrations were, in some cases, low. *Ex situ* chemical treatment was applied at the Sparrevohn Long Range Radar Station Site (AK), where solvent extraction was used to reduce average PCB concentrations from 80 mg/kg in the untreated soils to 3.27 mg/kg in the treated soil (EPA, 1998a). Terra Kleen Response Group treated a total of 288 cy of stockpiled soil in 85-cy batches using solvent extraction in lined treatment cells. The solvent was reclaimed and burned on site (EPA, 1998a). Full-scale demonstration of chemical extraction using B.E.S.T. Solvent Technology for sludge impacted with PCBs was also conducted at the General Refining, Inc. Superfund site (EPA, 1993). The PCB concentrations in the 3,700 tons of sludge were reportedly reduced by approximately 99%; however, the initial concentrations in the untreated sludge ranged up to only approximately 14 mg/kg. The Springfield Township Superfund Site reportedly successfully remediated more than 12,000 tons of PCB-impacted soil with concentrations greater than 50 mg/kg by implementing a chemical extraction treatment (vendor ART International, Inc.) (EPA, 2004d). The final cleanup goal for the site was 1 mg/kg PCBs in soil and it does not appear from site documents that all of the treated soil met this goal; however, treated soils containing residual levels up to 5 mg/kg of PCBs were backfilled into the excavation areas and covered with a 1-foot thick layer of clean soil and re-vegetated (EPA, 2004d).

Overall Effectiveness and Reliability

While chemical extraction has been used in the past at various sites using the specific processes that have been described above, these processes are not in commercial operation in the United States or have not been applied under circumstances similar to the size, sediment characteristics, or concentration levels found in the River. For most projects, the volumes of PCB-impacted soils and/or sediments have been relatively small and the duration of the treatment operation has been relatively short. Thus, there is no precedent for the use of chemical extraction for a project of the size or duration, and with the range of PCB concentrations, that would be involved at the Rest of River. This creates uncertainties as to the long-term reliability of a full-scale system for this site.

One of the challenges posed by the use of chemical extraction, especially processes that use organic solvents, has been the potentially toxic, carcinogenic, flammable, and/or corrosive nature of the solvent selected for extraction. In general, the BioGenesis^{SM} process uses relatively non-hazardous chemicals that are also typical of water treatment processes. The BioGenesis^{SM} process does use hydrogen peroxide, a strong oxidizer, which must be stored and handled appropriately due to associated health and safety issues. Other issues with chemical extraction processes include difficulties with designing full-scale equipment capable of processing and treating large volumes of PCB-containing materials, especially fine-grained sediments – which are present in parts of the River. Mechanical difficulties have historically arisen as a result of the high organic, high moisture content, fine-grained sediments, which tend to clump and can clog equipment, or otherwise be physically difficult to treat.

For the BioGenesis^{SM} process, there is considerable uncertainty regarding the extent to which the PCB concentrations in sediments and soils can be reduced. As discussed in Section 9.4.1.2, to provide materials that could be considered for reuse, the treatment process would have to reliably and consistently achieve PCB levels as low as 1 or 2 mg/kg in the treated materials (or possibly even lower for reuse in the riverbed). Results from the bench-scale treatability study using Rest of River sediments and soils indicate that the concentrations cannot be reduced to these levels. Multiple treatment cycles appear to reduce concentrations to plateau levels, below which further reduction appears to be incrementally smaller or not possible within the limits of the testing. These plateau levels are significantly above 2 mg/kg (except in the largest grain-size fractions) (see Section 9.4.1.2).

The bench-scale testing does indicate that the process can treat materials so that the resulting mass-weighted average of the treated material is less than 50 mg/kg (results ranged from 7 to 48 mg/kg). In that case, a risk-based TSCA determination from EPA would be required (for materials that contained $\geq$ 50 mg/kg prior to treatment) to dispose of those materials in a permitted solid waste landfill. However, the treated material in some of the individual process outputs (prior to combining the outputs to calculate a mass-weighted average) had concentrations above 50 mg/kg. In particular, the concentrations in the smaller-grained material separated from the coarse-grained sediment ranged from 55 to 143 mg/kg after the first treatment cycle. It is uncertain whether a risk-based determination could be obtained that would allow this material to be combined with other treated material and be disposed of as non-TSCA material, or whether this material would require segregation and separate disposal. It is possible that with an additional size separation and treatment step, the concentration of these outputs could be reduced to less than 50 mg/kg, if needed. However, whether the additional treatment would be required for all material or only certain types of materials (e.g., only coarse-grained sediment) is not understood.

Further, in the bench-scale test of the BioGenesis^{SM} process, the volume of soil/sediment prior to treatment was greater than the volume of treated sediment/soil measured at the end of the process (i.e., there was sediment/soil that was unaccounted for in the test). As a result, the extent of any PCB destruction associated with TD 4 (i.e., in the Oxidation step using hydrogen peroxide) cannot be determined.

The bench-scale data show the reduction in PCBs after each treatment cycle (73% to 94% reduction in PCB concentration after 3 cycles), as well as an increase in the loss of solids (23% to 60% loss of mass after 3 cycles). Analysis of these data suggests that additional treatment cycles may serve only to continue to remove the limited amount of remaining fine-grained material, but not the PCBs on the larger material. In addition, in wastewater, the total PCB concentrations ranged from 160 µg/L to 3,340 µg/L, while the dissolved concentrations of PCBs were significantly lower, ranging from non-detect to 36 µg/L. These data indicate that the majority of PCBs recovered in wastewater are not in the dissolved phase but are associated with particulate matter. This results in some uncertainties regarding the amount of solids and the concentrations of those solids in the aqueous wastewater, as well as in the subsequent water treatment sludge, which would likely have high PCB concentrations and would also require treatment and/or disposal. This factor, in turn, creates further uncertainties regarding the effectiveness and reliability of the process if applied full-scale.

Consistent with the removal operations, if the BioGenesis^{SM} process were selected as a remedy component, it would be operated for 9 months per year, and shut down in the winter for 3 months. Depending upon the sediment and soil alternatives selected, the duration of treatment could range from approximately 5 years (if SED 10 were selected) to approximately 52 years (if SED 8 were selected). The longer the period of operation of the processing/treatment equipment, the greater likelihood would exist for periodic equipment failures and down-time. Based on the publicly available information, the BioGenesis^{SM} process has not been operated full scale over a period of more than a few months. Thus, it is difficult to predict the reliability of the equipment in the longer term.

Placement of treated soils and sediments in off-site permitted landfills is considered an effective and reliable means of disposing of the treated materials. This has been demonstrated at many sites. However, as discussed for TD 1 (Section 9.1.8.1), as the volume of treated materials requiring disposal and the length of time necessary to do so increase, the more uncertainty would exist as to whether off-site permitted landfills would have the necessary capacity available for the disposal of these materials in the future.

<u>Reliability of Operation, Monitoring, and Maintenance Requirements/Availability of Labor and Materials</u>

Following completion of treatment operations, the areas of the site disturbed by the construction activities (e.g., treatment facility area, staging areas, and access roads) would be restored to the extent practicable. A monitoring and maintenance program would then be implemented to address those areas. This program would be similar to that implemented for other upland areas and would be in place for five years following completion of restoration. Standard equipment and materials considered reliable for performing such activities would be used. Labor and materials needed to perform the monitoring and maintenance activities are expected to be readily available.

Technical Component Replacement Requirements

TD 4 would be used in combination with sediment or floodplain soil removal alternatives and would require a final disposition alternative for the treated material. Therefore, under TD 4, there would be no separate need or requirement for replacing components of the alternative under post-remediation conditions. However, during the first five years following completion of the treatment process, there may be a need for replacing soils or vegetation in the restored support areas, which should be readily implementable.

9.4.5.3 ***Potential Long-Term Adverse Impacts on Human Health or the Environment***

The evaluation of potential long-term adverse impacts of TD 4 on human health or the environment has included an assessment of several components, as described below. This evaluation focuses only on the potential long-term adverse impacts from the treatment facility. The long-term impacts associated with the removal alternatives and off-site transport/disposal, including those stemming from access roads, staging areas, and truck transport, are discussed under each of those alternatives.

Potentially Affected Populations

Implementation of TD 4 would require construction of an approximately 5-acre treatment facility, including a building for the chemical extraction equipment and staging and handling areas to segregate, store, and manage both untreated and treated materials. In the overall context of the Rest of River, the area affected would be relatively small. As such, no long-term impacts to populations of organisms would be expected beyond those that would occur in the immediate area during operation of the facility and for a period following restoration of the associated support areas, as discussed below.

Long-Term Ecological Impacts

The construction of the 5-acre treatment facility on the former DeVos property would occur within habitat that was previously altered for agricultural activity and is now open grassland with scattered shrub growth. Due to the relatively small size of the facility in the context of the Rest of River and the already altered nature of the habitat in that area, long-term ecological impacts are anticipated to be minimal. The construction and use of the treatment facility, as well as the increased noise and human presence, would impact a variety of wildlife species during the facility operation period; and the habitat alterations resulting from the facility would continue for a period of time (likely 3 to 5 years) after removal of the facility. During this period, bird species such as the eastern bluebird and red-tail hawk that utilize these open field habitats would have flight patterns disrupted and feeding grounds reduced, and small mammals such as meadow voles that live within the soft soils and white-tailed deer that graze on the abundant herbaceous vegetation would also be impacted. The facility would affect the mapped Priority Habitat of seven state-listed species,[525] a least three of which (American bittern, wood turtle, and foxtail sedge) regularly utilize this type of open field habitat and thus would be negatively impacted during this period. As shown in the MESA assessments in Appendix L, the construction and operation of a chemical extraction facility at the identified site would result in a take of at least those three state-listed species (and possibly others).

These impacts would be expected to be mainly temporary. Following removal of the facility, surface soils would be prepared and an appropriate grassland seed mix would be applied. Grassland habitat is expected to be restored within 3 to 5 years following the seeding, provided invasive species colonization is not excessive. In short, since the facility footprint represents a relatively small portion of the PSA and since this habitat has been previously altered and currently supports an early successional plant community, construction and operation of the facility and of temporary access and support areas are not anticipated to result in any significant long-term adverse ecological impacts.

Long-Term Impacts on Aesthetics and Recreational Use

Given the identified location for the chemical extraction facility in a previously altered grassland, TD 4 would not be expected to have long-term aesthetic or recreational-use impacts, beyond the temporary impacts during operation of that facility and for a short period after restoration of the affected areas.

Potential Measures to Avoid or Mitigate Long-Term Adverse Impacts

As discussed above, long-term adverse impacts from the chemical extraction facility would be minimal due to its relatively small size and the altered nature of the open grassland community. Potential measures to further minimize any such impacts include establishing

[525] Those species are American bittern, wood turtle, mustard white butterfly, foxtail sedge, and three dragonfly species.

an appropriate grassland cover over all disturbed areas after removal of the facility, as well as implementing an invasive species control program,

9.4.6 Reduction of Toxicity, Mobility, or Volume

TD 4 would involve the treatment of between 191,000 cy of sediments/soils containing 14,500 lbs of PCBs (if SED 3 and FP 2 were implemented) and approximately 2.9 million cy of material containing 94,100 lbs of PCBs (if SED 8 and FP 7 were implemented). The process would separate some of the PCBs from the sediments/soils and transfer them into an aqueous stream for wastewater treatment. The degree to which TD 4 would reduce the toxicity, mobility, and volume of PCBs is discussed below.

Reduction of Toxicity: The chemical treatment process would reduce the toxicity of soil and sediment by permanently removing some PCBs from these materials. As discussed above, bench-scale testing indicates that the BioGenesis^{SM} process would reduce the concentrations of PCBs in the treated soil and sediment by varying amounts, depending on the type of material and the number of treatment cycles. For water generated during the treatment process which would contain PCBs, water treatment processes would be used to treat the PCBs and reduce the toxicity of the water prior to discharge. However, the sludge from the water treatment process would contain elevated concentrations of PCBs and would need to be disposed of properly.

In addition, in the event that any material removed from the River or floodplain should constitute “principal threat” waste (e.g., free NAPL, drums of liquid waste), which is not anticipated, that waste would not treated in the on-site chemical extraction facility, but would be segregated and transported separately off-site for treatment and disposal, as appropriate.

Reduction of Mobility: Bench-scale data suggest that the BioGenesis^{SM} process would reduce the mobility of PCBs by removing the PCBs from the sediments/soils through the use of a proprietary blend of chemicals and surfactants. The bench-scale results indicate that the first treatment cycle removed more of the PCBs than the subsequent rounds, possibly because the PCBs that remain on the material after one treatment cycle are entrained in the material and difficult to remove. This, in turn, would suggest that the mobility of PCBs in treated material is less than for the untreated material. However, the bench-scale data indicate that the treatment process involves, at least in part, the washing of fine-grained materials with high PCB concentrations into the aqueous wastewater phase. The transfer of these materials into the wastewater would result in increased mobility of PCBs.

Ultimately, placement of the treated materials in a permitted landfill would result in the reduced mobility of PCBs by permanently isolating the PCB-containing sediments and soils from surface water infiltration, leaching to groundwater, or otherwise mobilizing.

Reduction of Volume: Treatment using the BioGenesis^{SM} process would reduce the volume of PCBs present in the removed sediments and floodplain soils; however, the extent to which PCB volumes are reduced when considering all process waste streams is questionable. During treatment, some of the finer particulate material containing PCBs would be transferred to the aqueous phase, which would ultimately require treatment prior to discharge. The process would generate approximately 1.2 to 1.4 volumes of water for each volume of sediment and would generate more than 3 times the water for each volume of floodplain soil. Although this water would be treated to meet applicable discharge limits, the treatment would generate volumes of spent carbon and water treatment sludge that would require disposal as PCB-containing material. In addition, the extent, if any, to which actual destruction of PCBs occurs during the process is unclear, since a mass balance could not be completed for the bench-scale testing.

9.4.7 Short-Term Effectiveness

Evaluation of the short-term effectiveness of TD 4 has included consideration of the short-term impacts of implementing this alternative on the environment (in terms of both ecological effects and increases in GHG emissions), on local communities and communities along truck transport routes, and on the workers involved in the treatment and disposition activities. For TD 4, short-term impacts are those that would occur during construction of the building and setting up the chemical extraction process equipment, conducting the treatment operations, and dismantling the treatment system.

Impacts on the Environment – Ecological Effects

The short-term effects on the environment resulting from the implementation of TD 4 would include potential impacts during construction of the building and setting up the chemical extraction process equipment, conducting the treatment operations (which would include moving, storage, and handling of large volumes of treated and untreated materials using heavy construction equipment), and dismantling of the treatment system. Specific impacts would depend on the area selected for construction of the treatment facility and the types of habitat affected. Construction and operation of the chemical extraction treatment system and support facilities on the former DeVos property would result in the temporary reduction of open field habitat used by a variety of birds, mammals, reptiles, and invertebrates. For example, as previously noted, bird species such as the eastern bluebird and red-tail hawk that utilize these open field habitats would have flight patterns disrupted and feeding grounds reduced, and small mammals such as meadow voles that live within the soft soils and white-tailed deer that graze on the abundant herbaceous vegetation would also be impacted. The construction and operation of the facility would also impact any state-listed species in the area. As noted above, the site is within the mapped Priority Habitat of several such species, at least three of which (American bittern, wood turtle, and foxtail sedge) regularly utilize the type of open field floodplain habitat present at this site, and the implementation of TD 4 at this site would result in a take of at least those three species.

The BioGenesis[SM] and water treatment processes use some chemicals that are in common commercial use and are generally non-toxic, if used safely. The process does use hydrogen peroxide, a strong oxidizer. These chemicals require appropriate handling, storage, and care. The potential for accidents (e.g., spills, leaks) would exist due to the storage of these chemicals at the site. In addition, the longer the time required to implement this alternative, the greater potential would exist for failure of process and control equipment and the consequent release of PCB-containing wastewaters and sludges into the environment.

Short-term effects on the environment associated with subsequent disposal of the treated material at an off-site disposal facility were discussed under TD 1 in Section 9.1.7.

<u>Carbon Footprint – GHG Emissions</u>

As described in Section 5.6 and Appendix M, an estimate has been developed of the carbon footprint composed of GHG emissions anticipated to occur through construction and operation of a chemical extraction facility to treat removed sediments and soils during implementation of TD 4. That estimate was based on the range of potential removal volumes requiring treatment, with the lower bound based on the combination of sediment and floodplain alternatives with the lowest *in situ* volume (SED 3 and FP 2 – 191,000 cy) and the upper bound based on the combination with the highest *in situ* volume (SED 8 and FP 7 – 2.9 million cy).

The total carbon footprint associated with TD 4 has been estimated to range from 27,000 tonnes to 370,000 tonnes of GHG emissions, based on the range of volumes to be treated. Of this total, GHG emissions associated with direct emission sources (primarily construction activities and transportation activities) range from approximately 17,000 tonnes to 240,000 tonnes. The GHG emissions associated with indirect emission sources (primarily power requirements for operating the chemical extraction treatment system) range from 6,900 tonnes to 87,000 tonnes. The GHG emissions calculated for off-site emissions (primarily refinement of diesel fuel and manufacture of concrete used in construction of buildings to house chemical extraction system) range from approximately 2,800 tonnes to 38,000 tonnes. The range of total GHG emissions estimated for this alternative is equivalent to the annual output of 5,200 to 70,700 passenger vehicles.

Impacts on Local Communities and Communities Along Truck Transport Routes

Implementation of TD 4 would result in short-term impacts on local communities. These short-term effects could include potential releases of chemicals used in the treatment process and/or PCB-containing wastewaters due to failure of process and control equipment. They would also include increased truck traffic and noise from construction and treatment activities. Truck traffic to deliver construction materials, equipment, and sediments/soils to the treatment facility and to remove treated materials from that facility would persist for the duration of the project. This additional traffic and equipment would increase noise levels and emissions of vehicle/equipment exhaust and nuisance dust to the air. These factors would especially affect those residents and businesses located in the immediate vicinity of the treatment facility.

The increased truck traffic would affect not only local communities, but areas along the routes used to transport treated material from the site to off-site disposal facilities. Assuming that 20-ton trucks would be used to transport treated material off-site for disposal and that *in situ* removal volumes would be bulked by 20% for such transport, the number of off-site truck trips for implementation of TD 4 would range from approximately 15,900 truck trips (average of 2,000 truck trips annually) for SED 3 plus FP 2 to approximately 243,200 truck trips (average of 6,100 truck trips annually) for SED 8 plus FP 7.[526] These trucks would travel a total of 8,745,000 miles for SED 3 plus FP 2 and 133,760,000 miles for SED 8 plus FP 7, including return trips. The short-term impacts from this increased truck traffic would include an increased risk of injuries from accidents, as well as potential spills of concentrated PCB-containing materials due to accidents as they are being transported.

Appendix N includes an analysis of potential accident-related injury risks from the increased truck traffic to transport the treated materials from the chemical extraction facility to an off-site disposal facility.[527] This analysis indicates that, based on the lower and upper bounds of the range of such off-site truck trips, the increased truck traffic would result in an estimated 4.11 to 62.87 non-fatal injuries due to accidents (average of 0.51 to 1.57 non-fatal injuries per year), with a probability of 98% to 100% of at least one such injury, and an estimated 0.19 to 2.94 fatalities from accidents (average of 0.024 to 0.074 fatalities per year), with a probability of 18% to 95% of at least one such fatality.

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[526] These estimates do not include the additional truck trips that would be necessary to transport excavated materials from the temporary staging areas to the chemical extraction facility.

[527] This analysis assumed that the treated materials would be transported for disposal at a non-TSCA solid waste permitted facility. The risks associated with transport of excavated materials from the temporary staging areas to the chemical extraction facility have been evaluated as part of risks to workers, discussed below.

Potential Measures to Avoid, Minimize, or Mitigate Short-Term Environmental and Community Impacts

Several actions would be taken in an attempt to avoid, minimize, or mitigate the negative short-term environmental impacts from construction and operation of the chemical extraction facility. The facility would be constructed in as small an area as possible, so as to minimize the amount of habitat disturbed. Engineering controls and BMPs would be implemented, to the extent practical and as needed, to reduce detrimental effects from construction and operation of the chemical extraction facility on the environment and local communities. Some potential BMPs that may be implemented during construction include, but are not limited to, use of the following:

- Stormwater management engineering controls and BMPs, including:
    - Hay or straw bales;
    - Silt fences;
    - Grass channel with a pretreatment device (e.g., sediment forebay with a check dam);
    - Water quality swale with a pretreatment device (e.g., sediment forebay with a check dam);
    - Covering staged materials;

- Air quality management engineering controls and BMPs (dust suppression)
    - Inspection of trucks prior to entering public roadways to identify and, if necessary, remove any accumulated soil on the exterior of the trucks;
    - Limiting traffic on unpaved roadways;

- Utilization of good housekeeping practices at the treatment facility;

- Proper equipment and vehicle maintenance;

- Avoidance of facility construction and operation at night except where necessary, and minimization of such activities on weekends and holidays;

- Efforts to avoid truck traffic through densely populated areas where practical;

- Where such travel is necessary, implementation of measures to ensure the safety of the impacted communities (e.g., traffic control, consultation with local public officials); and

- Performance of routine air monitoring during facility construction and operation in accordance with a project-specific air monitoring plan.

Despite the implementation of these measures, however, some short-term impacts from implementation of TD 4 would be inevitable.

Risks to Remediation Workers

Implementation of TD 4 would also result in health and safety risks to site workers during the treatment process. Appendix N includes an analysis of potential accident-related risks to on-site workers from implementation of this alternative, including the risk to truck drivers associated with transport of the removed materials from the staging areas to the treatment location.[528] These potential risks were estimated for the range of potential volumes of soil and sediment (approximately 191,000 to 2.9 million cy) that could be treated by the treatment facility (which would require the treatment facility to operate for approximately 8 to 40 years). Based on the lower and upper bounds of this range, this analysis indicates that implementation of TD 4 would result in an estimated 1.27 to 13.1 non-fatal injuries to workers (0.16 to 0.33 average annual non-fatal injuries), with a probability of 72% to 100% of at least one such injury, and an estimated 0.007 to 0.08 worker fatalities (0.0009 to 0.002 average annual fatalities), with a probability of 0.7% to 8% of at least one such fatality.

9.4.8 Implementability

9.4.8.1 Technical Implementability

The technical implementability of TD 4 has been evaluated in terms of the following factors:

General Availability of Technology: A full-scale BioGenesis plant would use a combination of commercially available equipment (pumps, hydrocyclones, centrifuges) and some specialized equipment (collision chamber, cavitation/oxidation unit) fabricated or modified by BioGenesis. The longer the operations period, the more uncertainty there would be as to the availability of the specialized equipment, and the greater likelihood would exist that this equipment would have to be repaired and/or replaced due to wear and tear, which would require that parts and the appropriate labor be available for the specialized equipment.

Ability To Be Implemented: GE has identified property that it owns along New Lenox Road as a potential location for a chemical extraction facility. Again, the longer the operations period, the greater potential would exist for failure of process and control equipment and the

528 As noted in Appendix N, these estimates slightly underestimate the worker site accident risks since the labor hours on which they are based do not include service support hours.

resultant incomplete treatment of the sediments/soils and/or release of PCB-containing wastewaters into the environment.

Reliability: For the BioGenesis[SM] process, there is uncertainty regarding the extent to which the PCB concentrations in sediments and soils can be reduced in full-scale operations. Results from the bench-scale treatability study using site-specific sediments and soils indicate that the concentrations would not be reduced to levels which would allow reuse. Further, as discussed in Section 9.4.5.2, the reliability of the process at full scale has not been demonstrated for PCBs in materials representative of those from the Rest of River area.

Availability of Space for Facilities: Implementation of this alternative depends on obtaining sufficient and appropriate space for construction of the treatment facility and support areas. As noted previously, GE has identified such a potential area. This area has sufficient space for a large building (~30,000 square feet) and also staging and handling areas for untreated and treated material. Thus, it is assumed that space would be available for implementation of TD 4.

Availability of Equipment, Materials, and Personnel: As noted above, equipment, materials, and personnel would be provided by BioGenesis and are expected to be available. Much of the BioGenesis equipment is commercially available (i.e., hydrocyclones, centrifuges, pumps). Other pieces of equipment (i.e., cavitation/oxidation unit, collision chamber) would be fabricated or modified by BioGenesis and are specific to its proprietary process. Trained personnel are expected to be available to set up and optimize full-scale equipment.

Ease of Conducting Additional Corrective Measures: Additional corrective measures would be required if treated materials did not meet minimum criteria for disposal or discharge. Corrective measures could include re-treating material using the same process as used for the first cycle. Based on bench-scale test results, additional cycles appear to contribute a higher proportion of fine-grained material to the wastewater, and also appear to be less effective at PCB removal (i.e., final concentrations after sequential cycles appear to decrease asymptotically). If EPA approval were obtained for disposal of treated materials with PCB concentrations less than 50 mg/kg at a non-TSCA landfill, and that level could not be achieved after subsequent treatment cycles, the use of an alternate off-site disposal facility licensed to receive TSCA material would be required.

Depending on water treatment discharge requirements, treated water may require subsequent treatment or alternate disposal. Accumulation of water for discharge or disposal may result in the need for significant storage space, and if not readily available, could become a rate-limiting step in the process.

Ability to Monitor Effectiveness: As noted during the bench-study, monitoring the effectiveness of the BioGenesis^{SM} process can be performed by sampling the various treated materials for chemical analysis, using standard sampling and analytical methods.

9.4.8.2 Administrative Implementability

The evaluation of the administrative implementability of TD 4 has included consideration of any regulatory requirements, the need for access agreements, and coordination with government agencies.

Regulatory Requirements: Implementation of TD 4 at the identified site would be an "on-site" activity for purposes of the permit exemption set forth in Section 121(e) of CERCLA and Paragraph 9.a of the CD. As such, no federal, state, or local permits or approvals would be required. However, this alternative would be required to meet the substantive requirements of applicable regulations that are designated as ARARs (unless waived). An evaluation of compliance with potential ARARs for construction and operation of a chemical extraction facility on the GE-owned property described above is provided in Tables T-4.a through T-4.c in Appendix C and was summarized in Section 9.4.4.

Access Agreements: Since GE currently owns the property identified as a potential location for a chemical extraction facility and associated support facilities, implementation of TD 4 would not require GE to obtain long-term access from another party.

Coordination with Agencies: Both prior to and during implementation of TD 4, GE would need to coordinate with EPA, as well as state and local agencies, to provide support with public/community outreach programs.

9.4.9 Cost

The range of estimated total costs to implement TD 4 is $90 M to $958 M (not including the cost of the sediment and floodplain removal alternatives). These costs include all labor, equipment, and materials necessary for the chemical treatment process as well as the associated post-treatment off-site disposal. The costs presented for TD 4 were based in part on cost information provided by BioGenesis (included in Appendix O) regarding the construction and operation of the chemical treatment process and the disposal of the water treatment sludge containing PCBs. Additional costs that were added include estimated costs for pre-design investigation activities; the transport of excavated materials from the staging areas to the treatment facility; project/construction management, engineering, and administration; and the post-treatment off-site disposal of treated sediments and soils. The range of estimated costs for TD 4 is represented by: (a) a lower bound based on the minimum volume of sediment/soil that could be treated (191,000 *in situ* cy assuming implementation of SED 3 and FP 2); and (b) an upper bound based on the maximum volume of sediment/soil that could be treated (2.9 million *in situ* cy assuming implementation of SED 8 and FP 7). In both cases, the estimated costs assume that one treatment cycle would allow off-site disposal of all treated materials at a non-TSCA solid waste landfill in accordance with an EPA risk-based TSCA determination.

The range of estimated capital costs associated with construction of the facility is $17 M for a 20 cy/hr facility to $20 M for a 40 cy/hr facility. The range of annual operations costs related to the chemical treatment of sediments and soils over the course of the entire project is from $4 M to $9 M per year (depending on the anticipated annual volume of materials to be treated), resulting in total operations costs of approximately $32 M to $365 M. The estimated total post-treatment disposal costs range from $40 M to $614 M.[529] As mentioned in Section 9.4.1.1, there would be a small component of post-treatment monitoring and maintenance costs associated with monitoring of the restoration of the facility area. For purposes of this Revised CMS Report, restoration and the associated monitoring and maintenance and costs are assumed to consist of monitoring and maintenance of the restored area for a period of five years at $25,000 per year, resulting in a total cost of $125,000. The following summarizes the total costs estimated for TD 4.

TD 4	**Minimum Est. Cost**	**Maximum Est. Cost**	**Description**
Total Capital Cost	$17 M	$20 M	Total cost for engineering, labor, equipment, materials associated with construction of treatment facility
Total Operations Cost	$32 M	$365 M	Total estimated cost for pre-treatment handling of excavated materials and the operation and maintenance of the chemical treatment facility during the years of operation (8 to 40 years)
Total Associated Off-site Disposal Costs	$40 M	$614 M	Total estimated post-treatment off-site disposal costs, assuming all treated materials may be disposed of as non-TSCA materials
Total Post-Treatment Monitoring and Maintenance Cost	$0.125 M	$0.125 M	Total estimated post-treatment monitoring and maintenance costs for 5 years after completion of restoration of facility area
Total Cost of Alternative	$89 M	$999 M	Total cost of TD 4 in 2010 dollars

529 These estimated costs assume that all treated solid materials may be disposed of as non-TSCA-regulated wastes. If those materials must be disposed of based on their pre-treatment TSCA classification, there would be significant additional costs beyond those discussed above. For instance, the off-site transport/disposal costs would add an additional $218 M to the costs associated with the maximum potential disposal volumes.

The range of estimated present worth costs for TD 4 was developed using a discount factor of 7%, an assumed overall duration of 10 to 52 years,[530] and a post-closure monitoring period of 5 years. That range is approximately $70 M to $286 M. More detailed cost estimate information and assumptions for each of the treatment/disposition alternatives are included in Appendix Q.

9.4.10 Overall Protection of Human Health and the Environment – Conclusions

As explained in Section 9.4.2, the evaluation of whether TD 4 would provide overall protection of human health and the environment draws upon the evaluations under several other Permit criteria, discussed in prior sections, as well as other factors relevant to the protection of health and the environment. The key considerations relevant to this criterion are discussed below.

General Effectiveness: As discussed in Section 9.4.5.2, the reliability of the chemical extraction process at full scale has not been demonstrated for PCBs in soils and sediments representative of those from the Rest of River area. However, bench-scale testing has indicated that use of the BioGenesis^{SM} process could reduce the concentrations of PCBs in treated sediments/soils. Based on that testing, it appears that the BioGenesis^{SM} process could reduce the PCB concentrations in the treated material to weighted average concentrations in the range of 7 to 48 mg/kg in the combined solids from the treatment outputs, but not to a sufficient degree to allow on-site reuse. Accordingly, it is assumed that the treated material would be disposed of in an off-site landfill, which would isolate the material from underlying soils and groundwater and from surface receptors. In this regard, however, TD 4 would not offer more effectiveness or permanence than disposal of untreated material. In addition, the BioGenesis^{SM} process would generate large volumes of wastewater that would also have to be treated, with off-site disposal of the PCB-containing water treatment sludge.

Compliance with ARARs: As discussed in Section 9.4.4, review of the potential ARARs for TD 4 indicates that TD 4 could be designed and implemented to meet certain of those ARARs (provided that the necessary determinations are obtained from EPA), but that other federal and state regulatory requirements would not be met. To the extent that the latter requirements constitute ARARs, they would need to be waived by EPA as technically impracticable (or on some other ground) under CERCLA and the NCP.

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[530] This range is based on the estimated overall duration of the lowest cost/lowest volume combination (SED 3 and FP 2) to that of the highest cost/highest volume combination (SED 8 and FP 7). Note that the lower bound of this range is different from the combination with the shortest duration, which is the combination of SED 10 and FP 9, with an estimated duration of 5 years.

Human Health Protection: TD 4 would provide human health protection through treatment and subsequent off-site disposal of the removed PCB-containing material. Implementation of this alternative would not be expected to have any significant long-term or short-term adverse effects on human health.

Environmental Protection: Implementation of TD 4 would provide protection for ecological receptors for the same reason discussed above for human receptors. At the same time, this alternative would produce short-term effects on the environment due to the loss of habitat in the area where the treatment facility would be located. Implementation of this alternative would also result in a significant amount of GHG emissions, with the amount dependent on the volume of materials to be treated. In addition, given the length of time required to implement this alternative (5 to 52 years), there is a potential, which increases with implementation time, for accidental spills or releases of: (a) the chemicals (e.g., hydrogen peroxide) used in the process and stored at the site; (b) PCB-containing wastewaters and sludges in the event of a failure of process and control equipment; and/or (c) PCB-containing materials during accidents as they are being transported off-site for treatment/disposal. At the altered grassland location identified for implementation of TD 4 for purposes of this Revised CMS Report, this alternative would not be anticipated to result in any significant long-term adverse habitat effects following completion of the treatment operations and restoration of the treatment facility area.

Summary: Based on the above considerations, it is concluded that TD 4 would provide overall protection of human health and the environment.

9.5 Evaluation of Thermal Desorption (TD 5)

9.5.1 Description of Alternative

TD 5 would involve treatment of the removed sediments and soils by thermal desorption. Thermal desorption removes organic contaminants from solid materials by raising the temperature of the contaminated material to a sufficiently high level to cause volatilization of the organic contaminants and water so as to transfer them from the sediment or soil to a gas stream. Various thermal desorption technologies employ differing combinations of temperature, time, and mixing to perform this transfer. The gas stream is then treated to remove particulates and the organic contaminants. The particulates are removed from the gas stream by scrubbers or filters, and the organics are treated by being condensed in a single- or multi-stage condenser, captured by carbon adsorption beds, and/or burned in an afterburner. The liquid condensate is then sent to an appropriate treatment/disposal facility, and the treated sediments or soils may be disposed of in an appropriate disposal facility or potentially reused, depending on its chemical concentrations and physical characteristics.

9.5.1.1 Thermal Desorption Process Evaluated

There are two classes of thermal desorbers: direct fired and indirect fired. In either approach, heat from the combustion of fuel in burners is applied to the sediments or soils to volatilize the organic contaminants. In a direct fired unit, the burner gases are mixed directly with the solids and the waste gases. The direct fired unit can be operated either to completely oxidize the desorbed organic contaminants or to recover most or part of them from the gas stream. In an indirect fired unit, the heat is conducted to the solids through metal walls or with a medium such as heated gas.

Two significant differences exist between direct and indirect fired units: (1) the degree to which air emissions can be controlled and (2) their operating production rate and corresponding cost of operation. Direct fired units require monitoring throughout the operations to verify that off-gas specifications are being met; therefore numerous monitored parameters can result in shutting down operations for not meeting these specifications. For safety purposes, there is a maximum organic material feed rate for direct fired units to prevent the potential for equipment failure and uncontrolled off-gas release. In addition, direct fired units generally have a higher percentage of solids that require re-treatment, which may cause more difficult air emissions issues. When large volumes of soil are subjected to thermal desorption treatment, the heat input required to volatilize the organic contaminants yields a very large volume of combustion gases from the burners.

In a direct fired unit, mixing the burner gases with contaminated soils or sediments results in high heat rates (i.e., efficient use of heat energy, BTUs) and correspondingly high production rates of treated material. The entire gas stream must be controlled prior to being emitted to the ambient air, which can become very expensive. In an indirect fired unit, managing the low volume gas stream becomes more cost-effective while achieving stringent control of emissions. Recovery of the organic contaminants is simpler for an indirect fired unit, because the high volume of combustion gas is not present and only the small volume of organic contaminants and process gas must be managed in the recovery system. Further, control of the oxygen concentration can be more easily maintained in an indirect fired unit, minimizing or eliminating oxidation of the organic contaminants and allowing its complete recovery. Even though the indirect fired units are typically less energy efficient than the direct fired units, the smaller control devices can be operated at higher efficiency and lower cost because burner gases are kept separate. For these reasons, indirect fired thermal desorption treatment was selected as the representative technology for purposes of the Revised CMS Report.

The thermal desorption system would consist of an indirect fired rotary desorber with collection of off-gas organics by condensation. Water from the system would be processed through a water treatment system that would remove, concentrate, and collect PCBs.

Treated water would be used to cool and remoisturize the treated soil/sediment, thereby providing a closed loop for the process water. The off-gas generated during the indirect fired thermal desorption treatment process would be filtered and condensed as a liquid stream. It is anticipated that treatment of the dredged/excavated materials would be preceded by dewatering to reduce the treatment costs and improve treatment efficiency. The dewatered material would undergo screening and/or size reduction so particles could be heated sufficiently to volatilize organic contaminants and to minimize potential difficulties with the mechanical equipment.

PCB condensate resulting from the thermal desorption process would be transported off-site for incineration in accordance with TSCA requirements. Depending on the chemical and/or physical characteristics of the treated soils and sediments, those materials would ultimately either be reused or be disposed of off-site. Based on a review of available information regarding the use of thermal treatment to address PCBs in sediments and soils at other sites (see Section 9.5.5.2), it is anticipated that the concentrations of PCBs in the treated sediments/soils would be substantially reduced. For purposes of the Revised CMS Report, it has been assumed that PCB levels in treated materials would be reduced to at least approximately 1 to 2 mg/kg. In light of this assumption, it has also been assumed that some of the treated soils would be amended and could be reused on-site as backfill in the floodplain, with the rest of the treated solid materials transported for disposal in an off-site permitted facility, as discussed further in Section 9.5.1.2. For those materials which contained PCBs at or above 50 mg/kg prior to treatment, a risk-based TSCA determination from EPA would be required both to reuse such material on-site and to dispose of such materials in a permitted solid waste (non-TSCA) landfill.

9.5.1.2 General Remedial Approach

The following summarizes the general remedial approach related to implementation of TD 5. It should be noted that while details on facility configuration, construction, operation, and disposal are provided in this description for purposes of the evaluations in this Revised CMS Report, the specific methods and facility components for implementation of this alternative would be determined during the design process based on engineering considerations and site conditions.

Site Selection, Procurement and Preparation: The first step in implementing TD 5 would be to select a site to construct the thermal desorption facility. GE has identified a potential location for a thermal desorption unit. That location would be the same as that described for TD 4 on GE-owned property along New Lenox Road (known as the former DeVos property). For purposes of the Revised CMS Report, it has been assumed that a thermal desorption unit with support areas (staging areas and access roads) would require approximately 5 acres, as shown on Figure 9-13. As discussed in Section 9.4.1.1, this area is located within the 100-year floodplain and, in part, within 200 feet of the River, but it is situated outside the 1 mg/kg PCB isopleth and outside the 20-acre area on this property that is currently subject to an Agricultural Preservation Restriction. As also discussed in Section 9.4.1.1, this 5-acre area contains a small wetland and the access road to it would cross another wetland (although the jurisdictional status of those wetlands is unknown); and it is located within mapped Priority Habitats and Estimated Habitats of state-listed rare species.

Site preparation activities would include clearing, grubbing, and the construction of site infrastructure. This would include construction of access roads and support facilities, such as materials staging areas and screening/size reduction facilities. The thermal desorption system could be a fixed base unit or a transportable unit, which would be determined during the design process based on engineering considerations and site conditions. System components would either be constructed/installed in the fixed base thermal desorption unit or brought to the site in trailers that make up the transportable thermal desorption unit.

Thermal Desorption Treatment Process: Once the support facilities are in place, dewatered excavated/dredged materials would be transported via trucks to the pre-treatment staging areas to undergo screening and/or size reduction. The descriptions provided in Section 6 for alternatives involving hydraulic dredging of sediments indicate that the dewatering and handling of dredged sediments would include mechanical dewatering (using a plate and frame filter press) and potentially the addition of drying agents (such as lime kiln dust, sand, or dry treated materials). It was assumed that sediments that are mechanically removed in the wet would require dewatering by being stockpiled at the staging areas to allow them to dewater by gravity, with drying agents added as necessary prior to treatment. For the thermal desorption alternative, GE has assumed in this Revised CMS Report that an intermediate step of mixing a drying agent would definitely be performed for both hydraulically and mechanically dredged sediments (as discussed further below) to achieve the 18 to 20% moisture content required for thermal desorption treatment (EPA, 1997c).

For this evaluation, it has been assumed that, before going through the thermal desorption process, all hydraulically removed sediments would need to go through the following pre-treatment steps: (1) screening of the dredged materials and separation of those materials according to size; (2) mechanical dewatering of the finer fraction using a plate and frame filter press; (3) mixing of the dewatered materials with dry material (e.g., sand, excavated floodplain soils, or thermally treated materials); and (4) pre-heating of the amended materials by the thermal desorption process exhaust to further reduce the moisture content below 18 to 20%. A similar approach would be used for mechanically dredged sediments except that these sediments would undergo gravity dewatering instead of mechanical dewatering. (The actual amount and type of the dry materials to be added to the dewatered and screened sediments would be determined during the design phase.) While these pre-treatment steps are largely intended to reduce moisture content, they would also result in the mixing of fine- and large-grained sediments such that the pre-treated materials would generally be considered homogeneous.

The resulting drier homogeneous material would be fed to the indirectly fired thermal desorber, which has been assumed for purposes of this Revised CMS Report, to have an estimated capacity range of 10 to 40 tons per hour. As the sediments and soils are heated to temperatures up to 1,400°F in the thermal desorber, the PCBs would volatilize from the sediments or soils. In addition to volatilizing PCBs, the thermal desorption process can lead to the volatilization and emission of certain metals (e.g., mercury), and the emission of dioxin/furans which can be formed during the process (Interstate Technology and Regulatory Council [ITRC], 1998). Dioxins/furans and volatilized metals in the gas stream would require additional technical and monitoring requirements (ITRC, 1998). The gas stream would enter a quench chamber where it would be cooled with water; and PCBs would be further removed in condensers. The gas stream exiting the condensers then would enter an air pollution control system, where the gas stream would be treated to further remove PCBs. The gas stream would be filtered to remove suspended oil mist and particulates. A liquid treatment system would treat condensate from the quench chamber and condensers.

As noted previously, it has been assumed that some of the treated solid material would be amended and reused on-site as backfill in the floodplain. Because the thermal treatment process would greatly reduce the organic content present in the treated materials, reuse would require that the materials first be amended by importing and mixing in an organic material source. For purposes of this Revised CMS Report, it has been assumed that approximately 50% of the thermally treated floodplain soils would be mixed/amended with topsoil (at an approximate 1:1 ratio) and reused on-site as backfill in the floodplain as part of the selected floodplain soil remedial alternative. That would provide all of the necessary backfill for floodplain areas.

Regarding potential use of treated sediments and the remaining treated soils as backfill in the River itself, GE is unaware of any precedent for the use of thermally treated materials as backfill in a riverine environment. Use of such materials as substrate in the River would involve a number of problems. For example, the thermally treated sediments would be different from the current in-river sediments in that the thermal treatment process would lower the organic content and alter the physical characteristics (e.g., cohesiveness) of the sediments. While amendment of the treated material would be required to replace the organic carbon content, it is uncertain whether the physical properties of the mixed materials (e.g., cohesiveness, plasticity, stability) would be sufficiently stable for use as riverbed material. Further, while it has been assumed for purposes of this Revised CMS Report that PCB concentrations would be reduced to below 1 mg/kg in the treated material, it is not clear that adding material containing PCBs, even at these low levels, to an aquatic environment would be acceptable to EPA. Finally, while amendment of the treated material with an organic carbon source should help bind some of the metals present in the treated materials, the thermal treatment has been shown to increase metals mobility, a concern that would be heightened if the material were placed back in the River. For these reasons, it has been assumed that none of the treated materials would be used as backfill or capping material in the River.[531]

Thus, for purposes of this Revised CMS Report, it has been assumed that all the treated sediments, as well as the remaining 50% of treated floodplain soils that is not reused on-site, would be disposed of in an off-site permitted facility. In this regard, it has been assumed that this material would be disposed of as non-TSCA material at a permitted solid waste landfill, in accordance with a risk-based TSCA determination from EPA. While the leachability of certain metals that may be present in the soils/sediment could be altered by thermal desorption treatment (for example, thermal desorption can oxidize lead, increasing toxicity and mobility [ITRC, 1998]) and thereby affect the ultimate end use and/or disposal costs of the treated soil/sediment, it has been assumed, for purposes of this Revised CMS Report, that metals leachability would not affect end use and/or disposal costs. The treatment by-products (PCB-containing condensate and air filter media) would be transported to a TSCA-licensed facility for appropriate disposition, including incineration of the liquid condensate.

Assuming that a risk-based TSCA determination is obtained from EPA for the treated material and that the material would not constitute hazardous waste under RCRA or comparable state requirements, the permitted solid waste landfill(s) for disposal of such material would be selected during design. One possible location for disposal of such thermally treated material from the Site could be Waste Management LLC's High Acres Landfill in New York. Possible locations for disposal in Massachusetts could include the Fitchburg-Westminster, Southbridge, and Bourne Landfills, subject to the necessary approvals. (Treated materials containing PCBs less than 2 mg/kg could be reused at these Massachusetts landfills per MDEP COMM-94-007 and COMM-97-001.) Other potential locations would be evaluated during design. For treated material (if any) for which such a risk-based determination is not obtained from EPA, disposition at a TSCA-permitted landfill

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531 Other potential beneficial reuses of material subject to thermal desorption could include use as landfill cover material or incorporation into asphalt (EPA, 2004a). The ability to implement either of these two options would be dependent on whether there is a need for such material at the time the remedial action is carried out. If thermal desorption was chosen as part of the selected remedy, further evaluation of beneficial reuse could be performed to determine if there are viable opportunities available. The evaluation would include, but not be limited to, determining if there is a need for treated material, the proximity of where the treated material would be used to the site, and what cost, if any, would be associated with reusing the treated material.

would be required. One possible location for disposition of such TSCA-regulated material could be Waste Management LLC's Model City Landfill in New York. Liquid treatment byproducts would need to be transported to a TSCA-permitted facility with an incinerator, such as the Veolia ES Technical Solutions facility in Port Arthur, Texas. Other potential locations would be evaluated during design.

The time period over which the thermal desorption facility would be operated would depend on the selected sediment and floodplain remediation alternatives. This time period would range from approximately 5 years if SED 10 were selected to approximately 52 years if SED 8 were selected, assuming that any floodplain remediation could be completed within those time frames.[532]

Restoration: Under TD 5, following completion of the treatment process, facility structures, staging areas, and access roads would be removed, and areas disturbed by the construction activities would be re-graded and re-vegetated, to the extent practicable. The treatment system itself would be decontaminated, dismantled, and transported off-site. Any fill material brought onto the site to support the facility would be removed, and surface soils would be restored by tilling and scarification. An appropriate grassland seed mix would be sown and established over the disturbed area.

Post-Treatment Monitoring and Maintenance: Following restoration of those areas disturbed by the construction activities, monitoring and maintenance of those restored areas would be conducted. For purposes of this Revised CMS Report, it is assumed that monitoring and maintenance of those areas would be conducted for 5 years following completion of restoration.

9.5.2 Overall Protection of Human Health and the Environment – Introduction

As discussed in Section 9.1.2, the evaluation of whether a treatment/disposal alternative would provide overall human health and environmental protection relies heavily on the

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[532] Note that the combination of sediment and floodplain alternatives with the shortest duration (SED 10 and FP 9) is not the same as the combination with the smallest volume (SED 3 and FP 2). For the evaluations in this section that are based on removal volumes, the latter combination is used as the basis for the lower end of the range. In addition, quantitative evaluations that assess active treatment or disposal operations (e.g., truck trips, traffic accident risks, risks to workers) are based on the assumed years of operation, rather than overall duration. The years of operation represent the number of years during which materials removed from the River and floodplain would be actively transported to and treated at the thermal desorption facility (i.e., excluding years when the only activities being conducted under the sediment and floodplain alternatives would be capping, backfilling, or restoration activities). For TD 5, the assumed years of operation range from approximately 8 years based on SED 3 and FP 2 (the smallest-volume combination) to approximately 40 years based on SED 8 and FP 7.

evaluations under several other Permit criteria – notably, long-term effectiveness and permanence (including long-term adverse impacts), short-term effectiveness, and compliance with ARARs. For that reason, the evaluation of whether TD 5 would be protective of human health and the environment is presented at the end of Section 9.5 so that it can take account of the evaluations under those other criteria.

9.5.3 Control of Sources of Releases

The thermal desorption process itself would not control sources of releases. However, thermal desorption would reduce the concentration of PCBs in treated materials by separating the PCBs from the sediments/soils. Therefore, if treated materials were released, the PCB concentration of the released material would be less than for untreated material. For those treated materials that would be reused as backfill on-site, sampling would be performed to determine the chemical characteristics of the treated materials and ensure that no concerns exist regarding future release or exposure. Subsequent off-site disposal/treatment of the remaining treated material (as well as the liquid condensate) would permanently isolate this PCB-containing material from the environment and eliminate the potential for a future release to the Rest of River.

9.5.4 Compliance with Federal and State ARARs

The potential ARARs identified by GE for TD 5 in accordance with directions from EPA are listed in Tables T-5a through T-5c in Appendix C. No chemical-specific ARARs have been identified for TD 5, although several guidances to be considered are listed in Table T-5.a.

The potential location-specific and action-specific ARARs for TD 5 are listed in Tables T-5.b and T-5.c.[533] Review of these ARARs indicates that TD 5 could be designed and implemented to achieve certain of those ARARs, but that there are some potential ARARs that would require a specific EPA approval or finding or would not be met. These include the following:

- The thermal desorption unit would not meet the definition of an incinerator under EPA's TSCA regulations (40 CFR § 761.3) and thus would not be designed to meet the requirements of EPA's TSCA regulations for a PCB incinerator (40 CFR § 761.70). In this situation, to allow use of the thermal desorption facility consistent with EPA's TSCA regulations, it would be necessary for EPA to determine that the location, design, and

[533] For the reasons discussed in Section 2.1.3, a number of these regulatory requirements do not constitute ARARs for the Rest of River remedial action, but are listed in these tables as potential ARARs per EPA's direction.

operation of the facility meet the substantive criteria for a risk-based approval under 40 CFR § 761.61(c). In addition, as noted above, a risk-based TSCA determination from EPA would be needed to allow on-site reuse of treated materials that originally contained PCBs $\geq$ 50 mg/kg.[534]

- Since the identified location for the thermal desorption facility is the same as that for the chemical extraction facility under TD 4, the potential location-related requirements that would require a specific EPA finding or a waiver (if they apply and constitute ARARs) are the same as those listed and discussed for TD 4 in Section 9.4.4. These include certain requirements of EPA's and the Corps of Engineers' regulations under Section 404 of the Clean Water Act, the federal Executive Orders for Wetlands Protection and Floodplain Management, the Massachusetts water quality certification regulations the Massachusetts Wetlands Protection Act regulations, and MESA and its implementing regulations – all as discussed in Section 9.4.4.

In addition to these requirements, as previously noted, it is not anticipated that the removed sediments and floodplain soils would constitute characteristic hazardous waste under RCRA and comparable state regulations. However, representative TCLP testing would be conducted to confirm that. In the unlikely event that particular sediments or soils that would be treated in the thermal desorption facility should be determined to constitute such hazardous waste, it is anticipated that the facility components used for such waste would meet the substantive requirements of EPA's hazardous waste regulations under RCRA. With respect to state requirements, the treatment facility may be exempt from the Massachusetts hazardous waste regulations.[535] However, if it were determined that that exemption is not applicable, the facility staging area at the identified location could not feasibly meet certain location standards in those regulations for hazardous waste treatment facilities (e.g., the requirements that waste piles used for such storage not be located within the 500-year floodplain and that there be a 200-foot buffer to the fenceline [310 CMR 30.701(6), 30.705(3)]), and might not meet certain design requirements of those regulations (e.g., the requirement that the waste pile liner must be at least 4 feet above the probable high groundwater table [310 CMR 30.641(1)(a)]).

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[534] Further, although requirements relating to off-site disposal are not ARARs, it should be noted, as previously mentioned, that a risk-based TSCA determination from EPA would also be needed to allow disposal of other such treated materials that originally contained PCBs $\geq$ 50 mg/kg in a non-TSCA landfill.

[535] As noted in Section 9.4.4 above, the MCP exempts the on-site treatment of hazardous waste as part of an MCP remedial action from the State's hazardous waste regulations unless MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).

If TD 5 were selected, GE would first determine whether any sediments or soils to be subject to thermal desorption would constitute hazardous waste. If so, GE would resolve with EPA the applicability of state hazardous waste regulations to the thermal desorption facility at the location selected for that facility. If such requirements were deemed applicable, GE would evaluate the available options, including: (a) exploring with EPA a waiver of any requirements that would be technically impracticable to meet; or (b) segregating such waste and disposing of it separately off-site.

9.5.5 Long-Term Reliability and Effectiveness

An assessment of the long-term reliability and effectiveness of TD 5 has included evaluation of the magnitude of residual risk associated with implementation of the alternative, the adequacy and reliability of the alternative, and any potential long-term adverse impacts associated with the alternative on human health or the environment.

9.5.5.1 Magnitude of Residual Risk

Under TD 5, most of the PCBs present in the removed sediments/soils would be volatilized using an indirect fired thermal desorption system and transferred to the off-gas from which they would be condensed into a liquid stream. Based on a review of available information regarding the use of thermal treatment to address PCBs in sediments and soils at other sites (see Section 9.5.5.2), it is anticipated that the concentrations of PCBs in the treated sediments/soils would be reduced to low levels – assumed, for purposes of this Revised CMS Report, to be 1 to 2 mg/kg. As stated previously, for those treated materials which are reused as backfill on-site, chemical characterization sampling would be performed to ensure that there are no concerns regarding future exposure. Subsequent off-site disposal of the remaining treated material (and treatment by-products) would permanently isolate the treated materials from the environment, which would prevent human or ecological exposure to those materials.

Minimal residual risks are anticipated in the location where the thermal desorption process is constructed and operated, since all operations would be performed within secured staging areas, and the staging areas and any residual PCBs associated with the operations would be removed following completion of the thermal desorption operations.

9.5.5.2 Adequacy and Reliability of Alternative

Evaluation of the adequacy and reliability of TD 5 included an assessment of the factors discussed below.

Use of Technology under Similar Conditions

Historically, thermal desorption to treat materials containing PCBs at other sites has primarily been used on soils, with limited application on sediments, likely due in part to the increased time and costs to sufficiently dewater the sediments as a pretreatment step. Examples of the use of thermal desorption for PCB-containing materials are:

- A low-temperature thermal desorption treatment facility was used at the Sangamo Weston/Twelve-Mile Creek/Lake Hartwell site in Pickens, South Carolina, to treat approximately 40,000 cy of PCB-impacted soil to a cleanup level of 2 mg/kg (EPA, 2003). The treated soil was backfilled on-site and capped with topsoil, and then the area was graded and restored.

- Thermal desorption was used to treat 53,685 cy of PCB-impacted soil at the Industrial Latex Site in Wallington, New Jersey (i.e., up to 4,000 mg/kg of Aroclor 1260) (Federal Remediation Technologies Roundtable Technology Cost and Performance Database, 2003, web site: http://costperformance.org/profile.cfm?ID=348&CaseID=348). The treated soil, with an average PCB concentration of 1 mg/kg, was backfilled on-site and compacted.

- At the Re-Solve, Inc. site in North Dartmouth, Massachusetts, 36,200 cy of PCB-impacted soil were treated to a cleanup level of < 25 mg/kg using low-temperature thermal desorption, with PCB concentrations ranging from 0.59 to 21 mg/kg in treated material (EPA, 2003).

- At the Outboard Marine Corporation Site along Lake Michigan in Waukegan, Illinois, thermal desorption was used to treat 12,755 tons of PCB-impacted soil and sediment to concentrations ranging from 0.4 mg/kg to 8.9 mg/kg with a PCB destruction and removal efficiency of 99.9999% (Federal Remediation Technologies Roundtable Technology Cost and Performance Database, 1995, web site: http://costperformance.org/profile.cfm?ID=209&CaseID=209).

- At the Wide Beach Development Site in Brandt, New York, thermal desorption was used in combination with alkaline polyethylene glycol (APEG) dehalogenation technology to treat 42,000 tons of PCB-impacted soil to the cleanup level of < 2 mg/kg (EPA, 1992a). The treated soils were not as stable as the pre-treated soils, and were sent off-site for disposal.

- Thermal desorption was used to treat 21,000 tons of PCB-impacted soil at a former industrial site in Springvale, Victoria, Australia (Ebrill and Lucas, 2010). The treated soil, with PCB concentrations of <0.1 mg/kg (non-detectable), retained its geotechnical properties and was reused on a local site as clean fill.

Originally thermal desorption was a part of the selected remedy for the Freeman's Bridge Road Site (New York) and the Fletcher's Paint Works Site (New Hampshire). However, the regulatory agencies (the New York State Department of Environmental Conservation [NYSDEC] and EPA, respectively) subsequently changed the thermal desorption portion of the remedies to off-site disposal for the waste with PCBs over 50 mg/kg (at the Freeman's Bridge Road Site) or for all of the waste (at the Fletcher's Paint Works Site). These agencies determined that off-site disposal would be a more effective or a more efficient and cost-effective approach than thermal desorption (NYSDEC, 2008; EPA, 2010).[536]

Overall Effectiveness and Reliability

Thermal desorption has been used in only limited instances to treat PCB-containing sediments and has been used at several sites to treat PCB-containing soils. However, at most of these sites, the volumes of PCB-impacted soils and/or sediments have been relatively small, the duration of the treatment operation has been relatively short, and when on-site reuse has occurred, the material has typically been placed back in a small area and covered with clean backfill. If thermal treatment were selected as a remedy component for the Rest of River, it would be operated for 9 months per year, and shut down in the winter for 3 months. Depending upon the sediment and soil alternatives selected, the duration of treatment could range from approximately 5 years (if SED 10 were selected) to approximately 52 years (if SED 8 were selected). The longer the period of operation of the thermal desorption facility, the greater likelihood would exist for periodic equipment failures and downtime. Moreover, mechanical problems can result from treatment of high-organic, high-moisture-content, fine-grained materials, which can clump and clog equipment or otherwise be physically difficult to treat. These types of materials are present in parts of the River. Since no thermal treatment unit was identified as having been operated full scale at a PCB site over a period of more than 1.5 years, it is difficult to predict the reliability of the equipment in the longer term.

While reuse as backfill, following mixture with an organic amendment, does not seem complicated to implement, it relies upon effective operation of the thermal treatment unit. Given the potentially long time frames and volumes of materials being considered for

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[536] At Freeman's Bridge Road Site, thermal desorption was used for the treatment of waste containing PCBs less than 50 mg/kg, but NYSDEC determined that thermal desorption was not an effective treatment method for waste containing PCBs greater than 50 mg/kg. At the Fletcher Paint Works Site, off-site disposal was identified as an alternative to thermal desorption that could achieve site goals to the same extent as thermal desorption, but within a much shorter timeframe and at a lower cost.

removal and treatment, consistent effective operation of the thermal treatment unit may be difficult to achieve, particularly given the mechanical problems with high-organic, high-moisture-content, fine-grained materials. Further, with long-term use of the equipment, there would be a greater potential for failure of process and control equipment, which could lead to the release of PCBs, metals, and/or dioxin/furans (if formed during the process) into the atmosphere, as well as incomplete treatment of the sediments/soils.

Placement of treated soils and sediments that are not reused into off-site permitted landfills is considered an effective and reliable means of disposing of such treated materials. This has been demonstrated at many sites. However, as discussed for TD 1 (Section 9.1.8.1), as the volume of treated materials requiring disposal and the length of time necessary to do so increase, the more uncertainty would exist as to whether off-site permitted landfills would have the necessary capacity available for the disposal of these materials in the future.

<u>Reliability of Operation, Monitoring, and Maintenance Requirements/Availability of Labor and Materials</u>

Following completion of treatment operations, the areas of the site disturbed by the construction activities (e.g., treatment facility area, staging areas, and access roads) would be restored to the extent practicable. A monitoring and maintenance program would then be implemented to address those areas. This program would be similar to that implemented for other upland areas and would be in place for five years following completion of restoration. Standard equipment and materials considered reliable for performing such activities would be used. Labor and materials needed to perform the monitoring and maintenance activities are expected to be readily available. For those locations where the treated material is amended and reused on-site as backfill in the floodplain, a monitoring and maintenance program would be in place as covered by the floodplain alternatives described in Section 7.

<u>Technical Component Replacement Requirements</u>

TD 5 would be used in combination with sediment or floodplain soil removal alternatives and would need to be implemented with reuse or a final disposition alternative for the treated material. Therefore, under TD 5, there would no separate need for replacing components of this alternative under post-remediation conditions. However, during the first five years following completion of the treatment process, there may be a need for replacing soils and vegetation in the restored support areas, which should be readily implementable.

9.5.5.3 Potential Long-Term Adverse Impacts on Human Health or the Environment

The evaluation of potential long-term adverse impacts of TD 5 on human health or the environment has included an assessment of several components, as described below. This evaluation focuses only on the potential long-term adverse impacts from the thermal desorption facility and support areas, as well as reuse of the treated material as backfill in the floodplain. The long-term impacts associated with the removal alternatives and off-site transportation/disposal, including those stemming from access roads, staging areas, and truck transport, are discussed under each of those alternatives.

Potentially Affected Populations

Implementation of TD 5 would require construction of an approximately 5-acre facility, including the thermal desorption unit and staging and handling areas to segregate, store, and manage both untreated and treated materials. In the overall context of the Rest of River, the area affected would be relatively small. As such, no long-term impacts to populations of organisms would be expected in that area beyond those that would occur in the immediate area during operation of the facility and for a period following restoration of the associated staging areas, as discussed below. In addition, the reuse of treated material as backfill in the floodplain would not have any long-term adverse impacts on human health, because the material would be sampled to ensure that it contains sufficiently low PCB concentrations to avoid potential adverse health effects (even under EPA's assumptions). In terms of environmental effects, the material would contain sufficiently low PCB concentrations to avoid potential adverse effects on ecological receptors (even under EPA's assumptions) and would be amended with organic topsoil material to support vegetative growth. On the other hand, as discussed further below, this soil would not match the existing soil in the forested floodplain wetlands and other wetland areas, and this would have a long-term adverse effect on those wetlands and the plants and animals that use them.

Long-Term Ecological Impacts

Since the identified location for the thermal desorption facility is the same as that identified for a chemical extraction facility under TD 4, the assessment of potential long-term ecological impacts from the construction and operation of a thermal desorption facility at that location, as well as associated support areas, would be the same as that presented for TD 4 in Section 9.4.5.3 – i.e., no significant long-term adverse ecological impacts would be expected.

However, the reuse of treated material as backfill in the floodplain would have long-term adverse environmental impacts. As discussed above in connection with the impacts of remedial construction activities in the floodplain (e.g., Sections 5.3.4.4 and 5.3.5.4), the wetlands in the floodplain, including both the forested floodplain areas and the other wetlands in the floodplain, contain high organic content soils (typically silty muck or other soils high in organic content) that have formed over many decades, with physical properties, soil chemistry, and a seed bank that are unique to the existing floodplain system. Floodplain soil that has been treated by thermal desorption, even when mixed with commercial topsoil containing organic material, would have different physical, chemical, and microbial characteristics that affect plant growth and hydraulic conductivity. Pre-existing soil conditions would not return until the natural pattern of flooding has deposited enough natural silt and organic material over the backfilled areas to approximate their prior condition. This would be a slow process that depends on the frequency and extent of sufficiently large depositional flood events, which are irregular and unpredictable. It could take decades for soil conditions in these backfilled wetland areas to become comparable to prior conditions. As a result, the changes in soil composition and properties would significantly affect the extent and type of plant growth and hydraulic conductivity in the affected areas for many years, and these changes would negatively affect the wildlife species that rely on or use these wetlands.

Long-Term Impacts on Aesthetics and Recreational Use

Given the identified location for the thermal desorption facility in a previously altered grassland, TD 5 would not be expected to have long-term aesthetic or recreational-use impacts, beyond the temporary impacts during operation of that facility and for a short period after restoration of the affected areas.

Potential Measures to Mitigate Long-Term Adverse Impacts

As discussed above, long-term adverse impacts from the thermal desorption facility would be minimal due to its relatively small size and the altered nature of the open grassland community. Potential measures to further minimize any such impacts would be the same as those described for TD 4 in Section 9.4.5. For the reuse of treated material as backfill in the floodplain, as discussed above, that material would be mixed/amended with topsoil containing organic material (at an approximate 1:1 ratio) to support vegetative growth, but doing so would not prevent the adverse long-term impacts resulting from the failure to match the characteristics of the existing soil in wetland areas.

9.5.6 Reduction of Toxicity, Mobility, or Volume

TD 5 would involve the treatment of between 191,000 cy of sediments/soils containing 14,500 lbs of PCBs (if SED 3 and FP 2 were implemented) and 2.9 million cy of material containing 94,100 lbs of PCBs (if SED 8 and FP 7 were implemented). PCBs present in the removed sediments and soils would be volatilized and transferred to the off-gas from which they would be condensed into a liquid stream. The degree to which TD 5 would reduce the toxicity, mobility, and volume of PCBs is discussed below.

Reduction of Toxicity: The indirect fired thermal desorption system would reduce the toxicity of PCB-containing soil and sediment by permanently removing PCBs from these materials. In addition, the PCBs in the liquid stream sent to a permitted off-site disposal facility would be destroyed.

Further, in the event that any material removed from the River or floodplain should constitute "principal threat" waste (e.g., free NAPL, drums of liquid waste), which is not anticipated, that waste would not be treated in the on-site thermal desorption unit, but would be segregated and transported separately off-site for treatment and disposal, as appropriate.

Reduction of Mobility: TD 5 would reduce the mobility of PCBs present in the removed sediment and soil by permanently removing PCBs from these materials. The treatment process would transfer the PCBs into the off-gas and then into the liquid stream that would be sent to a permitted off-site facility for destruction. A portion of the treated material would be reused on-site in the floodplain (assuming that, following sampling, the material is deemed suitable for reuses), with the remainder disposed of at a permitted off-site disposal facility. Placement of the treated materials in a permitted landfill would result in the reduced mobility of PCBs by permanently isolating the PCB-containing sediments and soils from surface water infiltration, leaching to groundwater, or otherwise mobilizing.

Reduction of Volume: Treatment of removed sediment and soil in the indirect fired thermal desorption system would reduce the volume of PCB-containing material. Experience at other sites indicates that PCB concentrations on the order of 1 to 2 mg/kg in treated solids can be achieved using thermal desorption. Thermal desorption would also remove the naturally occurring organic matter present in the river sediment and floodplain soils, resulting in a slightly lower volume for the treated sediment/soil.

9.5.7 Short-Term Effectiveness

Evaluation of the short-term effectiveness of TD 5 has included consideration of the short-term impacts of implementing this alternative on the environment (in terms of both ecological effects and increases in GHG emissions), on local communities and communities along truck transport routes, and on the workers involved in the treatment and disposition activities. For TD 5, short-term impacts are those that would occur during the period necessary for setting up the indirect fired thermal desorption system, conducting the treatment operations, and dismantling the treatment system.

Impacts on the Environment – Ecological Effects

The short-term effects on the environment resulting from the implementation of TD 5 would include potential impacts during construction of the support areas, set-up of the thermal desorption system, conducting the treatment operations (which would include moving, storage, and handling of large volumes of treated and untreated materials using heavy construction equipment), and dismantling of the treatment system. Specific impacts would depend on the location selected for the thermal desorption facility and the types of habitat affected. Construction of the thermal desorption system and support facilities on the former DeVos property would have the same ecological habitat effects described for implementation of TD 4 at that location in Section 9.4.7 above.

In addition, the longer the time required to implement this alternative, the greater potential would exist for failure of process and control equipment and a consequent release of PCBs, and metals and/or dioxin/furans (if formed during the process) into the atmosphere. Similarly, there would be a greater likelihood of spillage of the highly concentrated PCB-containing liquids during accidents as these materials are being transported off-site for treatment/disposal.

The reuse of treated soil as backfill in the floodplain would have short-term adverse environmental impacts due to the differences in soil characteristics between that material and the existing natural soil in wetland areas, as discussed for long-term effects in Section 9.5.5.3.

Carbon Footprint – GHG Emissions

As described in Section 5.6 and Appendix M, estimates have been developed of the carbon footprint composed of GHG emissions anticipated to occur through construction and operation of a thermal desorption facility to treat removed sediments and soils during implementation of TD 5. These estimates have been made for two scenarios: (1) assuming on-site reuse of 50% of the treated floodplain soils as backfill in the floodplain and off-site disposal of all other treated materials; and (2) assuming off-site disposal of all treated materials. For both scenarios, the estimates were based on the range of potential removal volumes requiring treatment – from the combination of sediment and floodplain alternatives with the lowest *in situ* volume (SED 3 and FP 2 – 191,000 cy) to the combination with the highest *in situ* volume (SED 8 and FP 7 – 2.9 million cy).

Based on this range of volumes, the total carbon footprint associated with TD 5 has been estimated to range from 66,000 tonnes (under both scenarios) to 1,000,000 tonnes (assuming 50% reuse of treated soils) or 1,100,000 tonnes (assuming no reuse of treated soils) of GHG emissions. Of this total, the GHG emissions associated with direct emission sources (primarily construction activities and transportation activities) range from approximately 55,000 tonnes (under both scenarios) to 860,000 tonnes (assuming reuse of treated soils) or 890,000 tonnes (assuming no reuse of treated soils). The GHG emissions associated with indirect emission sources (primarily power requirements for operating the thermal desorption treatment system) range from approximately 250 tonnes to 3,800 tonnes (under both scenarios). The GHG emissions calculated for off-site emissions (primarily refinement of diesel fuel, production (drilling) and distribution of natural gas for use in the thermal desorption treatment system, and manufacture of concrete used in construction of buildings to house thermal desorption system) range from approximately 11,000 tonnes (under both scenarios) to 160,000 tonnes (under both scenarios). The range of total GHG emissions estimated for this alternative is equivalent to the annual output of 12,600 to 210,300 passenger vehicles (assuming no reuse of treated soils).

Impacts on Local Communities and Communities Along Truck Transport Routes

Implementation of TD 5 would also result in short-term impacts on local communities. These short-term effects could include potential emissions of PCBs, metals, and/or dioxin/furans (if formed during the process) into the atmosphere due to process and control equipment failure. The short-term impacts would also include increased truck traffic and noise from construction and treatment activities. Truck traffic to deliver construction materials, equipment, and dewatered sediments/soils to the thermal desorption facility and to remove treated material from that facility would persist for the duration of the project. This additional traffic and equipment would increase noise levels and emissions of vehicle/equipment exhaust and nuisance dust to the air. These factors would especially affect any residents and businesses located in the immediate vicinity of the thermal desorption facility.

The increased truck traffic would affect not only local communities, but areas along the routes used to transport treated material to an off-site disposal facility. To estimate the amount of such truck traffic, it has been assumed that 20-ton trucks would be used to transport the treated material off-site and that the *in situ* removal volumes would be bulked by 20% for such transport. Using these assumptions, the number of off-site truck trips has been estimated for the same two scenarios mentioned above: (1) assuming on-site reuse of 50% of the treated floodplain soils as backfill in the floodplain and off-site disposal of all other treated materials; and (2) assuming off-site disposal of all treated materials. Using these assumptions, the estimated numbers of off-site truck trips, based on the lower and upper bounds of the range of potential volumes to be transported, are: (1) 13,300 to 190,500 truck trips (average of 1,700 to 4,800 truck trips annually) for the first scenario (assuming 50% reuse); and (2) 14,300 to 218,900 truck trips (average of 1,800 to 5,500 truck trips annually) for the second scenario (assuming no reuse).[537] To implement TD 5 assuming 50% reuse, the trucks would travel a total of 7,315,000 miles for SED 3 and FP 2 and 104,775,000 miles for SED 8 and FP 7, including return trips. To implement TD 5 assuming no reuse, the trucks would travel a total of 7,865,000 miles for SED 3 and FP 2 and 120,395,000 miles for SED 8 and FP 7, including return trips. The short-term impacts from this increased truck traffic would include an increased risk of injuries from accidents, as well as potential spills of concentrated PCB-containing liquids due to accidents as they are being transported.

Appendix N includes an analysis of potential accident-related injury risks from the increased truck traffic to transport the treated materials from the thermal desorption facility to an off-site disposal facility.[538] This analysis has been developed for the same two scenarios described above, based on the ranges of such off-site truck trips. The results are as follows:

- Under the first scenario (partial reuse), the analysis indicates that the increased truck traffic would result in an estimated 3.44 to 49.24 non-fatal injuries due to accidents (average of 0.43 to 1.23 non-fatal injuries per year), with a probability of 97% to 100% of at least one such injury, and an estimated 0.16 to 2.31 fatalities from accidents (average of 0.02 to 0.06 fatalities per year), with a probability of 15% to 90% of at least one such fatality.

- Under the second scenario (no reuse), the analysis indicates that such increased truck traffic would result in an estimated 3.70 to 56.59 non-fatal injuries due to accidents (average of 0.46 to 1.41 non-fatal injuries per year), with a probability of 98% to 100% of at least one such injury, and an estimated 0.17 to 2.65 fatalities from accidents (average of 0.02 to 0.07 fatalities per year), with a probability of 16% to 93% of at least one such fatality.

<u>Potential Measures to Avoid, Minimize, or Mitigate Short-Term Environmental and Community Impacts</u>

A number of measures would be employed in an effort to avoid, minimize, or mitigate the negative short-term impacts from construction and operation of the thermal desorption facility on the environment and local communities. These measures, which include

537 These estimates do not include the additional truck trips that would be necessary to transport excavated materials from the temporary staging areas to the thermal desorption facility.

538 The risks associated with transport of excavated materials from the temporary staging areas to the thermal desorption facility have been evaluated as part of risks to workers, discussed below.

engineering controls and BMPs, would be the same as the ones identified for TD 4 in Section 9.4.7 above. Despite the implementation of these measures, however, some short-term impacts from TD 5 would be inevitable.

Risks to Remediation Workers

Implementation of TD 5 would also result in health and safety risks to site workers during the treatment process. Appendix N includes an analysis of potential accident-related risks to on-site workers from implementation of this alternative, including the risk to industrial truck drivers associated with transport of the removed materials from the staging areas to the treatment location.[539] These potential risks were estimated for the range of potential volumes of soil and sediment (approximately 191,000 to 2.9 million cy) that could be treated by the treatment facility (which would require the treatment facility to operate for approximately 8 to 40 years). Based on the lower and upper bounds of this range, this analysis indicates that implementation of TD 5 would result in an estimated 1.27 to 13.1 non-fatal injuries to workers (0.16 to 0.33 average annual non-fatal injuries), with a probability of 72% to 100% of at least one such injury, and an estimated 0.007 to 0.08 worker fatalities (0.0009 to 0.002 average annual fatalities), with a probability of 0.7% to 8% of at least one such fatality.

9.5.8 Implementability

9.5.8.1 Technical Implementability

The technical implementability of TD 5 has been evaluated in terms of the following factors:

General Availability of Technology: While the technologies involved in implementation of TD 5 are specialized, they are available. There are thermal desorption vendors that have the equipment required to implement this technology. The longer the period of treatment operations, the greater likelihood would exist that this equipment would have to be repaired and/or replaced as necessary due to excessive wear and tear.

Ability To Be Implemented: Fixed-base and mobile indirect-fired thermal desorption treatment systems have been used at other Superfund sites for the treatment of PCBs. GE has identified property that it owns along New Lenox Road as a potential location for a thermal desorption facility.

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[539] As noted in Appendix N, these estimates slightly underestimate the worker site accident risks since the labor hours on which they are based do not include service support hours.

Reliability: Thermal desorption has been shown to be reliable at other sites for projects involving relatively small volumes and short durations, as discussed in Section 9.5.5.2. However, there is only limited precedent for implementation of thermal desorption for treatment of sediment. As previously noted, mechanical problems can arise as a result of the high-organic, high-moisture-content, fine-grained sediments, which tend to clump and can clog equipment or otherwise be physically difficult to treat. Moreover, the longer the operations period, the greater potential would exist for failure of process and control equipment, which could lead to the release of PCBs, metals, and/or dioxin/furans (if formed during the process) into the atmosphere, as well as incomplete treatment of the sediments/soils. There would also be a greater potential for spillage of the highly concentrated PCB-containing liquids during accidents as they are being transported off-site for treatment/disposal.

Availability of Space for Facilities: Implementation of this alternative depends on obtaining sufficient and appropriate space for construction of the thermal desorption facility and support areas. As noted previously, GE has identified such a potential area. This area has sufficient space for the thermal desorption facility and associated staging and handling areas for untreated and treated material. Thus, it is expected that space would be available for implementation of TD 5.

Availability of Equipment, Materials, and Personnel: As noted above, equipment, materials, and personnel necessary to construct, operate, and monitor an indirect fired thermal desorption treatment facility are available. In addition to that facility, implementation of TD 5 would require the development of staging and support areas and construction of access roads. To the extent possible, existing roadways would be used to transport equipment and dredged/excavated sediment/soil to and from the staging and support areas. Staging and support areas would be adequately and individually sized to accommodate equipment staging and necessary temporary material storage. The equipment and personnel required for these efforts would be available to support implementation of TD 5.

Ease of Conducting Additional Corrective Measures: Additional corrective measures would be required if treated materials did not meet minimum criteria for disposal or reuse. Corrective measures could include re-treating material or implementation of alternate disposal techniques.

Ability to Monitor Effectiveness: The effectiveness of TD 5 would be determined over time through periodic monitoring activities at the facility, including monitoring of the dewatered PCB-containing feed material, the desorber temperature, the off-gas, the PCB-containing liquid stream, and the treated soil/sediment to assess the effectiveness of the remedy. Standard approaches to monitoring the effectiveness of TD 5 are proven and readily available.

9.5.8.2 Administrative Implementability

The evaluation of the administrative implementability of TD 5 has included consideration of regulatory requirements, need for access agreements, and coordination with government agencies.

Regulatory Requirements: Implementation of TD 5 at the identified site would be an "on-site" activity for purposes of the permit exemption set forth in Section 121(e) of CERCLA and Paragraph 9.a of the CD. As such, no federal, state, or local permits or approvals would be required. However, this alternative would be required to meet the substantive requirements of applicable regulations that are designated as ARARs. An evaluation of compliance with potential ARARs for construction and operation of a thermal desorption facility on the GE-owned property described above is provided in Tables T-5.a through T-5.c in Appendix C and was summarized in Section 9.5.4.

Access Agreements: Since GE currently owns the property identified as a potential location for a thermal desorption facility and associated support facilities, implementation of TD 5 would not require GE to obtain long-term access from another party.

Coordination with Agencies: Both prior to and during implementation of TD 5, GE would need to coordinate with EPA, as well as state and local agencies, to provide as-needed support with public/community outreach programs.

9.5.9 Cost

The overall range of estimated total costs to implement TD 5 is $103 M to $1.53 billion (not including the cost of the sediment or floodplain removal alternatives). These costs include all labor, equipment, and materials necessary for the thermal treatment process as well as the associated post-treatment off-site disposal. Costs have been estimated for both scenarios: (1) assuming on-site reuse of 50% of the treated floodplain soils as backfill in the floodplain, and off-site disposal of remaining treated soils and all treated sediments; and (2) assuming off-site disposal of all treated materials. For both scenarios, the range of estimated costs is represented by: (a) a lower bound based on the minimum volume of sediment/soil that could be treated (191,000 *in situ* cy assuming implementation of SED 3 and FP 2); and (b) an upper bound based on the maximum volume of sediment/soil that could be treated (2.9 million *in situ* cy assuming implementation of SED 8 and FP 7). In all cases, the estimated costs assume that the treated solid materials to be transported off-site would be disposed of at a non-TSCA solid waste landfill, and that the liquid condensate would be transported to an appropriate TSCA incineration facility.

The range of estimated capital costs associated with construction/set-up of the thermal desorption facility is $20 M to $232 M (depending on the size of the facility). Annual operations costs related to the thermal treatment facility over the course of the entire project range from $5 M to $16 M per year, depending on the volume of materials to be treated, resulting in total operations costs of $42 M to $642 M. The estimated total post-treatment disposal costs range from $36 M to $595 M, depending on the volume of material being disposed of and the method of disposition.[540] As mentioned in Section 9.5.1.2, there would be a small component of post-treatment monitoring and maintenance costs associated with monitoring of the restoration of the facility area. For purposes of this Revised CMS Report, restoration and the associated monitoring and maintenance costs are assumed to consist of monitoring and maintenance of the restored area for a period of five years at $25,000 per year, resulting in a total cost of $125,000. The following summarizes the total costs estimated for TD 5.

TD 5	**Minimum Est. Cost**		**Maximum Est. Cost**		**Description**
	w/ reuse	**w/o reuse**	**w/ reuse**	**w/o reuse**	
Total Capital Cost	$20 M	$20 M	$232M	$232 M	Total cost for engineering, labor, equipment, materials associated with facility construction
Total Operations Cost	$47 M	$47 M	$698 M	$698 M	Total estimated cost for pre-treatment handling of excavated materials and for operation and maintenance of desorption facility during years of operation (8 to 40 years)
Total Associated Off-site Disposal Costs	$36 M	$39 M	$518 M	$595M	Total estimated post-treatment off-site disposal costs, assuming all treated materials may be disposed of as non-TSCA materials
Total Post-Treatment Monitoring and Maintenance Cost	$0.125 M	$0.125 M	$0.125 M	$0.125 M	Total estimated post-treatment monitoring and maintenance costs for 5 years from completion of restoration of facility area
Total Cost for Alternative	$103 M	$106 M	$1,450 M	$1,530 M	Total cost of TD 5 in 2010 dollars

[540] As noted above, these estimated costs assume that all treated solid materials may be disposed of as non-TSCA-regulated wastes. If those materials must be disposed of based on their pre-treatment TSCA classification, there would be significant additional costs beyond those discussed above. For instance, the off-site transport/disposal costs would add an additional $237 M to the costs associated with the maximum potential disposal volumes.

The overall range of estimated present worth costs for TD 5 was developed using a discount factor of 7%, an assumed overall duration of 10 to 52 years,[541] and a post-closure monitoring period of 5 years. That overall range is $81 M (based on the minimum volume and assumed combination of reuse and off-site disposal of treated materials) to $590 M (based on the maximum volume and assumed off-site disposal of all treated materials). More detailed cost estimate information and assumptions for each of the treatment/disposition alternatives are included in Appendix Q.

9.5.10 Overall Protection of Human Health and the Environment – Conclusions

As explained in Section 9.5.2, the evaluation of whether TD 5 would provide overall protection of human health and the environment draws upon the evaluations under several other Permit criteria, discussed in prior sections, as well as other factors relevant to the protection of health and the environment. The key considerations relevant to this criterion are discussed below.

<u>General Effectiveness</u>: As discussed in Section 9.5.5.2, the thermal desorption technology has been demonstrated to be an effective remedial technology for the treatment of PCB-impacted soil at some sites and not at others, but has only limited precedents for use on sediments. As discussed previously, most of the PCBs present in the sediments/soils would be volatilized using an indirect fired thermal desorption system and transferred to the off-gas from which they would be condensed into a liquid stream. The condensed PCBs would then be transported to a permitted off-site facility for destruction. However, to date, the volumes of PCB-impacted materials treated at other sites have generally been relatively small, the duration of the treatment operation has been relatively short, and when on-site reuse has occurred, the material has typically been placed into a small area and covered with clean backfill. While it has been assumed for purposes of this Revised CMS that metals leachability would not affect end use and/or disposal costs, the leachability of certain metals that may be present in the soils/sediment could be altered by the thermal desorption process (for example, thermal desorption can oxidize lead, increasing toxicity and mobility [ITRC, 1998]) and thereby affect the ultimate end use and/or disposal costs of the treated soil/sediment. Thus, the reliability of this process for a long-term treatment operation involving a large volume of sediments and soils, and the ability to use the treated solids, amended by organic material, as backfill in the floodplain are unknown.

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[541] This range is based on the estimated overall duration of the lowest cost/lowest volume combination (SED 3 and FP 2) to that of the highest cost/highest volume combination (SED 8 and FP 7). Note that the lower bound of this range is different from the combination with the shortest duration, which is the combination of SED 10 and FP 9, with an estimated duration of 5 years.

Compliance with ARARs: As discussed in Section 9.5.4, review of the potential ARARs for TD 5 indicates that TD 5 could be designed and implemented to meet certain of those ARARs (provided that the necessary determinations are obtained from EPA), but that other federal and state regulatory requirements would not be met. To the extent that the latter requirements constitute ARARs, they would need to be waived by EPA as technically impracticable (or on some other ground) under CERCLA and the NCP.

Human Health Protection: TD 5 would provide human health protection by substantially reducing the PCB concentrations in the treated solids materials, followed by on-site reuse (after amendment with organics) and/or off-site disposal of those materials and off-site disposal/destruction of the liquids containing the condensed PCBs. Implementation of this alternative, either with or without reuse of a portion of the treated soils as backfill in the floodplain, would not be expected to produce any significant short-term or long-term adverse impacts on human health.

Environmental Protection: Implementation of TD 5 would provide protection of ecological receptors from potential exposure to PCBs for the same reasons discussed for human receptors. It would produce short-term effects on the environment due to the loss of habitat in the area where the thermal desorption facility would be located. It would also produce by far the greatest amount of GHG emissions (for the range of volumes) of any of the treatment/disposition alternatives. In addition, given the length of time required to implement this alternative (5 to 52 years), there would be a potential, which increases with implementation time, for failure of process and control equipment and consequent release of PCBs, metals, dioxins/furans (if formed during the process) into the atmosphere. There would also be a greater likelihood of spillage of the highly concentrated PCB-containing liquids during accidents as they are being transported off-site for treatment/disposal. At the altered grassland location identified for implementation of TD 5 for purposes of this Revised CMS Report, this alternative would not be anticipated to result in any significant long-term adverse habitat effects following completion of the treatment operations and restoration of the staging areas. However, if a portion of the treated soils is reused as backfill in the floodplain, that reuse would result in long-term adverse environmental impacts in forested and other wetland areas due to the differences in soil characteristics (including physical, chemical, and microbial properties, as well as seed bank) between those materials (even if amended with topsoil) and the existing natural soils in those wetland areas.

Summary: For the reasons given above, it is concluded that TD 5 would provide overall protection of human health. With respect to environmental protection, it is concluded that if the treated soils are not used as backfill, TD 5 would provide overall protection of the environment, although the substantial carbon footprint of this alternative in terms of GHG emissions, particularly with the larger volumes, is of concern. If 50% of the treated soils are used as backfill in the floodplain, TD 5 would not meet the standard of overall protection of the environment due to the adverse impacts resulting from the inability of those soils to match the characteristics of the existing soils in wetland areas, as well as due to the large carbon footprint from GHG emissions.

9.6 Comparative Evaluation of Treatment/Disposition Alternatives

In Sections 9.1 through 9.5, the five treatment/disposition alternatives have been individually evaluated under the three General Standards and five of the six Selection Decision Factors specified in the Permit (attainment of IMPGs was excluded, since it is not relevant to the treatment/disposition alternatives). This section contains a comparative evaluation of the five alternatives using the same criteria.

This comparative analysis evaluates the relative performance of the various treatment/disposition alternatives under the Permit criteria to identify potential advantages and disadvantages of each alternative relative to the others. This analysis also addresses the requirement specified in the Permit (Special Condition II.G.3) to identify which alternative, in GE's opinion, is "best suited to meet the [General Standards] in consideration of the [Selection Decision Factors], including a balancing of those factors against one another." As this language reflects, and as discussed previously in Section 8.2, a comparison of alternatives necessarily involves balancing and trade-offs. As a result, this comparative analysis focuses primarily on differences among the alternatives with respect to each criterion.

9.6.1 Overview of Alternatives

All five alternatives would involve disposition of the sediments and floodplain soils in disposal facilities, either directly or after prior treatment. The three alternatives involving only disposal are: (1) disposal in off-site permitted landfills (TD 1); (2) disposition in on-site CDF(s) in a local waterbody (TD 2) (i.e., Wood Pond or one or more backwaters); and (3) disposition in an on-site Upland Disposal Facility (TD 3) (for which three potential locations have been identified). The other two alternatives would involve treatment, either by a chemical extraction process (TD 4) or by thermal desorption (TD 5). As discussed in the detailed analysis of TD 4, since the results from the bench-scale tests of the representative chemical extraction process (the BioGenesis^{SM} process) indicate that PCB concentrations in the treated sediments and soils would not be sufficiently low to allow reuse on-site, the treated sediments and soils would have to be transported to a landfill for disposal. For TD 5, it is assumed for purposes of this Revised CMS Report that the thermal desorption process would reduce the concentrations of PCBs in the treated solid materials to levels (around 1-2 mg/kg) that could allow reuse in the floodplain and that it would not increase the metals leachability of those materials so as to preclude such use. Thus, it is assumed that approximately half of the treated floodplain soils could be mixed with organic-rich topsoil on an approximate 1:1 basis and could be used on-site as backfill in the floodplain, and that the remaining treated floodplain soils and all treated sediments would be transported to an off-site landfill for disposal.[542] However, due to uncertainties regarding the ultimate effectiveness of the treatment process (as well as issues relating to the reuse of the treated soils), TD 5 has also been evaluated based on the alternate assumption that all the treated material would be transported to an off-site landfill for disposal.

All of the treatment/disposition alternatives except TD 2 have been evaluated considering the same range of sediment and soil volumes that could be removed under the sediment and floodplain alternatives. This range extends from 191,000 cy, based on a combination of SED 3 and FP 2, to 2.9 million cy, based on a combination of SED 8 and FP 7. Under TD 2, however, the in-water CDF(s) would be used only for the disposition of hydraulically dredged sediments from Reaches 5C and 6, which would be generated only under SED 6, SED 7, SED 8, or SED 9. Thus, TD 2 has been evaluated for a range of hydraulically dredged sediment volumes from 300,000 cy for SED 6 to 1,240,000 cy for SED 8. Given this limitation, the evaluations of TD 2 alone are not comparable to the evaluations of the other TD alternatives, since they do not take account of the fact that, with TD 2, another treatment/disposition alternative (e.g., off-site disposal) would be necessary for the remaining sediments and for floodplain soils. For cost comparison purposes, however, the TD 2 analysis assumes that the sediment and soil not placed in the CDF(s) would be transported off-site for disposal. Under this assumption, the lower-bound costs for TD 2 are based on the combined volumes from SED 6 and FP 2 and the upper-bound costs are based on the combined volumes from SED 8 and FP 7 (see Section 9.6.9).

9.6.2 Overall Protection of Human Health and the Environment – Introduction

As discussed previously, the evaluation of whether the treatment/disposition alternatives would provide overall human health and environmental protection draws on the evaluations under several other Permit criteria – notably long-term effectiveness and permanence (including long-term adverse impacts), short-term effectiveness, and compliance with ARARs. For that reason, the comparative evaluation of the overall protectiveness of the treatment/disposition alternatives is presented at the end of Section 9.6 so that it can take account of the comparative evaluations under those other criteria, as well as other factors relevant to the protection of human health and the environment.

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[542] For reasons discussed in Section 9.5.1.2, it has been assumed that none of the treated materials could be used as backfill or capping material in the River.

9.6.3 Control of Sources of Releases

All the treatment/disposition alternatives would control the potential for PCB-containing sediments and soils to be released and transported within the River or onto the floodplain, although some alternatives would provide more effective control of such releases than others.

Under TD 1, placement of the removed PCB-containing sediments and soils into a permitted off-site landfill or landfills would effectively isolate those materials from being released into the environment. TD 2 would minimize the potential for releases through placement of some of the removed materials into CDF(s) (coupled with the implementation of a long-term monitoring and maintenance program). Under TD 2, there is a potential for releases of sediments into the River during the filling process and through releases of PCBs in the water that permeates out of the CDF(s) through the berms; however, by design, the PCBs suspended in the water inside the CDF(s) should be filtered out by the berms during this process. It is also possible that releases from the CDF(s) could occur after CDF closure through migration to groundwater or due to damage caused by ice or floods. (Assuming that, under TD 2, the materials not placed in the CDF(s) would be disposed of off-site, that disposal would isolate those materials from being released.) TD 3 would address future releases through the placement of the materials in an Upland Disposal Facility and the implementation of a long-term monitoring and maintenance program. Placement of the PCB-containing sediments and soils into an Upland Disposal Facility would effectively isolate the removed materials from being released into the environment and transported to the River or the floodplain. This is because: (1) the Upland Disposal Facility would be located away from the River and outside the 500-year floodplain; (2) the materials would be dewatered prior to placement in that facility; and (3) the facility would include a double liner system, a geosynthetic drainage layer, a double leachate collection system, and an impermeable surface cover.

Under TD 4 and TD 5, the potential for the PCB-containing sediments and soils to be released within the River or onto the floodplain during treatment operations would be minimized by locating the treatment facility away from the River and using appropriate engineering control systems. Moreover, under TD 4, the treated solid materials would be transported to an off-site landfill for disposal, the wastewater would be subject to treatment prior to discharge to the River, and the water treatment sludge would also be transported to an off-site landfill for disposal. Under TD 5, to the extent that some of the treated solids are used as backfill in the floodplain, chemical characterization sampling would be performed to verify that those materials would not present concerns regarding future releases or exposure. The remainder of the treated solids – or all such solids if none are reused as floodplain backfill – would be transported to an off-site landfill for disposal, and the concentrated PCB-containing liquid condensate from the thermal desorption process would be sent off-site for incineration.

During implementation of TD 4 or TD 5, however, the potential exists for the release of PCBs and other constituents (e.g., metals and dioxins/furans [if formed]) to the air, with TD 5 having the greatest potential for such emissions due to the treatment process used (application of heat to transfer PCBs into the vapor phase). The potential also exists for PCBs to be released to the environment through the spillage or incomplete treatment of water generated during implementation of TD 4 or TD 5, with TD 4 having the greatest potential for such a release given the significant volume of water generated during the treatment process. Under both treatment alternatives, releases of PCB-containing materials during implementation would be controlled using conventional engineering practices.

In short, all of the treatment/disposition alternatives would effectively control the potential for future releases of PCBs from the removed materials within the River or onto the floodplain, although there would be a somewhat greater potential for such releases under TD 2 than under the other alternatives.

9.6.4 Compliance with Federal and State ARARs

The potential ARARs identified by GE for the treatment/disposition alternatives are listed in tables in Appendix C and have been summarized and discussed in the relevant subsections of the preceding sections on those individual alternatives. There are no ARARs for TD 1, since that alternative would involve off-site transport and disposal. The chemical-specific ARARs for TD 2 should be attained, and no chemical-specific ARARs have been identified for TD 3 through TD 5 (although several guidances to be considered are listed in the ARARs tables). Thus, the ARARs analysis has focused primarily on the regulatory requirements that have been identified as potential location-specific and action-specific ARARs.[543]

For TD 2, as discussed in Section 9.2.4, the CDF(s) could be designed and operated to meet certain of the identified ARARs, including those under TSCA (provided that EPA makes the necessary risk-based approval or waiver determination allowed by the TSCA regulations); but there are a number of potential ARARs that would not be met. For

[543] For the reasons discussed in Section 2.1.3, some of those requirements (i.e., those that do not address on-site hazardous substances of the media containing them) do not constitute ARARs for the Rest of River remedy under CERCLA, but have nevertheless been identified as potential ARARs at EPA's direction.

example, TD 2 would not meet a number of siting and design requirements under the Massachusetts water quality certification regulations and the Massachusetts Wetlands Protection Act regulations, including the requirement that there be no practicable alternative with less adverse impact on the aquatic ecosystem,[544] the prohibition on projects that would adversely affect the Estimated Habitat of state-listed wildlife species, the prohibition on a CDF in an ACEC, several design requirements for a CDF, and (if applicable) the provision of flood storage compensation for the loss of flood storage capacity (which would not be feasible for TD 2). In addition, TD 2 would not meet the MESA requirement that a project not result in a take of a state-listed species. Thus, to the extent that these requirements constitute ARARs, they would need to be waived by EPA under CERCLA and the NCP in order for TD 2 to be implemented. Further, in the unlikely event that the sediments to be placed in the CDF(s) were found to constitute hazardous waste under RCRA and comparable state regulations and were determined to be subject to federal or state hazardous waste regulations, the CDF(s) would not meet some of the substantive requirements of those regulations, which would thus also need to be waived as technically impracticable to meet.

For TD 3, as discussed in Section 9.3.4, the Upland Disposal Facility could be designed and operated to meet the identified ARARs, including those under TSCA (provided that EPA makes any necessary risk-based approval or waiver determination allowed by the TSCA regulations), with a few potential exceptions: First, under certain configurations at each of the identified sites, the operational footprint for an Upland Disposal Facility[545] would impact a small area or areas that could constitute regulated wetlands, surface waters, or other jurisdictional resource areas under federal or state regulations. If the operational footprint would impact such a regulated area, then, to comply with the relevant regulations, EPA would have to find that there is no practicable alternative with less adverse impact on the aquatic ecosystem or wetlands and that the project would include all practicable steps to minimize or mitigate harm to the affected resource(s). In addition, there are a few other requirements of these regulations that might not be met. Notably, the maximum (but not minimum) operational footprint of a disposal facility at the Rising Pond Site would include NHESP-mapped Estimated Habitat and Priority Habitat for the state-listed wood turtle. Thus, under that scenario, the prohibitions in the Massachusetts water quality certification regulations and Wetlands Protection Act regulations on projects that would adversely affect

[544] This is also a requirement of certain federal regulations, such as EPA's and the U.S. Army Corps' regulations under Section 404 of the Clean Water Act.

[545] As described in Section 9.3, the operational footprint for an Upland Disposal Facility includes the area that would be used for waste disposal (the landfill) plus access roads, material staging areas, and other ancillary facilities, but excluding set-back and buffer areas that would not be disturbed by transport and disposal operations.

such Estimated Habitat and the MESA prohibition on a take of a state-listed species (if these prohibitions constitute ARARs) would need to be waived by EPA as technically impracticable to meet. Finally, in the unlikely event that the sediments or soils to be placed in the Upland Disposal Facility were found to constitute hazardous waste and were determined to be subject to federal or state hazardous waste regulations, there are a few requirements of those regulations that might not be met – notably, certain state siting requirements for a hazardous waste landfill (this would be investigated further during design).[546] If any such requirements could not be met at the identified location, those requirements would also need to be waived by EPA as technically impracticable to meet.

For TD 4 and TD 5, as discussed in Sections 9.4.4. and 9.5.4, the chemical extraction or thermal desorption facility could be designed and operated to meet certain of the identified ARARs, including those under TSCA (assuming that EPA makes the necessary risk-based approval determination allowed by the TSCA regulations); but there are a few such requirements that would not or may not be met at the location identified for that facility. For example, if two small wetlands that would be affected by the facility constitute regulated wetlands under federal or state regulations, EPA would have to find that there is no practicable alternative with less adverse impact on the wetlands and that the project would include all practicable steps to minimize harm to those wetlands. Additionally, in that case, since the treatment facility would be located within the Estimated Habitat of certain state-listed wildlife species, the prohibitions in the Massachusetts water quality certification regulations and Wetlands Protection Act regulations on projects that would adversely affect such habitat would not be met. Further, in any event, since the facility location would be within the Priority Habitat of a number of state-listed species and would adversely impact some of those species, the MESA prohibition on a take of such species would not be met. Thus, if these requirements constitute ARARs, they would need to be waived by EPA as technically impracticable to meet. Finally, in the unlikely event that the sediments or soils to be treated in the chemical extraction or thermal desorption facility were found to constitute hazardous waste and that the state hazardous waste regulations were found to apply, the facility could not feasibly meet certain locational standards in those regulations for hazardous waste treatment/storage facilities (e.g., that the waste piles for such storage not be located in the 500-year floodplain) and may not meet certain design requirements of those regulations. In that case, GE would evaluate available options, including, if necessary, seeking a waiver of any requirements that would be technically impracticable to meet.

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[546] In the event that materials to be placed in the disposal facility constitute hazardous waste, the substantive technical requirements of the federal and state regulations for a hazardous waste landfill would be met.

9.6.5 Long-Term Reliability and Effectiveness

The assessment of long-term reliability and effectiveness for the treatment/disposition alternatives has included an evaluation of the magnitude of residual risk, the adequacy and reliability of the alternatives, and potential long-term adverse impacts on human health or the environment.

9.6.5.1 Magnitude of Residual Risk

Placement of PCB-containing sediments/soils in off-site permitted landfills (TD 1), in one or more CDF(s) (TD 2), or in an Upland Disposal Facility (TD 3) would permanently isolate those materials from direct contact with human and ecological receptors, thus minimizing or eliminating the potential for long-term exposure to those sediments/soils and any associated risk (under EPA assumptions). Under TD 2, as noted above, there is a greater potential for releases than under TD 1 and TD 3, particularly since the CDF(s) would not have an impermeable cover or bottom liner designed to prevent water from entering or leachate (and possibly dissolved-phase PCBs) from exiting the CDF(s) and/or if there is damage to the CDF(s). Nevertheless, the CDF(s) would be designed to contain the dredged sediments and to withstand adverse weather and high flow events, and monitoring and maintenance would be performed to minimize releases.

Under TD 4 and TD 5, it is not expected that there would be any significant residual risks, because: (a) all treatment operations would be performed within secured areas, and residual PCBs associated with the operations would be removed following completion of the treatment operations; (b) all treated material would be transported off-site for disposal, except for any such material reused on-site under TD 5; and (c) any such treated materials reused on-site under TD 5 would be sampled to verify that the material to be reused would not pose a residual risk.

In summary, all of the treatment/disposition alternatives would minimize any future residual risk from exposure to the PCB-containing materials, although there would be a somewhat greater potential for such exposure under TD 2 than under the other alternatives, for the reasons noted above.

9.6.5.2 Adequacy and Reliability of Alternatives

There are considerable differences in the adequacy and reliability of the five treatment/disposition alternatives.

Use of off-site disposal facilities (TD 1) is a common and effective means for permanent disposition of PCB-containing material. However, as the volume of materials requiring disposal and the length of time required to do so increase, the more uncertainty would exist as to whether the capacity needed for the disposal of the sediments and soils would be available in appropriate off-site facilities over the long term. This uncertainty would be reduced or even eliminated with the smaller-volume, shorter-duration removal alternatives.

In-water CDFs (TD 2) have been used to dispose of dredged PCB-containing sediments at some environmental dredging sites. In this case, as discussed above, there is a somewhat greater potential for releases from the CDF(s), which would be constructed within waterways, than from off-site or local upland disposal facilities.

On-site disposal of PCB-containing materials in an upland facility (TD 3) has been used as part of a final remedy at a number of sites and is an effective and reliable means for permanently isolating such materials, provided that the facility is properly constructed, monitored, and maintained. The type of facility contemplated in TD 3 would be designed in accordance with applicable requirements, and monitoring and maintenance activities would be carried out on an annual basis for 100 years.

The use of chemical extraction (TD 4), including the BioGenesis^{SM} process, has not been demonstrated at full scale on sediments and soils representative of those in the Rest of River. As a result, there are uncertainties about the long-term reliability and effectiveness of operating such a system for a project of the size and duration, and with the range of PCB concentrations, that would be involved at the Rest of River. As discussed in Section 9.4.1.2, results from the site-specific BioGenesis bench-scale study indicate that the process would not reduce PCB concentrations in the treated materials to levels that would allow reuse. Further, while the test data indicate that the process could reduce PCB concentrations to levels where the resulting mass-weighted average PCB concentrations in the combined process outputs are less than 50 mg/kg, those levels were not achieved in all the individual outputs, and the extent to which the treated materials could be disposed of as non-TSCA material is uncertain. These and other factors (described in Section 9.4.5.2) create uncertainties regarding the effectiveness and reliability of using the chemical extraction process in a full-scale application for treatment of sediments and soils from the Rest of River.

Thermal desorption (TD 5) has been used at several sites to treat PCB-containing soils to achieve concentrations on the order of 1 to 2 mg/kg.[547] However, there is only limited precedent for use of this technology on sediments, due in part to the time and cost of

[547] Thermal desorption was initially selected as a remedy for soils at other sites and then abandoned (in whole or in part) in favor of off-site disposal. These sites include the Fletcher’s Paint Works Site (NH) and the Freeman’s Bridge Road Site (NY), as described in Section 9.5.5.2.

removing moisture from the sediments prior to treatment. Mechanical problems can result from treatment of high-organic, high-moisture-content, fine-grained materials, which can clump and clog equipment or otherwise be physically difficult to treat. Moreover, at the sites identified where thermal desorption has been used, the volumes of materials that were treated were substantially smaller and the duration of the treatment operations was substantially shorter than the volumes and duration that could be required at the Rest of River. Further, when on-site reuse of treated materials has occurred, the materials have typically been placed in a small area and covered with clean backfill. While it has been assumed for the Revised CMS Report that metals leachability would not affect end use and/or disposal costs, the thermal desorption process could alter the leachability of certain metals that may be present in the soils/sediments (e.g., by oxidizing lead, increasing its toxicity and mobility) and thereby affect the ultimate end use and/or disposal costs of the treated soils/sediment. For these reasons, the reliability of this process for a long-term treatment operation with a large volume of materials like sediments/soils from the Rest of River is unknown, as is the ability to use the treated solids, amended by organic material, as backfill in the floodplain without being covered by other material.

Based on these differences, the adequacy and reliability criterion favors either TD 1 or TD 3 for disposal of the excavated materials under the lower-volume removal alternatives, and favors TD 3 for disposal of the excavated materials under the larger-volume removal alternatives.

9.6.5.3 Potential Long-Term Adverse Impacts on Human Health or the Environment

Implementation of TD 1, TD 2, and TD 3 would isolate the removed sediments/soils from potential human and ecological exposure since the material would be contained in structures designed specifically for that purpose. Under TD 4, removed material would first be treated, and then disposed of off-site. For TD 5, materials would be treated, and then a portion might be reused in the floodplain assuming that it has acceptable residual levels of contaminants (i.e., PCBs and metals) for such use, with the remainder disposed of off-site. Thus, under all the treatment/disposition alternatives, no long-term adverse impacts on humans or ecological receptors from exposure to the PCB-containing materials are expected.

TD 1 would not cause any adverse long-term environmental impacts in the Rest of River area since it would involve off-site transport and disposal of the PCB-containing materials.

Under TD 4 and TD 5, as discussed in Sections 9.4.5.3 and 9.5.5.3, the construction and operation of a 5-acre treatment facility at the former DeVos property would result in a loss of the habitat within that area (a former agricultural area that is now open grassland with scattered shrubs) during the period of treatment operations and for a few years thereafter.

That loss, as well as increased noise and human presence in the area, would affect the wildlife in the area (which includes the Priority Habitat for certain state-listed species) during that period. However, given the relatively small size of the facility, the previously altered nature of the habitat, and the planned re-seeding of the area with a grassland mix following removal of the facility, long-term ecological impacts associated with construction and operation of the facility, if any, would be minimal. On the other hand, under TD 5, if a portion of the thermally treated soils is reused as backfill in the floodplain, that reuse would result in long-term adverse environmental impacts in the forested floodplain and other wetland areas due to the differences in soil characteristics (including physical, chemical, and microbial properties, as well as seed bank) between those materials (even if amended with topsoil) and the existing natural soils in those wetland areas, as discussed in Section 9.5.5.3.

For TD 3, as discussed in Section 9.3.5.3, the construction of the Upland Disposal Facility would result in the alteration of existing habitat within the operational footprint of that facility. In the landfill area itself, as well as any support areas (e.g., access roads) that would remain after closure, the habitat alteration would be permanent, although the landfill would be capped and planted with grass. In support areas (access roads, staging areas, etc.) that would no longer be needed after closure, restoration efforts would be implemented, but the habitat impacts could still last for decades after restoration, especially in replanted forest areas. The significance of the change in habitat would depend on the existing habitat at the location of the facility, as well as the size of the facility. For the identified locations for such a facility, the existing habitat that would be affected ranges from a highly disturbed area at the majority of the Woods Pond Site that is or was used as a sand and gravel quarry – where there would be no long-term negative impacts from the habitat change – to upland forest at a portion of that site (particularly under the maximum volume scenario) and most of the Forest Street and Rising Pond Sites – where the long-term loss of forested habitat and permanent change to a replanted grassland in the landfill area would be more significant.[548] In any event, the long-term change in habitat would be localized to the discrete operational footprint of the facility (or the landfill and permanent support areas area for a permanent change), rather than constituting widespread impacts in the Rest of River area. Moreover, placement of the facility outside the floodplain of the River and away from or with minimal impacts on wetlands would avoid or minimize long-term impacts to species that inhabit those types of areas.

[548] As noted in Section 9.3.5.3, the maximum (but not minimum) operational footprint for a disposal facility at the Rising Pond Site would impact the Priority Habitat of the state-listed wood turtle and result in a take of the wood turtle.

For TD 2, as discussed in Section 9.2.5.3, the placement of an in-water CDF in Woods Pond and/or one of the two identified backwaters would have more significant long-term adverse environmental impacts. It would result in a permanent loss of the aquatic habitat in those areas, causing a long-term loss of the benthic invertebrates and other biota that use those areas. In particular, depending on the location and size of the CDF(s), TD 2 would adversely affect the Priority Habitat of up to nine state-listed species. In addition, the CDF(s) would raise the raise the topography of the CDF area(s), reduce available shoreline/wetland habitat, and produce a loss of the existing flood storage capacity of those areas (since provision of complete flood storage compensation at the appropriate elevations/areas in Reaches 5C and 6 would not be practical), as well as causing localized alterations in the hydraulics of the River during high flow events. Further, the CDF(s) would permanently alter the previously undisturbed appearance of the area(s) where the CDF(s) would be located, negatively impacting the aesthetic appeal of those areas to recreational users of the River, particularly in areas where sheetpile walls would be visible; and the impacted areas would be eliminated from use for canoeing and fishing.

Thus, of the treatment/disposition alternatives, TD 2 would have the greatest long-term adverse environmental impacts, followed by TD 5 and then other alternatives.

9.6.6 Reduction of Toxicity, Mobility, or Volume

The degree to which the treatment/disposition alternatives would reduce the toxicity, mobility, and volume of PCBs is discussed below.

Reduction of Toxicity: TD 1 through TD 3 would not include any treatment processes that would reduce the toxicity of, or directly affect, PCB concentrations in the removed sediment and soil. TD 4 and TD 5 would incorporate treatment processes that can, to varying degrees, reduce concentrations of PCBs. The latter alternatives would involve the treatment of between approximately 191,000 cy of sediments/soils containing 14,500 lbs of PCBs (if SED 3 and FP 2 were implemented) to approximately 2.9 million cy of material containing 94,100 lbs of PCBs (if SED 8 and FP 7 were implemented). Under TD 4, the chemical treatment process would reduce the toxicity of the sediment and soil by permanently removing some PCBs from these materials. As discussed in Section 9.4.1.2, bench-scale testing indicates that the BioGenesis[SM] process would reduce the concentrations of PCBs in the treated sediment and soil by varying amounts, depending on the type of material and the number of passes through the system, although not to a sufficient extent to allow on-site reuse of that material. The waters generated during the process would contain PCBs, and these would be treated using wastewater treatment methods prior to discharge. The PCB-containing sludge generated during the wastewater treatment would be sent to a permitted off-site disposal facility. Under TD 5, the indirect fired thermal desorption system would reduce the toxicity of the PCB-containing sediment and soil by permanently removing PCBs from these materials, and the PCBs in the liquid stream would be sent to a permitted off-site disposal facility for destruction. As noted above, experience at other sites indicates that this process can reduce PCB concentrations in the treated solids to levels on the order of 1 to 2 mg/kg and potentially support reuse of that material as backfill in floodplain areas following amendment.[549]

Reduction of Mobility: All of the alternatives would reduce the mobility of PCBs in the sediment and soil. In TD 1, TD 2, and TD 3, these materials would be removed and disposed of in off-site permitted landfill(s) (TD 1) or permanently contained within on-site CDF(s) (TD 2) or an Upland Disposal Facility (TD 3). TD 4 and TD 5 would reduce the mobility of PCBs present in the sediment/soil via chemical extraction or thermal desorption. (It should be noted, however, that the bench-scale data for the BioGenesis℠ process suggest that that process involves, at least in part, the washing of fine-grained materials with high PCB concentrations into the aqueous wastewater phase, which would result in increased mobility of PCBs, with treatment of the wastewater required prior to discharge.) The treated materials would be sent to a permitted off-site landfill – with the qualification that, under TD 5, some of the treated solids could be amended with organic-rich materials and then reused as backfill in the floodplain, but only after confirmation of reduced PCB concentrations and non-leachability of metals, and therefore reduced mobility for those constituents.

Reduction of Volume: TD 1, TD 2, and TD 3 would not reduce the volume of PCB-containing material. For TD 4, treatment of sediment/soil using the BioGenesis℠ process would reduce the volume of PCBs present in those materials by transferring some of the PCBs to an aqueous waste stream for subsequent treatment. PCB-containing sludge would be generated from the wastewater treatment system and would be sent to a permitted off-site facility for disposal. In the bench test of the BioGenesis℠ process, the volume of soil/sediment prior to treatment was greater than the volume of treated sediment/soil measured at the end of the process (i.e., there was sediment/soil that was unaccounted for in the bench test); as a result, the extent of any PCB destruction associated with TD 4 (i.e., in the Oxidation step using hydrogen peroxide) cannot be determined. For TD 5, treatment of sediment/soil in the thermal desorption system would reduce the volume of PCBs present in those materials, with the liquid condensate transported to an off-site facility for destruction. As noted previously, thermal desorption at other sites indicates that low PCB concentrations (e.g., 1 mg/kg to 2 mg/kg) may be achieved in the treated solids.

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[549] It should also be noted that, under all alternatives, if "principal threat" wastes (e.g., NAPL) should be encountered (which is not anticipated), those wastes would be segregated from the remaining materials subject to disposition or treatment, and would be separately sent off-site for treatment and disposal.

9.6.7 Short-Term Effectiveness

Evaluation of the short-term effectiveness of the treatment/disposition alternatives has included consideration of the short-term impacts of implementing these alternatives on the environment (considering both ecological effects and increases in GHG emissions), on the local communities (as well as communities along truck transportation corridors), and on the workers involved in the treatment and disposition activities. Short-term impacts from the implementation of these alternatives would last for the duration of these activities, which would depend on the duration of the selected combination of sediment and floodplain soil alternatives.

Impacts on the Environment

All the treatment/disposition alternatives would produce some short-term adverse impacts on the environment, but to varying degrees depending on the duration and scope of the alternative. The short-term impacts of TD 2 through TD 5 would include loss of habitat and loss or displacement of aquatic biota and other wildlife in the areas where the disposition or treatment facilities are located, as well as in adjacent areas, during construction and operations. TD 2 would affect a large portion of Woods Pond and/or one of the two backwaters identified for a CDF, as well as the adjacent floodplain. Specific short-term impacts associated with TD 3 would depend on the habitat at the selected location and the operational footprint of the facility. As noted above, the existing habitat that would be disturbed at the identified locations for an Upland Disposal Facility ranges from a previously disturbed area at much of the Woods Pond Site that is or was used as a quarry – where there would be minimal, if any, adverse short-term ecological impacts – to mature upland forest at a portion of that site (particularly under the maximum volume scenario) and most of the Forest Street and Rising Pond Sites, which would experience more significant short-term impacts, including the loss of birds, mammals, reptiles, and other wildlife that use that forested habitat. Construction of a treatment facility for TD 4 or TD 5 on the former DeVos property would result in the temporary reduction of open field habitat on that property, which is used by various birds, mammals, reptiles, and invertebrates, including a number of state-listed species that utilize open field habitat within the floodplain. In addition, under TD 5, the reuse of treated soil as backfill in the floodplain would have short-term adverse environmental impacts in floodplain forest and other wetland areas due to the differences in soil characteristics between that material and the existing soil in those wetland areas.

All of the treatment/disposition alternatives could also have short-term effects on the environment due to the potential for accidental releases of PCB-containing materials – i.e., PCB-containing sediments and/or soils (for all alternatives), PCB-containing wastewaters and sludges (for TD 4), and PCB-containing liquid concentrate (for TD 5) – during transportation to off-site or local disposition or treatment facilities. In addition, TD 4 and TD

5 have a potential for failure of process and control equipment during operations, which could result in a release of PCB-containing materials to the environment, such as PCB-containing wastewaters and sludges (TD 4) and PCB-containing liquid concentrate and vapors (TD 5). Failure of process and control equipment during operations under TD 5 could also result in the formation and release of dioxins/furans, and/or the release of metals (e.g., mercury) to the atmosphere. Further, under TD 4, there is a potential for accidental spills of the chemicals used in the extraction process. The potential for these types of effects would increase with the length of the implementation period.

Carbon Footprint – GHG Emissions

As described in Section 5.6 and Appendix M, estimates have been developed of the carbon footprint composed of GHG emissions anticipated to occur through activities during the implementation of the treatment/disposition alternatives. These estimates were based on the ranges of the potential volumes of sediments and soils that would require disposal or treatment – from the lowest to the highest. Table 9-3 below summarizes the resulting ranges of total GHG emissions associated with each TD alternative. To provide context regarding the emissions reported below, the number of passenger vehicles that would emit an equivalent quantity of CO_2-eq in one year is also presented in the table.

Table 9-3 – Calculated GHG Emissions Anticipated to Result from Treatment/Disposition Alternatives

Alternative	Total GHG Emissions (tonnes)	No. Vehicles w/ Equivalent Emissions
TD 1	19,000 – 290,000	3,600 – 55,400
TD 2	See note 1	See note 1
TD 3 (see note 2)	5,500 – 61,000	1,100 –11,700
TD 4	27,000 – 370,000	5,200 – 70,700
TD 5 (w/ reuse)	66,000 – 1,000,000	12,600 – 191,200
TD 5 (w/o reuse)	66,000 – 1,100,000	12,600 – 210,300

Notes:

1. Emissions estimated for TD 2 range from 2,700 to 8,800 tonnes and do not include the emissions that would be necessary for off-site transport and disposal of materials that are not placed in the CDF(s). As such, these estimates are not comparable to the emissions listed for the other alternatives.
2. As discussed in Section 9.3.7, the lower bound of this range for TD 3 is based on disposal of the minimum potential removal volume at the Woods Pond Site (which would have the lowest GHG emissions of the identified sites) and the upper bound is based on disposal of the maximum potential removal volume at the Rising Pond Site, which is the only one of the identified local disposal sites that could accommodate that maximum volume.

As shown in Table 9-3 (excluding TD 2, which is not comparable), TD 5 would have by far the greatest amount of total GHG emissions for the range of volumes; TD 4 would have the next largest amount, followed by TD 1. TD 3 would have lowest amount of total GHG emissions for the range of volumes – approximately 3 to 5 times less than the next lowest alternative (TD 1). It should be noted, however, that the magnitude of the differences among alternatives increases dramatically with the removal volume. For example, the lower-bound estimates for TD 1 and TD 3 are 19,000 and 5,500 tonnes, respectively – a difference of 13,500 tonnes. However, the upper-bound estimates are 290,000 tonnes for TD 1 and 61,000 tonnes for TD 3 – a difference of 229,000 tonnes (17 times more than the difference at the lower bound). Such differences are even more pronounced when comparing TD 3 with TD 4 and TD 5.

Impacts on Local Communities and Communities Along Truck Transportation Routes

All the alternatives would also result in short-term impacts to the local communities in the Rest of River area. These impacts would include disruption, noise, and other impacts resulting from the increased truck traffic and from the construction and operation of the on-site disposition or treatment facilities, and would last for the duration of the project.

The truck traffic required for implementation of all of the alternatives would create potential short-term impacts not only for the local communities, but also for communities along off-site transportation routes. TD 1, TD 3, TD 4, and TD 5 would result in an increase in truck traffic due to the transport of excavated or treated materials from the staging areas to the disposal or treatment facility(ies) (and, for TD 4 and TD 5, from the treatment facility to off-site disposal facilities) and for the delivery of construction materials and equipment to the disposal or treatment facility (for TD 3 through TD 5). For TD 2, although there would be no off-site transport of hydraulically dredged sediments (as they would be disposed of in the CDF(s)), there would be off-site truck traffic associated with the transport of materials and equipment to the site for construction and closure of the CDF(s) (as well as the truck traffic associated with off-site disposal of the sediments that are not placed in the CDF(s) and of the excavated floodplain soils).

The estimated numbers of off-site truck trips for each alternative, based on the estimated range of volumes that could be involved and an assumption that 20-ton capacity trucks would be used to transport excavated materials and that smaller (16-ton) capacity trucks would be used for importation of materials and equipment to the site, are shown in Table 9-4.[550]

Table 9-4 – Estimated Off-Site Truck Trips for Treatment/Disposition Alternatives

Alternative	Off-Site Truck Trips for Lower-Bound Volume	Off-Site Truck Trips for Upper-Bound Volume
TD 1	15,900 (2,000)	243,000 (6,100)
TD 2	See note 3	See note 3
TD 3 (see note 4)	1,450 (180)	68,000 (3,600)
TD 4	15,900 (2,000)	243,000 (6,100)
TD 5 (w/ reuse)	13,300 (1,700)	190,500 (4,800)
TD 5 (w/o reuse)	14,300 (1,800)	218,900 (5,500)

Notes:

1. Truck trips estimated assuming 16-ton capacity trucks for importing material and equipment to the site, 20-ton capacity trucks for transporting excavated materials, and 20% bulking factor in the trucks. Numbers have been rounded.
2. The number in parentheses represents average annual truck trips.
3. Truck trips estimated for TD 2 range from 5,600 to 19,500 and do not include the truck trips that would be necessary for off-site transport and disposal of materials that are not placed in the CDF(s). As such, these estimates are not comparable to the numbers of truck trips listed for the other alternatives.
4. As shown in Table 9-2 in Section 9.3.7, the lower bound of this range for TD 3 is based on construction of an Upland Disposal Facility at the Woods Pond Site and the upper bound is based on construction of such a facility at the Forest Street Site.
5. A 10% volume reduction of sediment/soil after treatment has been assumed for thermal desorption treatment (TD 5).
6. For TD 5 with reuse, it is assumed that approximately 50% of the floodplain soils treated by thermal desorption would be reused on-site and that all remaining materials would be transported off-site for disposal.

As shown in this table, excluding TD 2, which is not comparable, TD 3 would involve by far the fewest off-site truck trips for the range of volumes, while those for the other alternatives are roughly comparable, with somewhat more for TD 1 and TD 4 than for TD 5. Again,

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[550] For comparability among alternatives, this table shows only off-site truck trips – i.e., those for importation of construction materials and equipment to the site over public roads for construction and closure of a local disposal or treatment facility, as well as those for transport of excavated or treated soils/sediments to off-site disposal facilities. It does not include transport of excavated materials from the staging areas to the local disposal or treatment facility

however, the magnitude of the differences among alternatives increases with the removal volume. For example, the lower-bound estimates for TD 1 and TD 3 are approximately 15,900 and 1,450 off-site truck trips, respectively – a difference of 14,450 trips. However, the upper-bound estimates are approximately 243,000 off-site truck trips for TD 1 and 68,000 such trips for TD 3 – a difference of 175,000 truck trips (12 times more than the difference at the lower bound).

The additional truck traffic would also increase the risk of traffic accidents along transport routes. Appendix N presents an analysis of potential risks from the increased off-site truck traffic that would be associated with the treatment/disposition alternatives in terms of potential fatalities and non-fatal injuries from truck accidents.[551] A summary of that analysis, based on the above range of off-site truck trips, is presented in Table 9-5 below.

Table 9-5 – Incidence of Accident-Related Injuries/Fatalities Due to Increased Off-Site Truck Traffic

Impacts	TD 1	TD 2	TD 3 [3]	TD 4	TD 5 (w/ Reuse)	TD 5 (w/o Reuse)
Non-Fatal Injuries						
Number	4.34 – 67.03	See note 2	0.03 – 1.60	4.11 – 62.87	3.44 – 49.24	3.70 – 56.59
Average Annual Number	0.45 – 1.28	See note 2	0.0002 – 0.084	0.51 – 1.57	0.43 – 1.23	0.46 – 1.41
Probability[1]	99 – 100%	See note 2	3 – 80%	98 – 100%	97 – 100%	98 – 100%
Fatalities						
Number	0.20 – 3.14	See note 2	0.002 – 0.07	0.19 – 2.94	0.16 – 2.31	0.17 – 2.65
Average Annual Number	0.02 – 0.06	See note 2	0.0002 – 0.004	0.02 – 0.07	0.02 – 0.06	0.02 – 0.07
Probability[1]	18 – 96%	See note 2	0.2 – 7%	18 – 95%	15 – 90%	16 – 93%

Notes:

1. Probability indicates the probability of at least one injury/fatality.
2. The estimated risks of accidents for TD 2 are based only on the truck trips necessary to transport materials to the site for the construction of the CDF(s) and do not consider the truck

[551] This analysis quantified these traffic accident risks for the off-site truck trips (i.e., those used to import construction materials and equipment to the site, as well as to transport excavated or treated soils/sediments to off-site disposal facilities). The risks associated with transport of excavated materials from the staging areas to a local disposal or treatment facility are quantified as part of worker risks (i.e., risks to industrial truck drivers as a function of total labor hours), described below.

trips for off-site transport of the materials that would not be placed in the CDF(s). As such, those risks are not comparable to the estimated risks for the other treatment/disposition alternatives (which consider all removed materials). Under the scenario evaluated, the risks estimated for TD 2 are 0.01 to 0.02 fatalities (with a 1% to 2% probability of at least one fatality) and 0.13 to 0.46 non-fatal injuries (with a 12% to 37% probability of at least one injury).

3. The lower bound of this range for TD 3 is based on construction of an Upland Disposal Facility at the Woods Pond Site and the upper bound is based on construction of such a facility at the Forest Street Site.

As shown in Table 9-5, the incidence of potential injuries and fatalities resulting from accidents associated with increased off-site truck traffic would be the greatest for TD 1 and TD 4, followed closely by TD 5, and would be far lower for TD 3. As with the number of off-site truck trips, the differences in estimated injuries and fatalities resulting from such traffic become more pronounced as the removal volumes increase. As an example, the estimated number of non-fatal injuries at the lower bound is 0.03 for TD 3 and around 4 for TD 1, TD 4, and TD 5; while the estimated number at the upper bound is 1.6 for TD 3 and 49 to 67 for those other alternatives.

<u>Potential Measures to Avoid, Minimize, or Mitigate Short-Term Environmental and Community Impacts</u>

A number of measures would be employed in an effort to avoid, minimize, or mitigate the short-term impacts of the treatment/disposition alternatives on the environment and the affected communities. These measures are described in Sections 9.1.7, 9.2.7, 9.3.7, 9.4.7, and 9.5.7. Despite the implementation of these measures, there would still be some detrimental short-term impacts and risks associated with implementation of each of the alternatives. As would be expected, the level of impact and thus the scope and duration of mitigation measures are related to the scale/scope of the alternative and the duration of implementing the alternative. For TD 1, the mitigation measures would relate to the increased truck traffic, while for the other TD alternatives, mitigation measures would address the increase in truck traffic as well as the impacts associated with construction and operation of the different facilities.

<u>Risks to Remediation Workers</u>

There would also be health and safety risks to site workers implementing each of these alternatives. For TD 1, these risks would consist of risks to the truck drivers and to the employees of the off-site disposal facilities, rather than to on-site remediation workers, and hence have not been quantified. For TD 2 through TD 5, Appendix N contains an analysis of estimated risks to site workers from implementation of those alternatives, with the range of potential risks based on the range of total labor hours for implementation of the alternatives.[552] The following table shows the range of estimated fatalities and non-fatal injuries for alternatives TD 2 through TD 5:

Table 9-6 – Incidence of Potential Accidents/Injuries Due to Implementation of Alternatives TD 2 Through TD 5

Impacts	TD 2	TD 3[2]	TD 4	TD 5
Labor-hours (hours)	73,000 – 259,000	306,000 – 1,836,000	160,600 – 1,673,600	160,600 – 1,673,600
Years of Operation	6 – 20	8 – 40	8 – 40	8 – 40
Non-Fatal Injuries				
Number	0.70 – 2.50	2.69 – 16.4	1.27 – 13.1	1.27 – 13.1
Average Annual Number	0.12 –0.13	0.34 – 0.41	0.16 – 0.33	0.16 – 0.33
Probability[1]	50 – 92%	93 – 100%	72 – 100%	72 – 100%
Fatalities				
Number	0.01 – 0.03	0.02 – 0.11	0.007 – 0.08	0.007 – 0.08
Average Annual Number	0.0012 – 0.0013	0.002 – 0.003	0.0009 – 0.002	0.0009 – 0.002
Probability[1]	1 – 3%	2 – 11%	0.7 – 8%	0.7 – 8%

Notes:

1. Probability indicates the probability of at least one injury/fatality.
2. The lower bound of this range for TD 3 is based on disposal of the minimum potential removal volume at the Woods Pond Site, and the upper bound is based on disposal of the maximum potential removal volume at the Rising Pond Site, which is the only one of the identified local disposal sites that could accommodate that maximum volume and thus has the longest period of operations.

Excluding TD 1 (which would have no risks of injuries or fatalities to site workers), Table 9-4 shows that estimated risks to site workers for the range of volumes would be lowest for TD 2 (due to its fewer years of operation) and higher for the other alternatives, with TD 3 slightly higher than TD 4 and TD 5. In this case, there are no substantial differences among TD 3, TD 4, and TD 5 at the same volumes, but there are significant differences between the lower and upper bounds. For example, the estimated numbers of non-fatal injuries to site workers under these alternatives are approximately 1.3 to 2.7 at the lower bound and 13 to 16 at the upper bound.

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[552] For TD 3, TD 4, and TD 5, this analysis includes the risks to industrial truck drivers transporting excavated materials from the staging areas to the Upland Disposal Facility or the treatment facility.

Summary of Short-Term Effectiveness

All of the treatment/disposition alternatives would have some short-term negative impacts on the environment, local communities, and communities along transport routes. TD 2 through TD 5 would cause a loss of habitat and loss or displacement of wildlife in the area where the disposal or treatment facility is located, as well as in adjacent areas, during construction and operation of the facility. In addition, all alternatives would involve a potential for accidental releases of various PCB-containing materials during transportation to off-site or local disposal or treatment facilities. This potential would increase with TD 4 and TD 5, since those alternatives would pose additional risks associated with the potential for failure of process and control equipment during operations, and releases of process byproducts/chemicals to the environment. Further, while all alternatives would generate GHG emissions, the estimates of such emissions indicate that, for the range of volumes (excluding TD 2, which is not comparable), TD 5 would produce by far the most such emissions and TD 3 would produce the least.

All of the alternatives would also cause an increase in truck traffic on local roads and along transport routes to off-site disposal facilities, with the attendant increase in noise and risk of accidents. The estimates of off-site truck trips and traffic accident risks from that truck traffic indicate that, for the range of volumes (excluding TD 2), TD 1 and TD 4 would involve the most off-site truck trips and cause the most injuries related to such transport, followed closely by TD 5, with far fewer off-site truck trips and transport-related injuries for TD 3. In terms of risks to on-site workers, excluding TD 1 (which would not affect site workers) and TD 2 (which is not comparable), the estimated injuries for the other three TD alternatives are roughly comparable for the same volumes.

For all of these measures of short-term effects, the adverse impacts would increase substantially, and the magnitude of the differences among alternatives would likewise increase, as the volume of removed materials to be disposed of or treated and the corresponding implementation time increase.

9.6.8 Implementability

9.6.8.1 Technical Implementability

All of the treatment/disposition alternatives are considered technically implementable, subject to certain qualifications:

- For TD 1, while there are currently a number of existing permitted TSCA and solid waste landfills with the capacity to accept all of the removed material, there are uncertainties at this time regarding the future availability of the necessary capacity in off-site landfills for disposal of the removed materials under the sediment and floodplain alternatives that have the larger volumes and longer durations.

- For TD 2, while CDFs have been constructed at a number of sites, it is expected that the CDF(s) in Woods Pond and/or the backwaters would result in a loss of flood storage capacity. It would likely not be feasible to obtain sufficient flood storage compensation at the appropriate elevations/areas, if required, to provide for construction of a CDF(s) large enough to hold the necessary sediment disposal volumes.

- For TD 3, construction and use of an Upland Disposal Facility would be readily implementable. As noted in Section 9.3.1, GE has identified three potential locations for such a facility, with varying maximum capacities (ranging from 1.0 to 2.9 million cy).[553] For sediment-floodplain combinations involving the need to dispose of volumes up to approximately 1.0 million cy, any of these locations could be used. For combinations involving the need to dispose of greater volumes, a disposal location with sufficient capacity to handle that volume or a combination of two disposal locations could be used.

- TD 4 and TD 5 would be implementable provided that vendors are available to operate the treatment process. As noted in Sections 9.4.8 and 9.5.8, GE has identified the former DeVos property as a potential area to locate a treatment facility. However, there are several uncertainties regarding full-scale application of the BioGenesis[SM] process to the Rest of River materials; and with thermal desorption, problems with handling high-organic, high-moisture-content, fine-grained sediments could reduce the efficiency of the process. TD 4 and TD 5 thus present more significant technical implementability challenges than TD 1 and TD 3.

9.6.8.2 Administrative Implementability

Administrative implementability has been evaluated in consideration of regulatory requirements, the need for access agreements, and coordination with governmental agencies.

For TD 1, ARARs are not relevant because that alternative would involve off-site transport and disposal; however, these activities would be conducted in accordance with the requirements of applicable federal, state, and local regulations relating to the off-site

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[553] The Forest Street Site has a maximum capacity of 1.0 million cy, the Woods Pond Site has a maximum capacity of 2.0 million cy, and the Rising Pond Site has a maximum capacity of 2.9 million cy.

transport and disposal. The four other alternatives would be “on-site” activities for purposes of the permit exemption set forth in Section 121(e) of CERCLA and Paragraph 9.a of the CD. As such, no federal, state, or local permits or approvals would be required. However, implementation of these alternatives would need to comply with the substantive requirements of applicable and appropriate regulations (i.e., ARARs) (unless waived). A comparative evaluation of compliance with potential ARARs for those alternatives was presented in Section 9.6.4.

Implementation of TD 1 would not require GE to obtain access agreements. Implementation of TD 2 and TD 3 would require GE to have permanent access to the location(s) selected for the disposal facility(ies). Implementation of TD 4 and TD 5 would require GE to have access to the location selected for the treatment facility for the time frame needed to implement the alternative. GE is the current owner of the potential location identified for TD 4 and TD 5, as well as the Rising Pond Site identified as a potential location for TD 3. Further, GE has the right to acquire the other two sites identified as potential locations for TD 3 (i.e., the Woods Pond Site and the Forest Street Site). Therefore, assuming use of one or more of these locations, no site access agreements would be required for implementation of TD 3 through TD 5, but such agreements may be required for TD 2.

Finally, all alternatives would require coordination with EPA, as well as state and local agencies, to provide as-need support with public/community outreach programs. This factor does not provide a clear basis for distinguishing among the alternatives.

9.6.9 Cost

The estimated cost ranges for each treatment/disposition alternative, including total capital cost, estimated annual OMM cost, and total estimated present worth cost, were presented in the detailed evaluation of each alternative. These cost ranges are summarized in Table 9-7, based on the potential range of volumes that could be involved, although they do not include the cost of implementing the sediment or floodplain alternatives. Note that, in this case, the costs presented for TD 2 include not only the costs for disposition in the CDF(s) of the hydraulically dredged sediments from Reaches 5C and 6 under SED 6 through SED 9, but also the estimated costs for off-site transport and disposal of the remaining sediments removed under those alternatives, as well as excavated floodplain soils (lower-bound costs consider SED 6 and FP 2 and upper-bound costs consider SED 8 and FP 7). In addition, for TD 3, the range of costs presented are for an Upland Disposal Facility constructed at the Rising Pond Site, since that is the only single location with the capability to hold the maximum potential volume of 2.9 million cy. As described above, two smaller landfills at different locations could be constructed and used if necessary to handle that maximum removal volume, but specific costs for this approach have not been estimated.

Table 9-7 – Cost Summary for Treatment/Disposition Alternatives

	TD 1	TD 2	TD 3	TD 4	TD 5 (with reuse)	TD 5 (w/o reuse)
Total Capital Costs	0	$6.5 – 20 M	$9.5 – 67 M	$17 – 20 M	$20 – 232 M	$20 – 232 M
Total Operations Cost	0	$6.8 – 25 M	$11 – 110 M	$32 – 365 M	$47 – 698 M	$47 – 698 M
Total Off-Site Disposal Costs	$55 – 832 M	$75 – 445 M	0	$40 – 614 M	$36 – 518 M	$39 – 595 M
Total Monitoring and Maintenance Costs	0	$12 – 20 M	$15 – 24 M	$0.125 M	$0.125 M	$0.125 M
Total Cost for Alternative	**$55 – 832 M**	**$100 – 510 M**	**$36 – 201 M**	**$89 – 999 M**	**$103 – 1,450 M**	**$106 – 1,530 M**
Total Present Worth	$40 – 220 M	$46 – 131 M	$17 – 49 M	$70 – 286 M	$81 – 569 M	$83 – 590 M

Notes:

1. All costs are in 2010 dollars. $ M = Million dollars.
2. With the exception of TD 2, the ranges of costs presented are the minimum and maximum anticipated costs based on the potential range of volumes that would be potentially removed under the sediment and floodplain soil alternatives (191,000 cy to 2.9 M cy). For TD 2, the lower-bound costs are based on the combined volume of SED 6 and FP 2 and the upper-bound costs are based on the combined volume of SED 8 and FP 7, with material not placed in the CDF(s) assumed to be transported off-site for non-TSCA disposal. Thus, the upper-bound costs, but not the lower-bound costs, for TD 2 are comparable to the costs for the other alternatives.
3. Total Capital Costs are for engineering, labor, equipment, and materials associated with implementation.
4. Total Operations Costs consist of the total of the average annual costs for operation, placement, and/or treatment of sediments and/or soils, estimated for the range of durations for implementing the alternatives.
5. Total Monitoring and Maintenance Costs are for performance of post-closure monitoring and maintenance programs of 100 years for TD 2 and TD 3 and 5 years for TD 4 and TD 5.
6. Total Present Worth cost is based on using a discount factor of 7%, considering the range of total potential durations for the alternative, and post-closure monitoring and maintenance periods of 100 years for TD 2 and TD 3 and 5 years for TD 4 and TD 5.
7. For TD 5 with reuse, it is assumed that approximately 50% of the floodplain soils treated by thermal desorption would be reused on-site and that all remaining materials would be transported off-site for disposal.

As shown in Table 9-5, TD 3 is the least costly alternative. At the low end of the volume range, it would cost about 2 to 4 times less than the other alternatives; and at the high end of the range, it would cost about 2 to 10 times less. Thus, TD 3 would provide for permanent and effective isolation of the removed sediments and soils for a fraction of the costs of the other alternatives. As such, based on the costs of the treatment/disposition alternatives (i.e., without considering the costs of the sediment and floodplain soil removal alternatives), TD 3 is clearly the most cost-effective alternative. The costs will be evaluated further after considering the combined cost estimates presented in Section 10.

9.6.10 Overall Protection of Human Health and the Environment – Conclusions

As explained above, the evaluation of whether the treatment/disposition alternatives would provide overall protection of human health and the environment draws upon the evaluations under several other Permit criteria, discussed in prior sections, as well as other factors relevant to the protection of health and the environment. The results of this evaluation are presented below for each alternative.

TD 1 (off-site disposal) would provide protection of human health and the environment by providing for permanent disposal of the PCB-containing sediments and soils in permitted off-site landfills.

TD 2 (disposition in on-site CDF[s]) would provide protection of human health and ecological receptors by permanently isolating the hydraulically dredged sediments from Reaches 5C and 6 in covered in-water CDF(s), which would be subject to monitoring and maintenance activities to verify the long-term integrity of the CDF(s). However, this alternative would not provide for disposition of the remaining sediments or the excavated floodplain soils, which would need to be disposed of elsewhere. Moreover, implementation of TD 2 would cause significant long-term environmental impacts, because the CDF(s) would result in a permanent loss of the aquatic habitat in a large portion of Woods Pond and/or one or more of the backwaters where the CDF(s) would be constructed and in adjacent areas, would result in a take of several state-listed species, would alter the natural appearance of the areas containing the CDF(s), and would result in a permanent loss of flood storage capacity in those areas (assuming that sufficient compensatory flood storage could not be provided). As a result, TD 2 would not meet the standard of providing overall protection of the environment.

TD 3 (on-site upland disposal) would provide protection of human health and the environment by permanently isolating the PCB-containing sediments and soils in an Upland Disposal Facility, which would be constructed with an appropriate double liner, cover, and double leachate collection system. The facility would also be subject to long-term monitoring and maintenance to ensure the effectiveness of the isolation. While this alternative would cause a change in existing habitat within the operational footprint of the Upland Disposal Facility, the capped landfill area would be replanted with grass, and the support areas that are no longer needed after closure would be restored to the extent practical. The significance of the long-term or permanent change in habitat would depend on the existing habitat at the selected location (which would range from a disturbed current/former quarry area with minimal habitat value to upland forest habitat), as well as the necessary size of the facility. In any event, the change in habitat would be confined to the operational footprint of the facility.

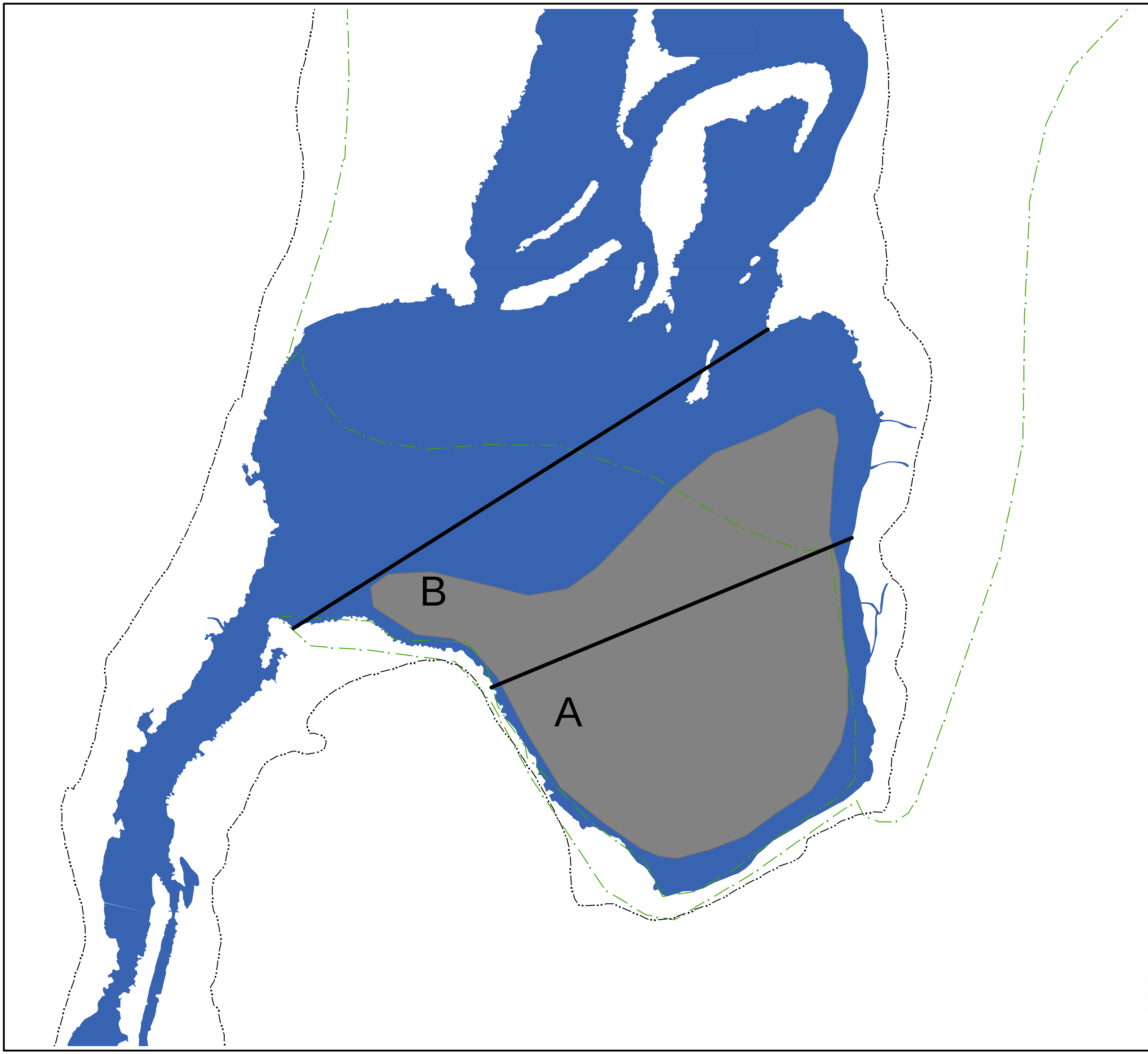
TD 4 (chemical extraction) would provide protection of human health and the environment by reducing the PCB concentrations in the sediments and soils, followed by off-site disposal of the treated material. Based on bench-scale study results, the chemical extraction process would not reduce PCB concentrations in the treated material to levels that would allow on-site reuse. Thus, the treated solid material would have to be transported off-site for disposal. Moreover, the long-term reliability and effectiveness of the chemical extraction process have not been demonstrated at full scale for PCBs in sediments and soils representative of those from the Rest of River.

TD 5 (thermal desorption) would provide human health protection by reducing the PCB concentrations in the sediments and soils, followed by on-site reuse and/or off-site disposal of those treated materials and off-site disposal/destruction of the liquids containing the condensed PCBs. On-site reuse of a portion of the treated soils would be protective of health because the treated solids would be sufficiently characterized to ensure that they would not cause adverse human health effects. From an environmental perspective, TD 5 would provide protection of ecological receptors from potential exposure to PCBs for the same reasons discussed for human receptors. However, if a portion of the treated soils is reused as backfill in the floodplain, that reuse would result in long-term adverse environmental impacts in the forested floodplain and other wetland areas due to the differences in soil characteristics between those materials (even if amended with organic-containing topsoil) and the existing natural soils in those wetland areas. In addition, regardless of whether treated soil is reused in the floodplain, TD 5 would produce by far the greatest amount of GHG emissions (for the range of volumes) of any of the alternatives, which is of concern from an environmental standpoint. Finally, since thermal desorption has not to date been used for the sediment and soil volumes and implementation durations that could be involved at the Rest of River, the reliability of the thermal desorption process for such a large-scale operation is unknown. As discussed in Section 9.5.10, it is concluded that: (a) if the treated soils are not reused, TD 5 would provide overall protection of the environment, although its substantial carbon footprint would be of concern; and (b) if some of the treated soils are reused as backfill in the floodplain, TD 5 would not meet the standard of overall protection of the environment due to the adverse impacts resulting from the inability of those soils to match the characteristics of the existing soils in wetland areas, as well as due to the large carbon footprint.

9.6.11 Overall Conclusion

For the reasons discussed above, it is concluded that all of the treatment/disposition alternatives except TD 2 and possibly TD 5 (depending on whether treated soil is reused in the floodplain) would meet the General Standards in the Permit (provided that ARAR waivers are obtained for any requirements that could not practicably be met). Further, GE has concluded, based on a consideration and balancing of the Selection Decision Factors, that TD 3 is “best suited” to meet the General Standards, primarily because it would permanently isolate the PCB-containing sediments and soils from human and ecological receptors, would have a high degree of reliability, would not cause widespread long-term adverse environmental impacts in the Rest of River, would have substantially lower GHG emissions and lower traffic accident risks from off-site truck traffic (for the range of volumes) than any of the other alternatives (excluding TD 2, which is not comparable), would be fully implementable, and would have the lowest cost.[554] Indeed, the NCP requires that when more than one alternative would achieve the threshold criteria, the most cost-effective alternative must be selected (see 40 CFR § 300.430(f)(1)(ii)(D)). Standing alone (i.e., without considering the costs of the sediment and floodplain soil removal alternatives), TD 3 is clearly the most cost-effective of the treatment/disposition alternatives. This conclusion will be reviewed further after considering the combined cost estimates presented in Section 10.

[554] As shown in prior subsections, the extent to which TD 3 is better suited to meet the Permit criteria than TD 1 in light of these factors would increase with the volume of excavated materials to be disposed of and the duration of the implementation period, and is less pronounced with the volumes and durations at and near the lower end of the range.



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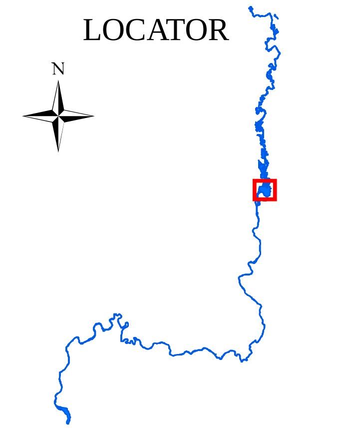

SCALE

250 125 0 250 Feet

LEGEND

Sheet Pile

FEMA 500-Yr Floodplain

NHESP Priority Habitat of Rare Species (2010)

"Deep Hole"

Housatonic River

Note: Sheet pile locations from 1996 Harrington CDF survey

Figure 9-1. Potential locations for in-water CDFs within Woods Pond.

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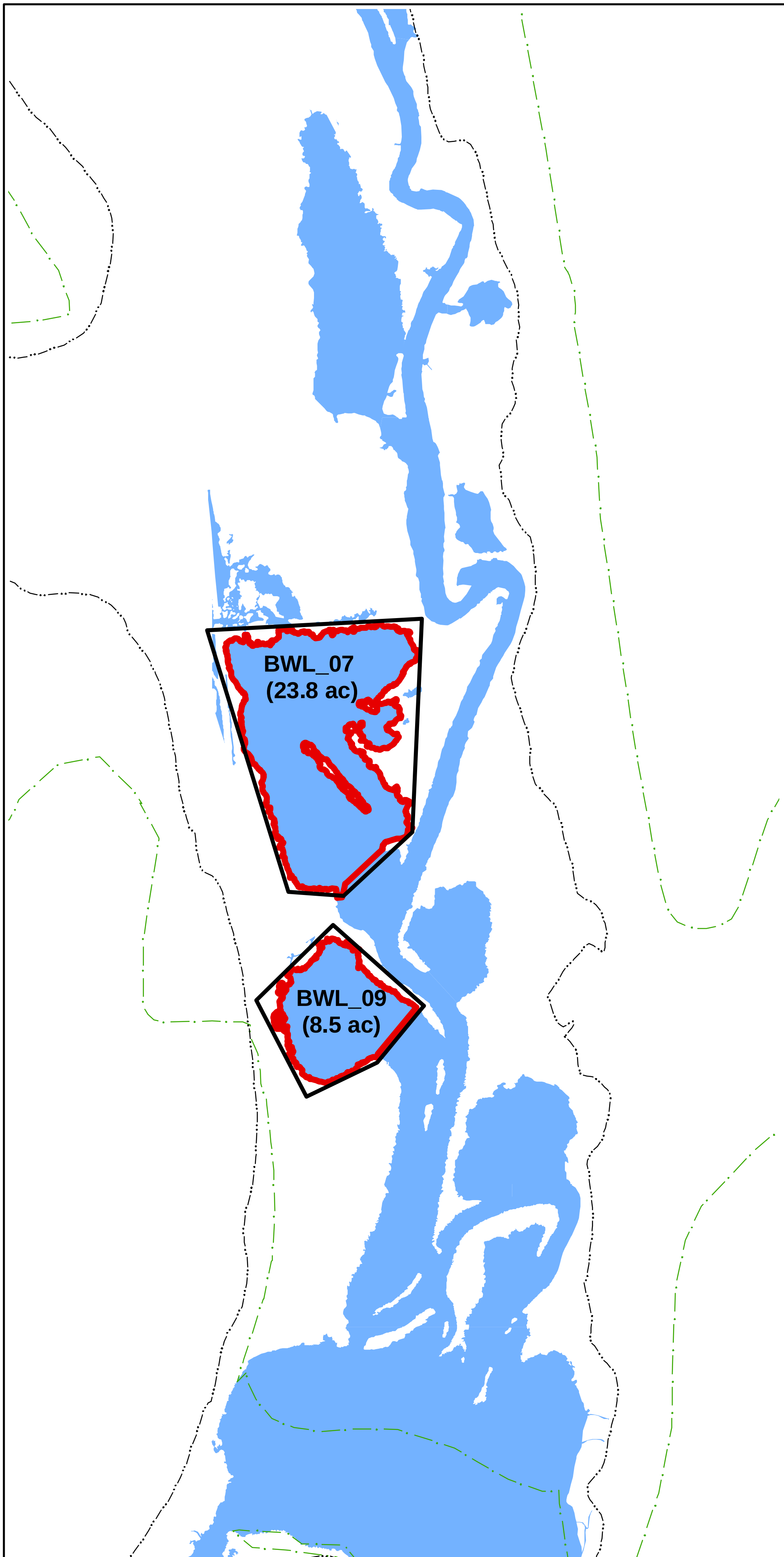

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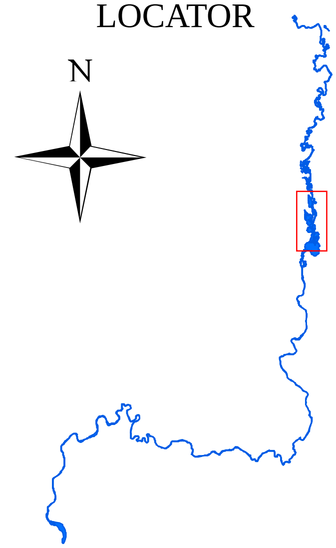

SCALE

500 250 0 500 Feet

LEGEND

- FEMA 500-Yr Floodplain
- NHESP Priority Habitat of Rare Species (2010)
- Potential CDF
- Backwater Area
- Housatonic River

Figure 9-2. Potential backwaters for in-water CDFs.

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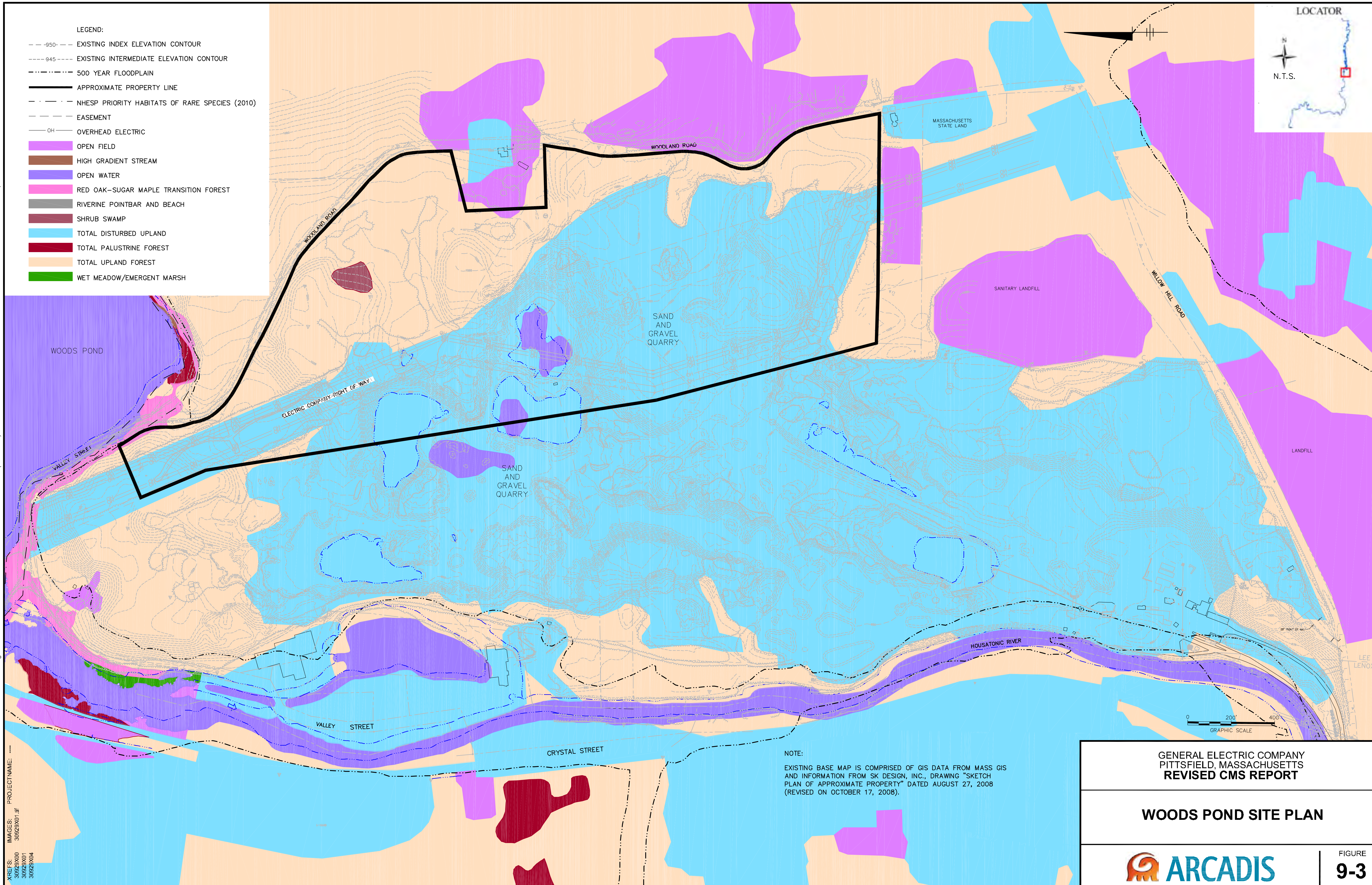

NOTE:

EXISTING BASE MAP IS COMPRISED OF GIS DATA FROM MASS GIS AND INFORMATION FROM SK DESIGN, INC., DRAWING "SKETCH PLAN OF APPROXIMATE PROPERTY" DATED AUGUST 27, 2008 (REVISED ON OCTOBER 17, 2008).

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WOODS POND SITE PLAN

ARCADIS

FIGURE **9-3**

CITY: SYRACUSE, NY DIV/GROUP: ENVCAD DB: K. DAVIS LD: K. DAVIS PIC: P. KEANEY PM: D. KNUTSEN TM: G. GREAPENTROG LYR: ON=*;OFF=*REF* G:\GE\ENVCAD\SYRACUSE\ACT\NB0030929\0002\00001\DWG\CMS\30929P01.dwg LAYOUT: 9-3 SAVED: 10/1/2010 1:46 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: --- PLOTSTYLETABLE: --- PLOTTED: 10/1/2010 1:47 PM BY: DAVIS, KATHI
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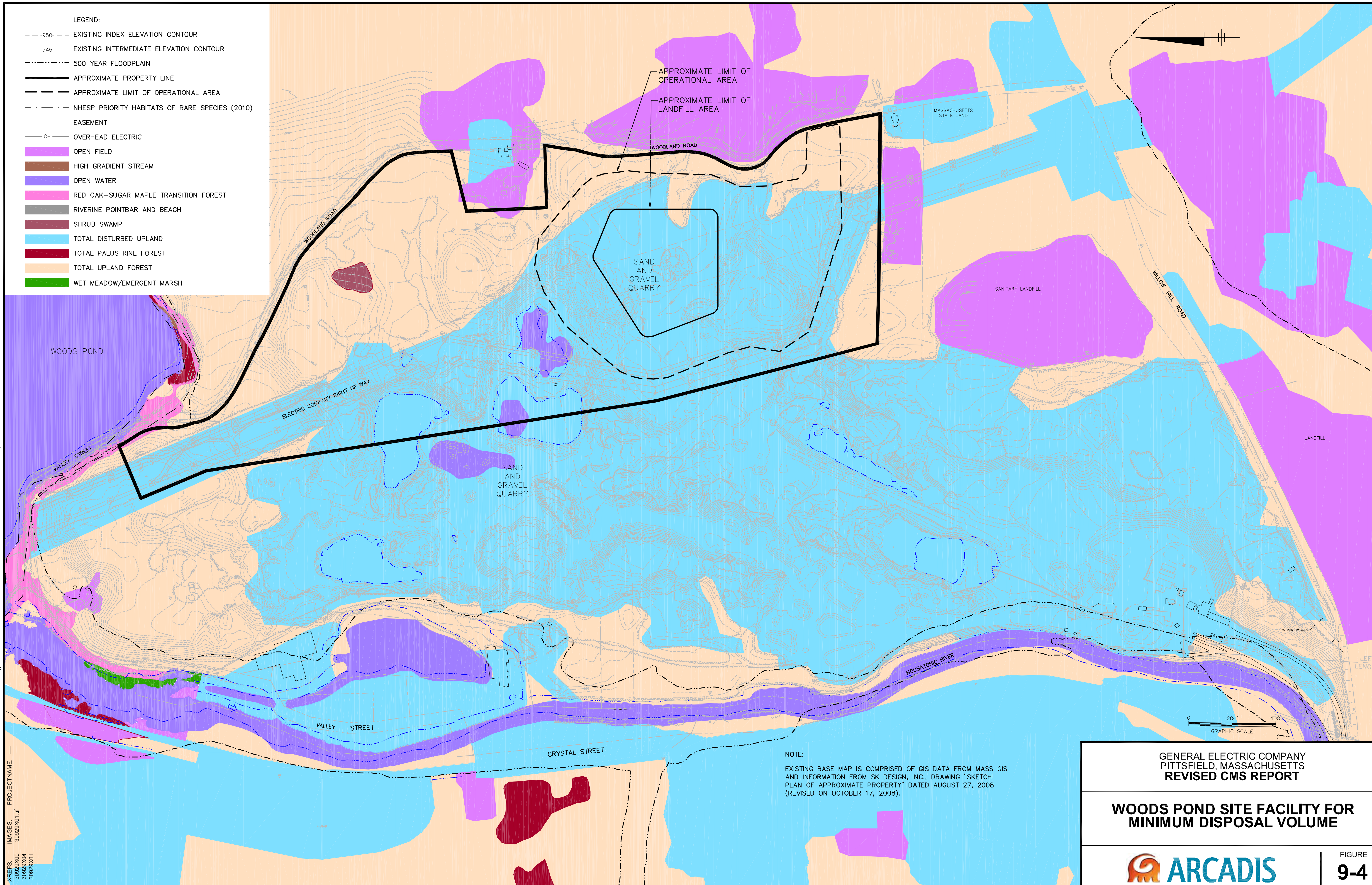

NOTE:

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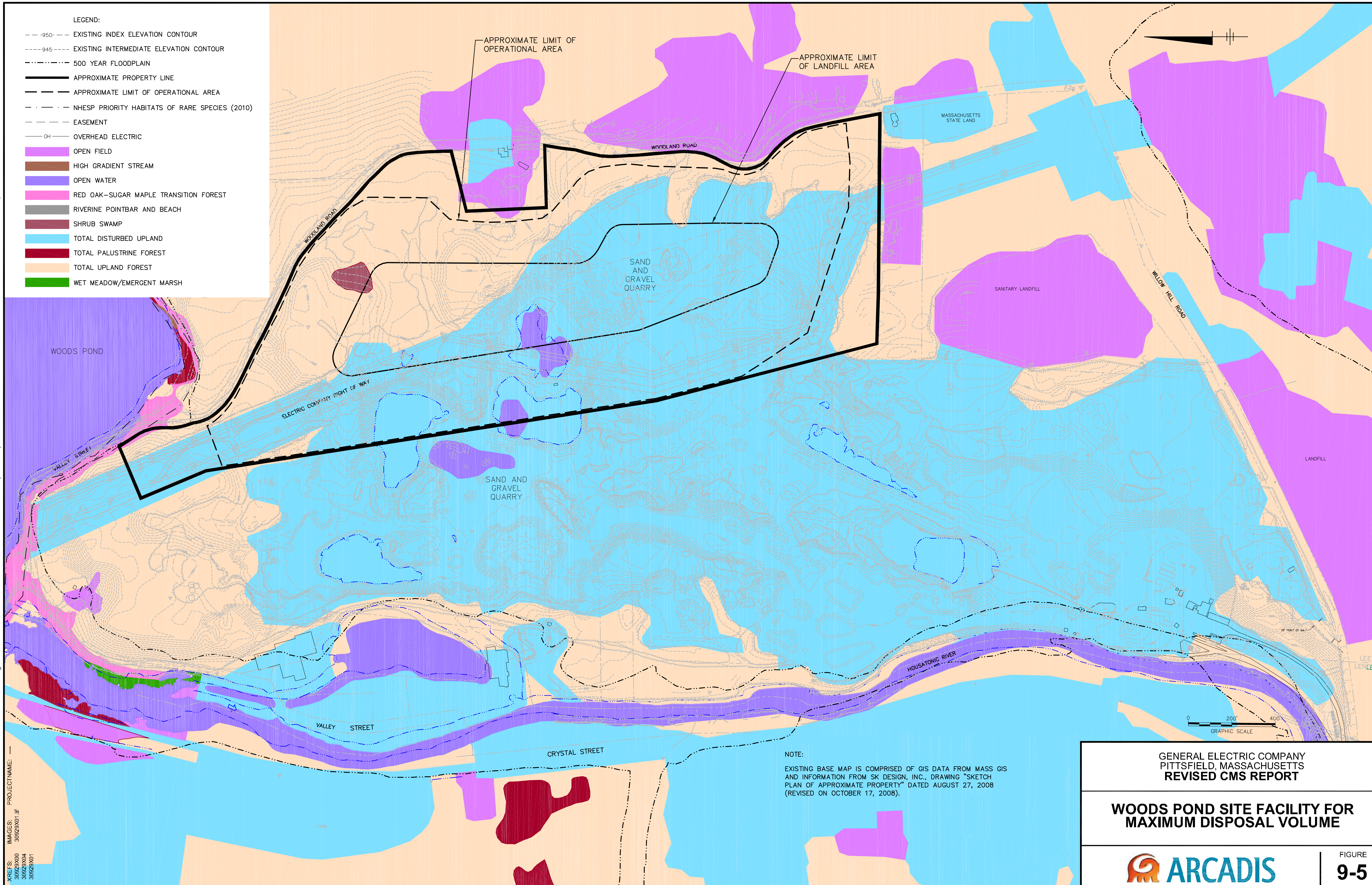
WOODS POND SITE FACILITY FOR MINIMUM DISPOSAL VOLUME

ARCADIS

FIGURE
9-4



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WOODS POND SITE FACILITY FOR MAXIMUM DISPOSAL VOLUME

ARCADIS

FIGURE **9-5**

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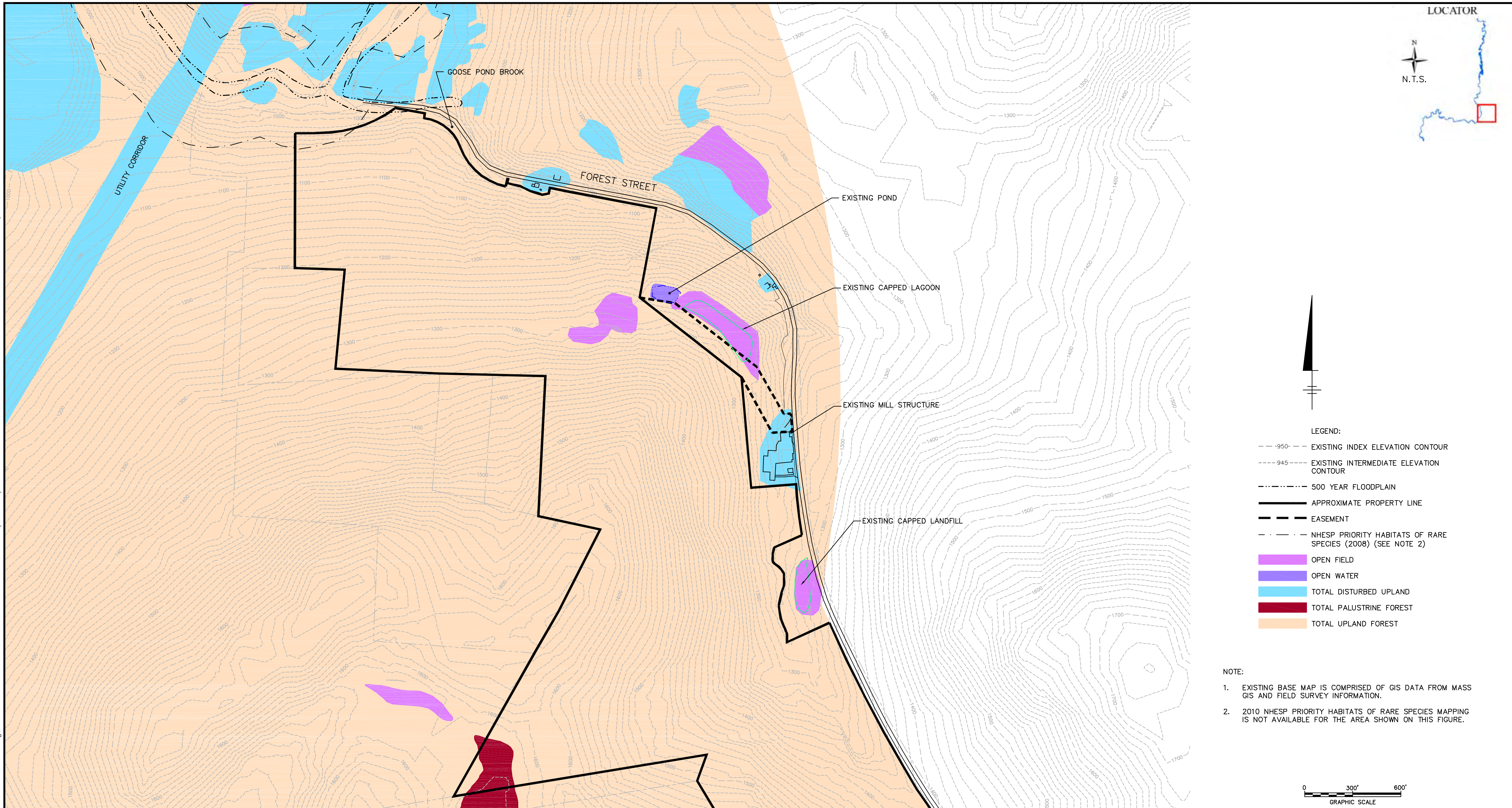

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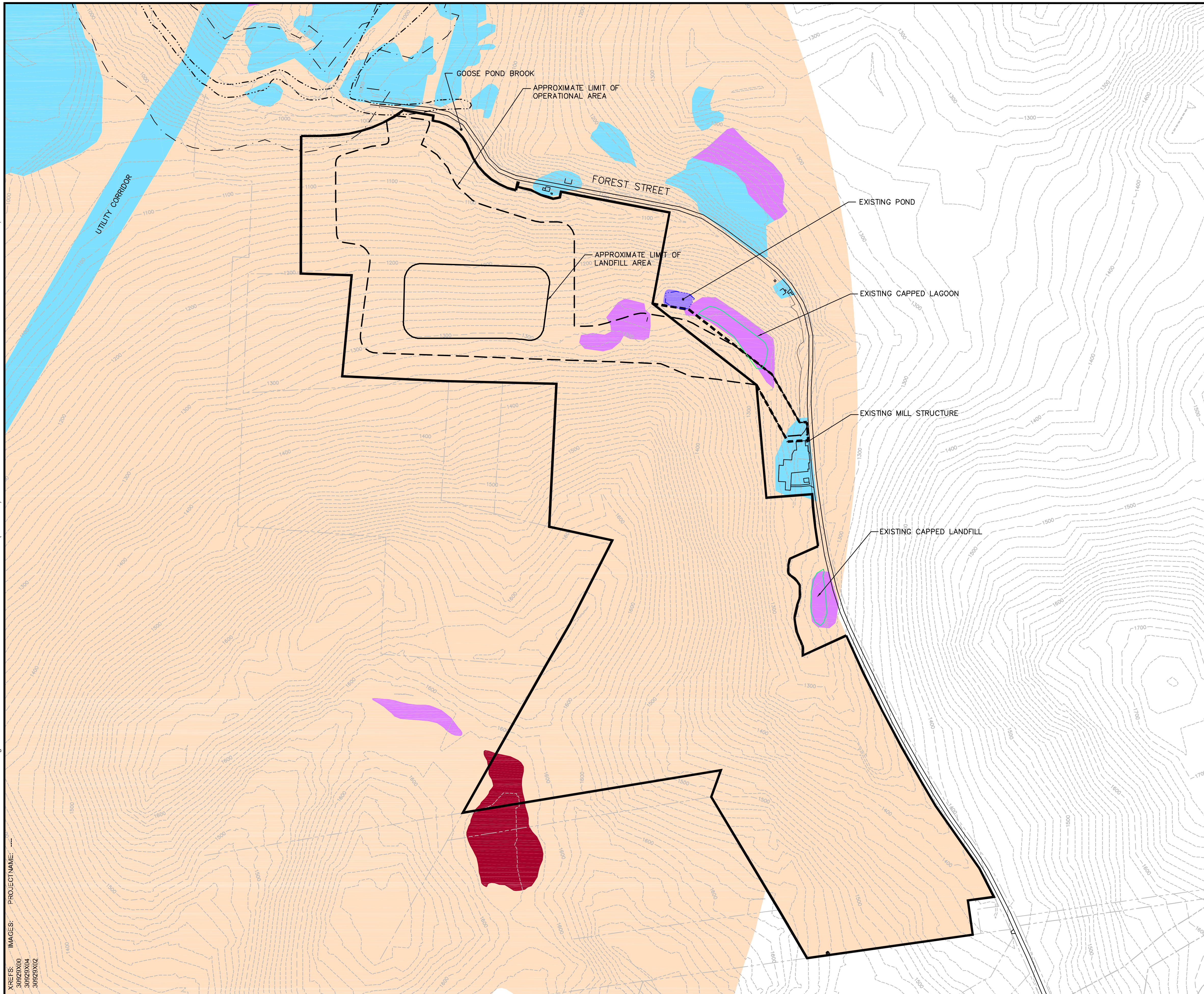
FOREST STREET SITE PLAN

ARCADIS

FIGURE
9-6



LEGEND:

- EXISTING INDEX ELEVATION CONTOUR
- EXISTING INTERMEDIATE ELEVATION CONTOUR
- 500 YEAR FLOODPLAIN
- APPROXIMATE PROPERTY LINE
- EASEMENT
- APPROXIMATE LIMIT OF OPERATIONAL AREA
- NHESP PRIORITY HABITATS OF RARE SPECIES (2008) (SEE NOTE 2)
- OPEN FIELD
- OPEN WATER
- TOTAL DISTURBED UPLAND
- TOTAL PALUSTRINE FOREST
- TOTAL UPLAND FOREST

NOTE:

1. EXISTING BASE MAP IS COMPRISED OF GIS DATA FROM MASS GIS AND FIELD SURVEY INFORMATION.
2. 2010 NHESP PRIORITY HABITATS OF RARE SPECIES MAPPING IS NOT AVAILABLE FOR THE AREA SHOWN ON THIS FIGURE.

0 300' 600'
GRAPHIC SCALE

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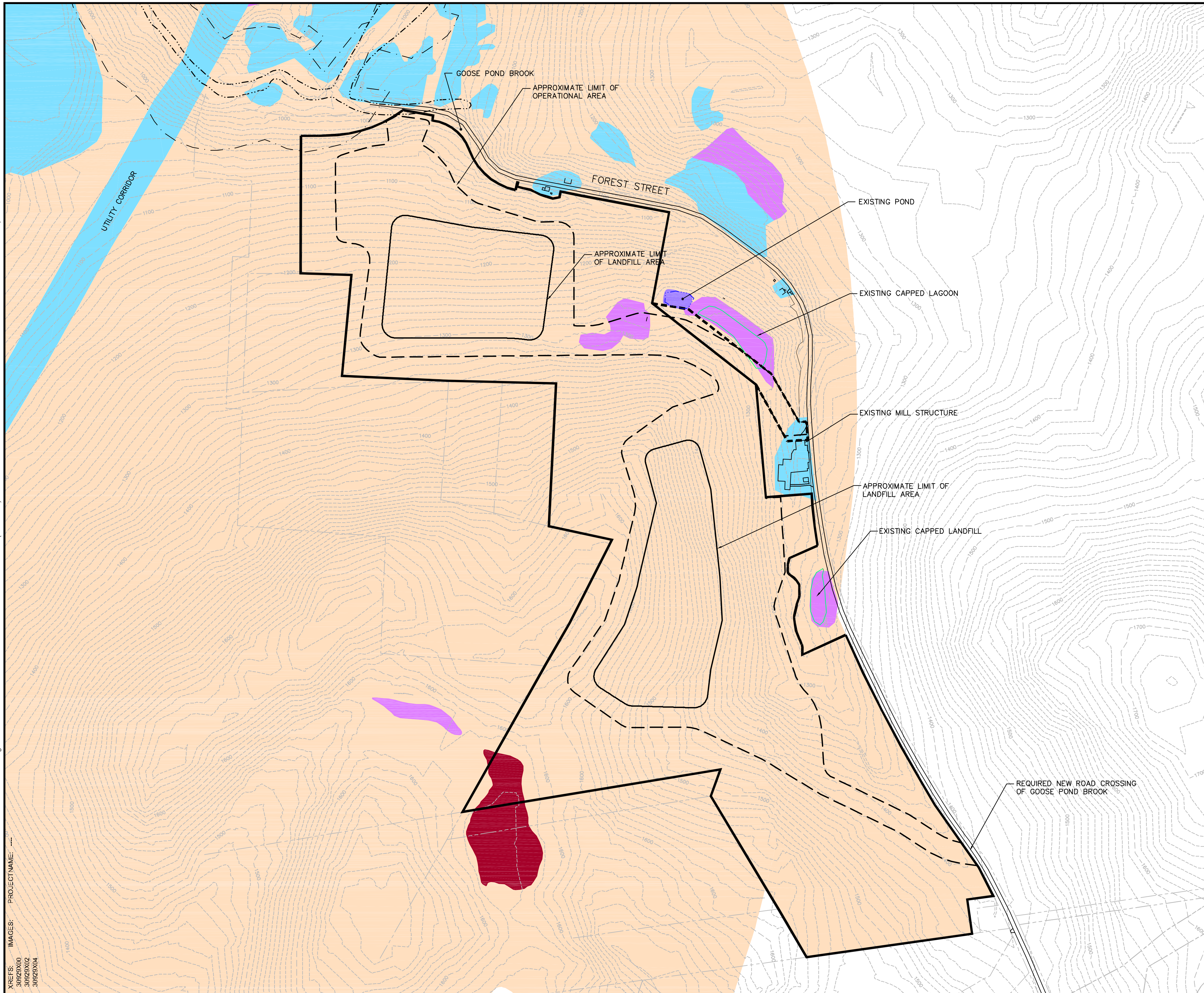
FOREST STREET SITE FACILITY FOR MINIMUM DISPOSAL VOLUME

ARCADIS

FIGURE
9-7



LEGEND:

- -950- EXISTING INDEX ELEVATION CONTOUR
- 945 EXISTING INTERMEDIATE ELEVATION CONTOUR
- 500 YEAR FLOODPLAIN
- APPROXIMATE PROPERTY LINE
- EASEMENT
- APPROXIMATE LIMIT OF OPERATIONAL AREA
- NHESP PRIORITY HABITATS OF RARE SPECIES (2008) (SEE NOTE 2)
- OPEN FIELD
- OPEN WATER
- TOTAL DISTURBED UPLAND
- TOTAL PALUSTRINE FOREST
- TOTAL UPLAND FOREST

NOTE:

1. EXISTING BASE MAP IS COMPRISED OF GIS DATA FROM MASS GIS AND FIELD SURVEY INFORMATION.
2. 2010 NHESP PRIORITY HABITATS OF RARE SPECIES MAPPING IS NOT AVAILABLE FOR THE AREA SHOWN ON THIS FIGURE.

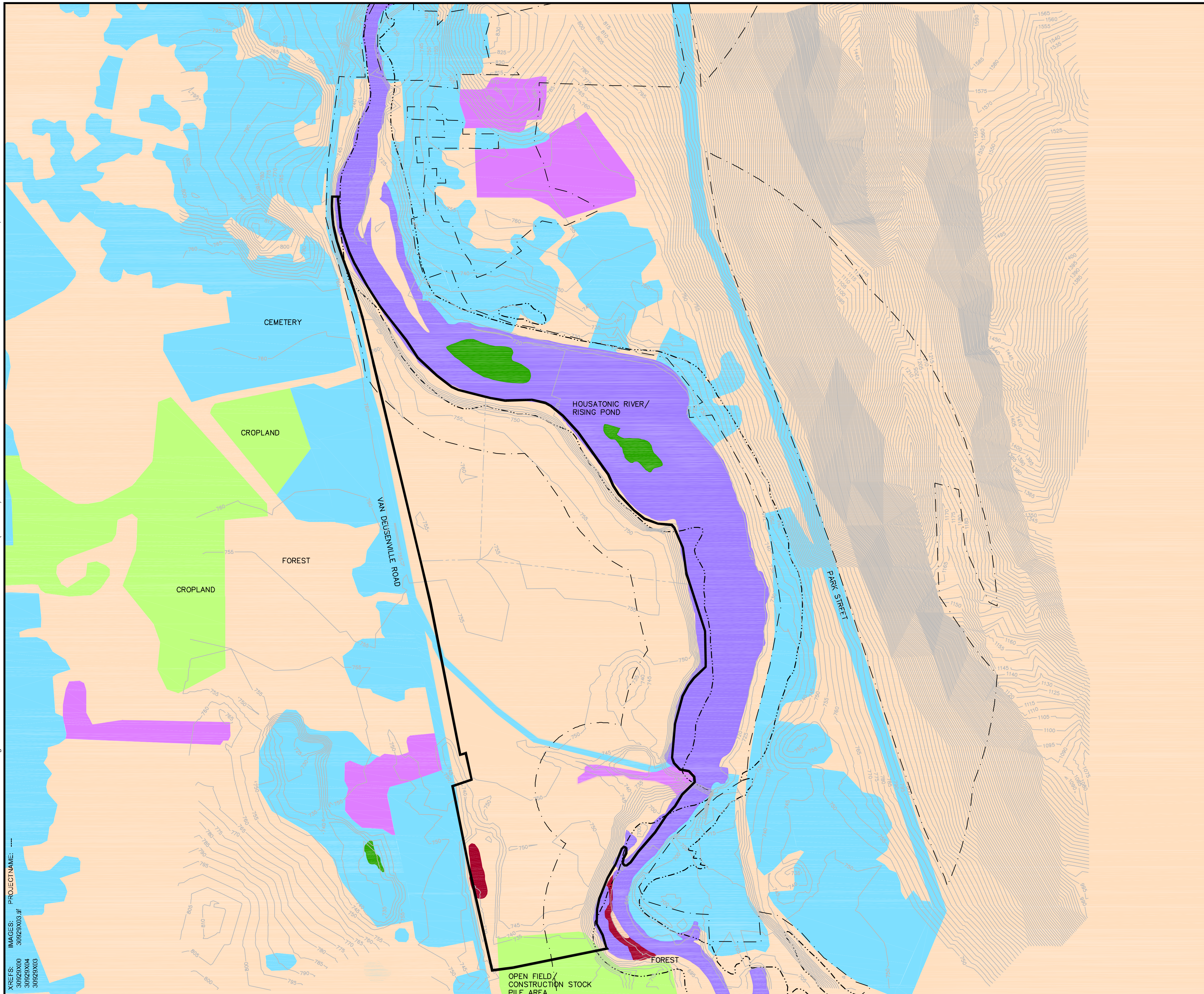
0 300' 600'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CMS REPORT

FOREST STREET SITE FACILITY FOR MAXIMUM DISPOSAL VOLUME

ARCADIS

FIGURE
9-8



LEGEND:

- EXISTING INDEX ELEVATION CONTOUR (950)
- EXISTING INTERMEDIATE ELEVATION CONTOUR (945)
- 500 YEAR FLOODPLAIN
- APPROXIMATE PROPERTY LINE
- NHESP PRIORITY HABITATS OF RARE SPECIES (2010)
- AGRICULTURAL FIELD
- OPEN FIELD
- OPEN WATER
- TOTAL DISTURBED UPLAND
- TOTAL PALUSTRINE FOREST
- TOTAL UPLAND FOREST
- WET MEADOW/EMERGENT MARSH

NOTE:

EXISTING BASE MAP IS COMPRISED OF GIS DATA FROM MASS GIS.

0 300' 600'
GRAPHIC SCALE

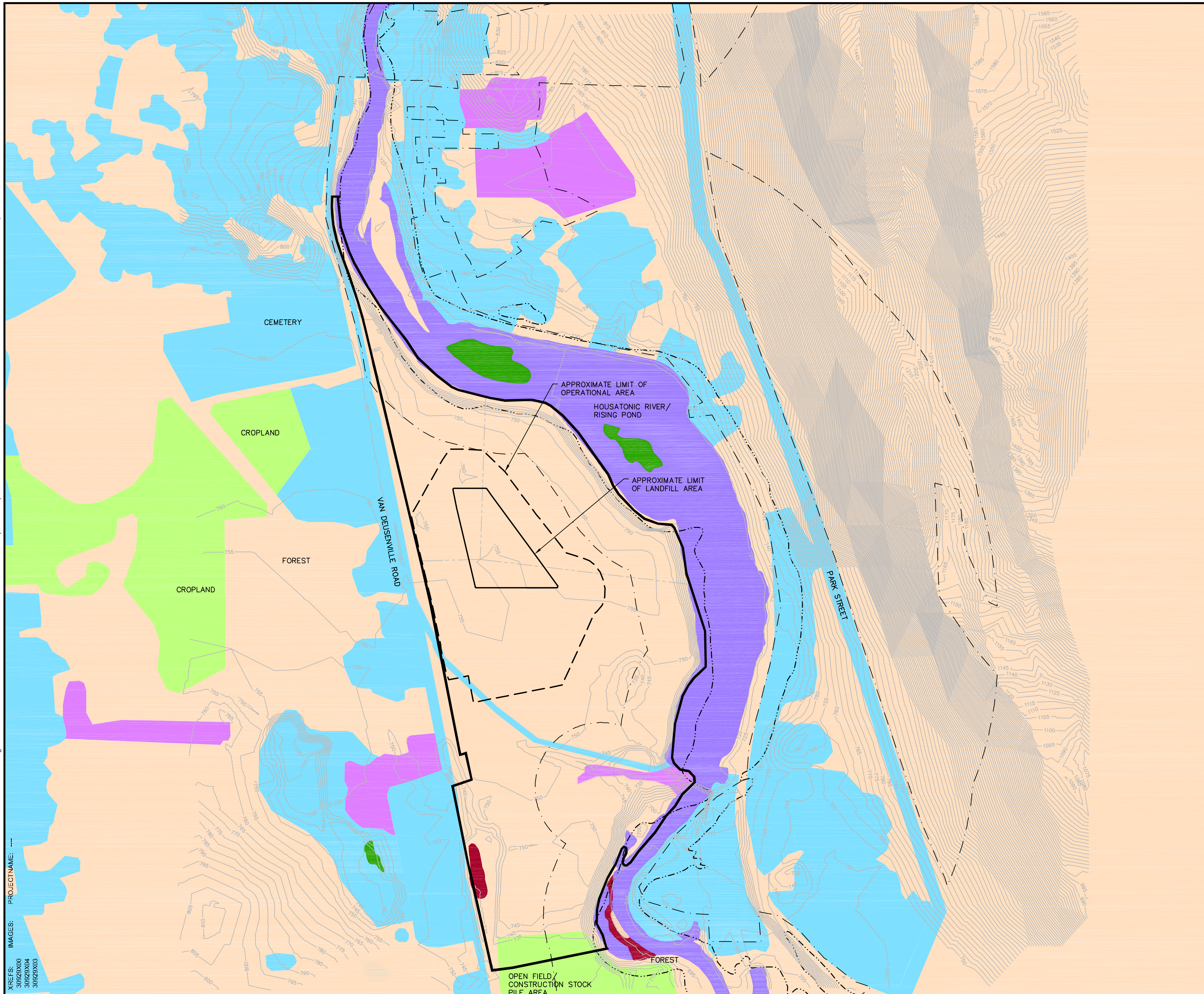
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CMS REPORT

RISING POND SITE PLAN

ARCADIS

FIGURE
9-9

CITY: SYRACUSE, NY DIV/GROUP: ENVCAD DB: K. DAVIS LD: K. DAVIS PIC: P. KEANEY PM: D. KNUTSEN TM: G. GREAPENTROG LYR: ON=*;OFF=*REF*
R:\ENVCAD\SYRACUSE\ACT\NB00309290002\00001\DWG\CMS\30929P07.dwg LAYOUT: 9-9 SAVED: 10/4/2010 9:45 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 10/8/2010 1:38 PM BY: DAVIS, KATHI
XREFS: 30929X00 30929X04 30929X03 IMAGES: 30929X03.tif PROJECTNAME: ----



LEGEND:

- EXISTING INDEX ELEVATION CONTOUR (-950-)
- EXISTING INTERMEDIATE ELEVATION CONTOUR (945)
- 500 YEAR FLOODPLAIN
- APPROXIMATE PROPERTY LINE
- APPROXIMATE LIMIT OF OPERATIONAL AREA
- NHESP PRIORITY HABITATS OF RARE SPECIES (2010)
- AGRICULTURAL FIELD
- OPEN FIELD
- OPEN WATER
- TOTAL DISTURBED UPLAND
- TOTAL PALUSTRINE FOREST
- TOTAL UPLAND FOREST
- WET MEADOW/EMERGENT MARSH

NOTE:

EXISTING BASE MAP IS COMPRISED OF GIS DATA FROM MASS GIS.

0 300' 600'

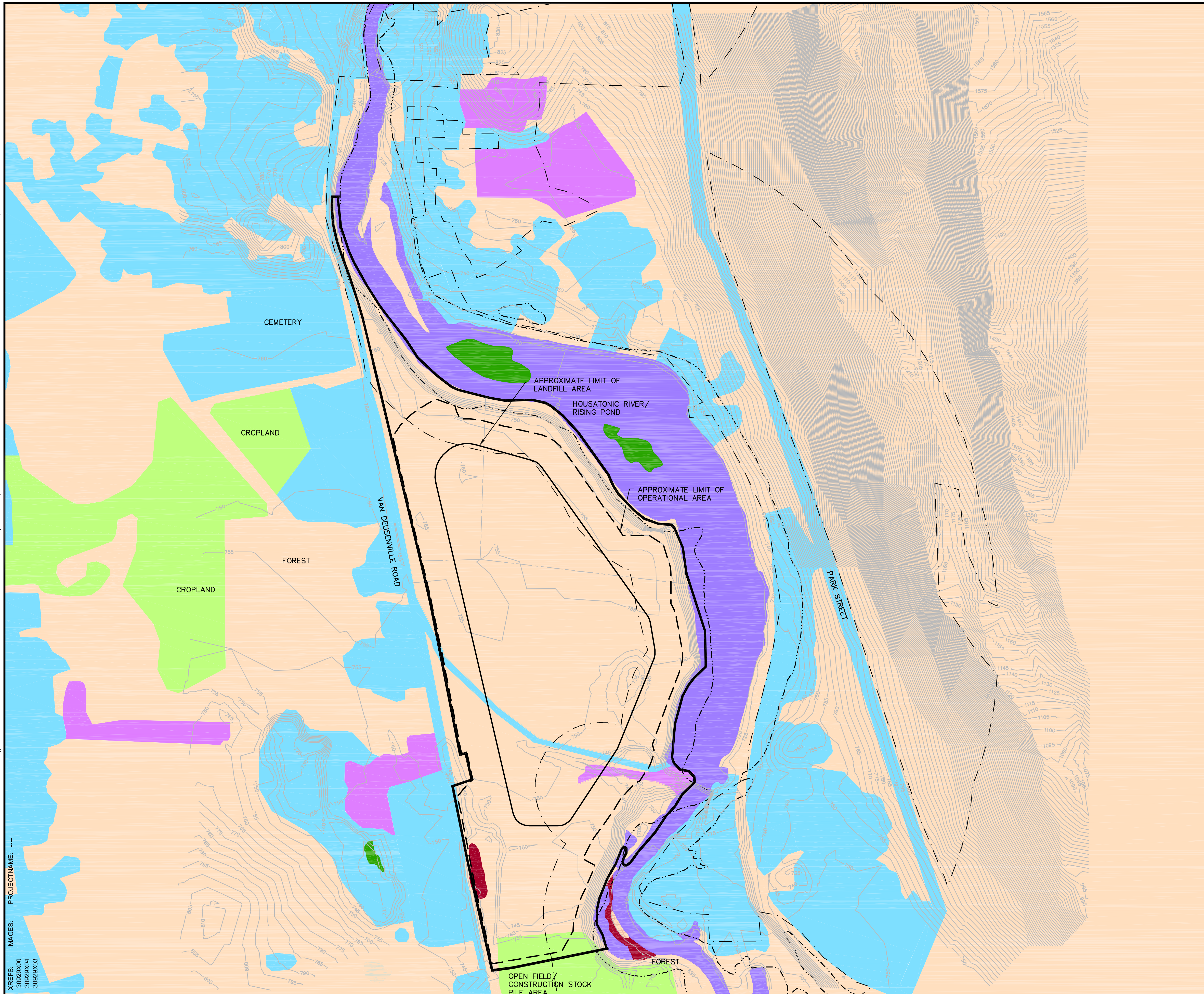
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CMS REPORT

RISING POND SITE FACILITY FOR MINIMUM DISPOSAL VOLUME

ARCADIS

FIGURE
9-10



LEGEND:

- EXISTING INDEX ELEVATION CONTOUR (-950-)
- EXISTING INTERMEDIATE ELEVATION CONTOUR (945)
- 500 YEAR FLOODPLAIN
- APPROXIMATE PROPERTY LINE
- APPROXIMATE LIMIT OF OPERATIONAL AREA
- NHESP PRIORITY HABITATS OF RARE SPECIES (2010)
- AGRICULTURAL FIELD
- OPEN FIELD
- OPEN WATER
- TOTAL DISTURBED UPLAND
- TOTAL PALUSTRINE FOREST
- TOTAL UPLAND FOREST
- WET MEADOW/EMERGENT MARSH

NOTE:
EXISTING BASE MAP IS COMPRISED OF GIS DATA FROM MASS GIS.

0 300' 600'
GRAPHIC SCALE

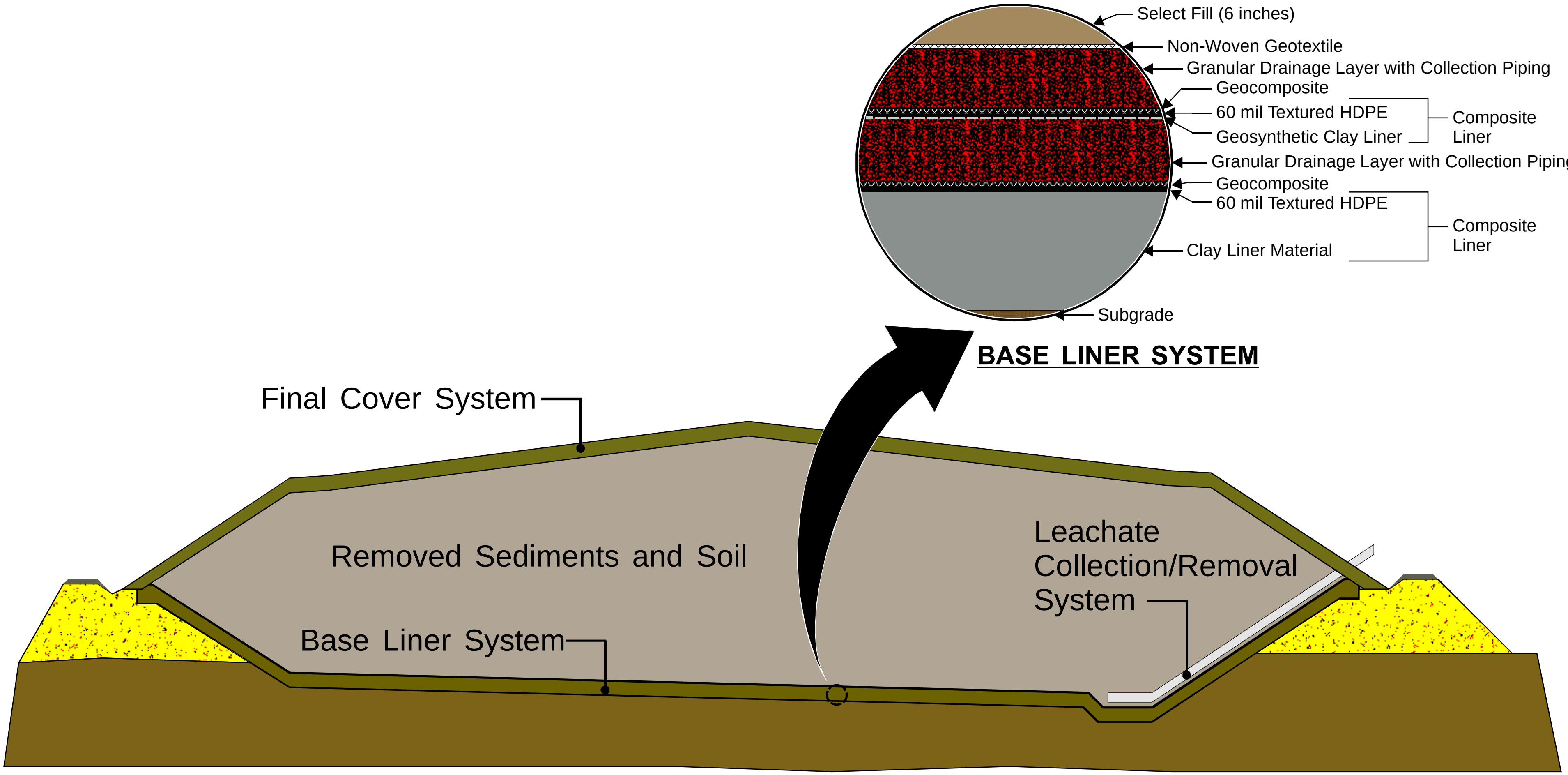
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
REVISED CMS REPORT

RISING POND SITE FACILITY FOR MAXIMUM DISPOSAL VOLUME

ARCADIS

FIGURE
9-11

CITY: SYRACUSE, NY DIV/GROUP: ENVCAD DB: K.DAVIS LD: K.DAVIS PIC: P.KEANEY PM: D.KNUTSEN TM: G.GREAPENTROG LYR: ON=*;OFF=*REF* PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 10/4/2010 9:49 AM BY: DAVIS, KATHI
R:\ENVCAD\SYRACUSE\ACT\NB\00309290002\00001\DWG\CMS\30929P09.dwg LAYOUT: 9-11 SAVED: 9/15/2010 12:00 PM ACADVER: 17.0S (LMS TECH)
XREFS: 30929X00 30929X04 30929X03 IMAGES: PROJECTNAME: ----



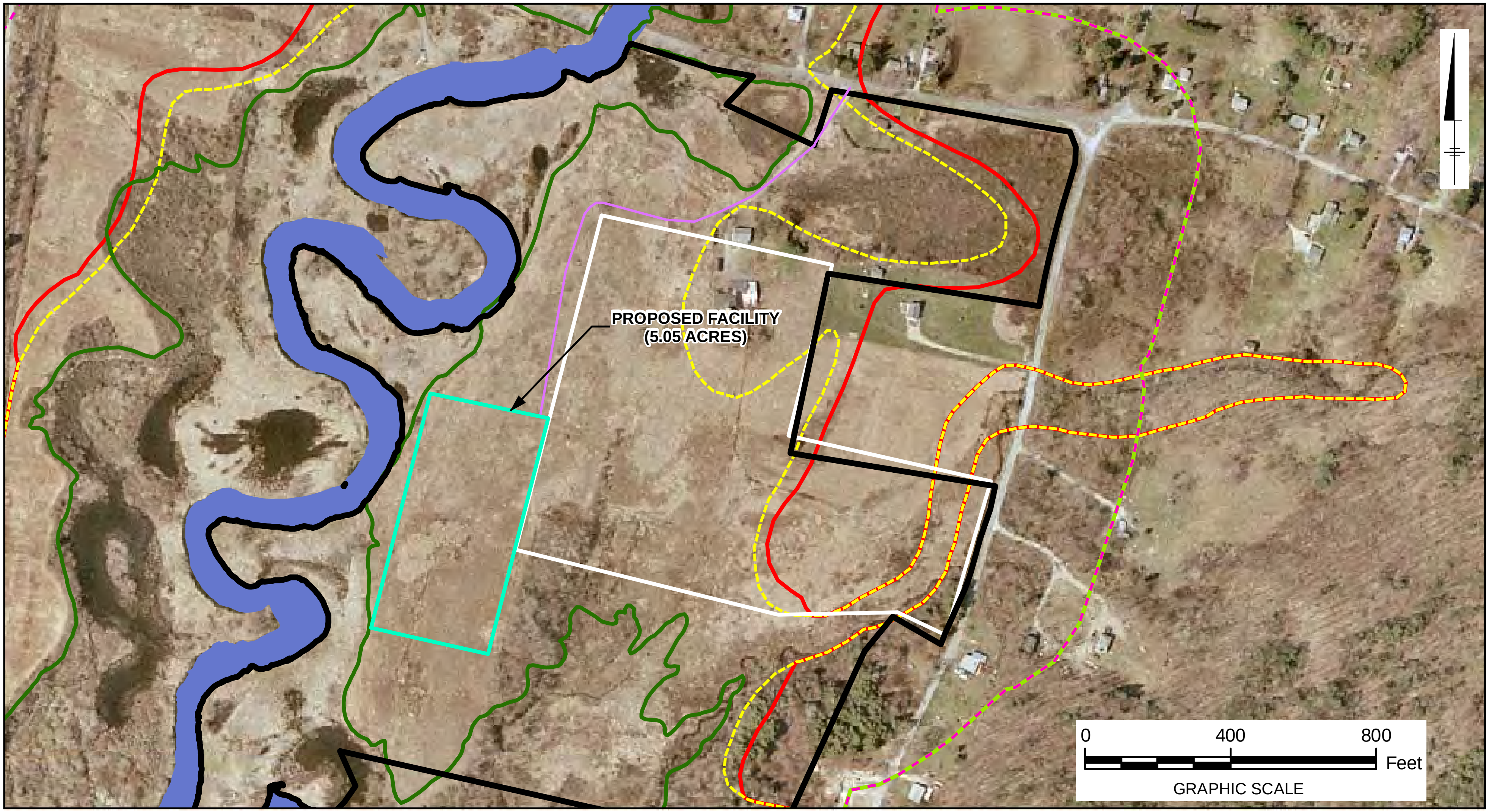
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
HOUSATONIC RIVER - REST OF RIVER
REVISED CMS REPORT

TYPICAL LANDFILL CROSS-SECTION

ARCADIS

FIGURE
9-12

CITY: SYR DIV/GROUP: AIT DB: AMB JCR KES LD: LP
GE HOUSATONIC (B0030929.0002.00001)
R:\GE_GIS\GE_Housatonic\CMS_Report\mxd\FormerDevosParcel_NHESPHabitat.mxd - 10/8/2010 @ 9:59:18 AM



LEGEND:

- FACILITY ROAD (APPROXIMATE)
- NHESP PRIORITY HABITATS OF RARE SPECIES
- NHESP ESTIMATED HABITATS OF RARE WILDLIFE
- FACILITY LOCATION (APPROXIMATE)
- GE PARCEL
- AREA SUBJECT TO AGRICULTURAL PRESERVATION RESTRICTION
- 1 mg/kg PCB ISOPLETH
- FEMA 100-YEAR FLOODPLAIN
- FEMA 500-YEAR FLOODPLAIN
- HOUSATONIC RIVER

NOTES:

1. HYDROGRAPHY, FLOODPLAIN AND TAX PARCEL DATA PROVIDED BY QEA.
2. 2005 NATURAL COLOR .5 METER RESOLUTION IMAGERY FROM MASSGIS.

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REVISED CMS REPORT

POTENTIAL SITE FOR CHEMICAL EXTRACTION OR THERMAL DESORPTION FACILITY

ARCADIS

FIGURE
9-13

10. Combined Cost Estimates

As presented in previous sections, cost estimates have been developed for the individual sediment and floodplain alternatives, the selected sediment-floodplain alternative combinations, and the treatment/disposition alternatives (Sections 6, 7, 8, and 9, respectively). To develop the combined cost estimates discussed in this section, the ten sediment alternatives were paired with the appropriate treatment/disposition alternatives, creating a total of 58 cost estimates. Likewise, the nine floodplain alternatives were paired with the appropriate treatment/disposition alternatives, resulting in 56 cost estimates for those combinations. Finally, the seven sediment-floodplain alternative combinations subject to detailed evaluation were also combined with the appropriate treatment/disposition alternatives, resulting in 52 cost estimates for those combinations. A summary of the combined cost estimates and related assumptions is presented below. To illustrate this approach, Appendix Q to this CMS Report provides more detailed information on the cost estimates for the combinations of the seven sediment-floodplain alternative combinations with the appropriate treatment/disposition alternatives.

10.1 Combinations of Sediment Alternatives and Treatment/Disposition Alternatives

Table 10-1 presents the total cost estimates for the SED and TD combinations (including capital and OMM costs). For the SED and TD combinations involving removal, total cost estimates range from $110 million for the combination of SED 10 with TD 3 (local upland disposal at the Rising Pond Site) to approximately $2.4 billion for the combination of SED 8 with TD 5 (thermal desorption).

The following key assumptions were made in developing the combined costs of SED-TD alternatives:

- For the remedial combinations that involve TD 1, it was assumed that, following removal and processing/dewatering at the staging areas (which are considered under the sediment alternatives), no additional material handling activities would be necessary before off-site transport and disposal – i.e., that removed materials would be sufficiently stabilized for off-site transport as part of the removal alternatives. It was also assumed that removed materials, regardless of the removal method, would be appropriately segregated with respect to TSCA classification as part of the removal alternatives. Therefore, no extra costs for material handling were either added to or subtracted from the combined cost estimates for the remedial combinations involving TD 1.

- As discussed in Section 9.2, it has been assumed that the CDF(s) that are part of TD 2 would be used only for disposition of hydraulically dredged sediments from Reaches 5C and 6 under SED 6, SED 7, SED 8, and SED 9. Since SED 3, SED 4, SED 5, and SED

10 do not include hydraulic dredging of sediments, no combined costs are presented for combinations of those sediment alternatives with TD 2. For the combined cost estimates for SED 6, SED 7, SED 8, and SED 9 with TD 2, it was assumed that all sediments removed from reaches other than Reaches 5C and 6 would be transported off-site for disposal. In addition, it was assumed that sediment dewatering and stabilization – activities that were part of the individual sediment alternatives – would not be necessary for the materials to be placed in the CDF(s); and hence costs for sediment dewatering and stabilization were subtracted from the costs for the combinations that involve TD 2. Additionally, some sediments that would otherwise be removed from Reaches 5C and 6 are located within the conceptual footprint of the CDF(s). Construction of the CDF(s) would make the removal of these sediments unnecessary; thus, the sediment removal volumes in Reaches 5C and 6 were reduced in SED 6, SED 7, SED 8, and SED 9 by the volumes of sediments located within the footprint of the CDF(s), and the costs were adjusted accordingly.

- For the combinations of sediment alternatives with TD 3, separate estimates were made for each of the three potential locations identified in Section 9.3.1 for an Upland Disposal Facility.[555] For each of those combinations, adjustments were made to the individual sediment alternative cost estimates presented in Section 6 to account for the fact that, following remediation, the access road and staging area materials would be placed in the Upland Disposal Facility, rather than transported for off-site disposal.

- Where relevant in the combinations of sediment alternatives with TD 4, it was assumed that hydraulically dredged sediments from Reaches 5C and 6 could be pumped directly to the chemical treatment facility (at the assumed location identified in Section 9.4.1.1) without being dewatered. In these cases, the following costs were not included in the combined cost estimates: (1) costs for dewatering and associated water treatment (activities that were part of the original sediment alternatives); and (2) costs for transporting removed sediments hydraulically dredged from Reaches 5C and 6 to the on-site chemical treatment facility. In general, the cost estimates for the combinations that involve TD 4 were based on cost estimates provided by BioGenesis, with certain adjustments and additions to incorporate costs associated with non-treatment activities, as discussed in Section 9.4.9. The costs that were added to the BioGenesis estimates include the costs for transport to the treatment facility location and for off-site transport and disposal of the treated solid materials. These costs were based on the assumption

[555] Since the removal volume involved in SED 8 would exceed the capacity of an Upland Disposal Facility at the Woods Pond Site or the Forest Street Site, cost estimates for the combination of SED 8 with TD 3 were made only for the Rising Pond Site, where the entire volume of removed material could be disposed of. However, as noted in Section 9.3.1, a combination of disposal locations could also be used.

that the treated materials would contain average PCB concentrations less than 50 mg/kg and would be disposed of off-site at a non-TSCA solid waste landfill pursuant to a risk-based TSCA determination from EPA.

- For the combinations of sediment alternatives with TD 5, it was assumed that the thermal desorption process (assumed to take place at the located identified in Section 9.5.1.2) would reduce the PCB concentrations in the treated materials to levels of 1 to 2 mg/kg. Because there is no known precedent for the reuse of such thermally treated materials as backfill in riverine environments, it was assumed that these materials would be transported off-site for disposal in a non-TSCA landfill.

- For all combinations, it was assumed that none of the removed materials would constitute hazardous waste under RCRA criteria or comparable state criteria.

In addition to the total cost estimates, as required by the Permit, the present worth cost for each combination of SED and TD alternatives is presented in Table 10-2, using a 7% discount rate.

10.2 Combinations of Floodplain Alternatives and Treatment/Disposition Alternatives

Table 10-3 presents the total costs for the FP and TD combinations (including capital and OMM costs). For the FP and TD combinations involving removal, the total costs range from $18 million for the combination of FP 2 with TD 1 (off-site disposal) to $676 million for the combination of FP 7 with TD 5B (thermal desorption without re-use).

The following key assumptions were made in developing the combined costs of SED-TD alternatives:

- For the combinations of floodplain alternatives with TD 3, separate estimates were again made for each of the three potential locations identified in Section 9.3.1 for an Upland Disposal Facility. For each of those combinations, adjustments were made to the individual FP cost estimates presented in Section 7, to account for the fact that the access road and staging area materials would be placed in the Upland Disposal Facility rather than transported for off-site disposal.

- For the combinations of floodplain alternatives with TD 4, the cost estimates were generally based on cost information provided by BioGenesis, with certain adjustments and additions to incorporate costs associated with non-treatment activities, as discussed in Section 9.4.9. The costs that were added to the BioGenesis estimates include the costs for transport to the treatment facility (at the assumed location identified in Section 9.4.1.1) and for off-site transport and disposal of the treated solid materials. These costs were based on the assumption that the treated materials would contain average PCB concentrations less than 50 mg/kg and would be disposed of off-site at a non-TSCA solid waste landfill pursuant to a risk-based TSCA determination from EPA.

- The combinations of floodplain alternatives with TD 5 (assumed to take place at the located identified in Section 9.5.1.2) were evaluated under two scenarios: (1) assuming that a portion of the treated floodplain soils (approximately 50%) would be reused as backfill in the floodplain after being amended with organic material, and that the remainder would be transported off-site for disposal in a non-TSCA landfill (TD 5A); and (2) assuming that all treated soils would be transported off-site for disposal in a non-TSCA landfill (TD 5B). For the combinations that involve TD 5A, given the assumed reuse of treated material as backfill, the floodplain backfill costs were removed from the estimates; however, costs associated with the purchase and placement of topsoil were not removed from the combined cost estimates, and instead were assumed to represent the costs associated with the amendment of the thermally treated materials prior to use as backfill.

- For all combinations, it was assumed that none of the removed materials would constitute hazardous waste under RCRA criteria or comparable state criteria.

In addition to the total cost estimates, as required by the Permit, the present worth cost for each combination of FP and TD alternatives is presented in Table 10-4, using a 7% discount rate.

10.3 Combinations of Combined Sediment/Floodplain Alternatives with Treatment/Disposition Alternatives

Table 10-5 presents the total cost estimates for the combinations of the SED/FP combined alternatives with the TD alternatives (including capital and OMM costs). For the SED/FP and TD combinations involving removal, total cost estimates range from $121 million for combining SED 10/FP 9 with TD 3 (local upland disposal at the Rising Pond Site) to approximately $3.0 billion for combining SED 8/FP 7 with TD 5B (thermal desorption).[556]

---

[556] As noted above, more detailed information regarding these combined cost estimates is provided in Appendix Q.

The following key assumptions were made in developing the combined costs of the SED/FP and TD alternatives:

- For the remedial combinations that involve TD 1, it was assumed that, following removal and processing/dewatering (as necessary) at the staging areas, no additional material handling activities would be necessary before off-site transport and disposal – i.e., that removed materials would be sufficiently stabilized for off-site transport as part of the removal alternatives. It was also assumed that removed materials, regardless of the removal method, would be appropriately segregated with respect to TSCA classification as part of the removal alternatives. Therefore, no extra costs for material handling were either added to or subtracted from the combined cost estimates for the remedial combinations involving TD 1.

- As discussed in Section 9.2, it has been assumed that the CDF(s) that are part of TD 2 would be used only for disposition of hydraulically dredged sediments from Reaches 5C and 6 under SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8. Since SED 3/FP 3, SED 5/FP 4, and SED 10/FP 9 do not include hydraulic dredging of sediments, no cost estimates are presented for combinations of those combined alternatives with TD 2. For the combined cost estimates for SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8 with TD 2, it was assumed that all floodplain soils, as well as any sediments removed from reaches other than Reaches 5C and 6, would be transported off-site for disposal. In addition, it was assumed that sediment dewatering and stabilization – activities that were part of the individual sediment alternatives – would not be necessary for the materials to be placed in the CDF(s); and hence costs for sediment dewatering and stabilization were subtracted from the costs for the combinations that involve TD 2. Additionally, some sediments that would otherwise be removed from Reaches 5C and 6 are located within the conceptual footprint of the CDF(s). Construction of the CDF(s) would make the removal of these sediments unnecessary; thus, the sediment removal volumes in Reaches 5C and 6 were reduced in SED 6/FP 4, SED 8/FP 7, and SED 9/FP 8 by the volumes of sediments located within the footprint of the CDF(s), and the costs were adjusted accordingly.

- For the combinations of the combined sediment-floodplain alternatives with TD 3, separate estimates were again made for each of the three potential locations identified for an Upland Disposal Facility.[557] For each of those combinations, adjustments were

557 Since the removal volume involved in SED 8/FP 7 would exceed the capacity of an Upland Disposal Facility at the Woods Pond Site or the Forest Street Site, cost estimates for the combination of SED 8/FP 7 with TD 3 were made only for the Rising Pond Site, where the entire volume of removed material could be disposed of. However, as noted in Section 9.3.1, a combination of disposal locations could also be used.

made to the SED/FP cost estimates presented in Section 8 to account for the fact that, following remediation, the access road and staging area materials would be placed in the Upland Disposal Facility, rather than transported for off-site disposal.

- Where relevant in the combinations of combined sediment/floodplain alternatives with TD 4, it was assumed that hydraulically dredged sediments from Reaches 5C and 6 could be pumped directly to the chemical treatment facility (at the identified location) without being dewatered. In these cases, the following costs were not included in the combined cost estimates: (1) costs for dewatering and associated water treatment (activities that were part of the original combined sediment/floodplain alternatives); and (2) costs for transporting removed sediments hydraulically dredged from Reaches 5C and 6 to the on-site chemical treatment facility. In general, the cost estimates for the combinations that involve TD 4 were based on cost estimates provided by BioGenesis, with certain adjustments and additions to incorporate costs associated with non-treatment activities, as discussed in Section 9.4.9. The costs that were added to the BioGenesis estimates include the costs for transport to the treatment facility location and for off-site transport and disposal of the treated solid materials. These costs were based on the assumption that the treated materials would contain average PCB concentrations less than 50 mg/kg and would be disposed of off-site at a non-TSCA solid waste landfill pursuant to a risk-based TSCA determination from EPA.

- The combinations of sediment-floodplain alternatives with TD 5 were evaluated under two scenarios: (1) assuming that a portion of the treated floodplain soils (approximately 50%) would be reused as backfill in the floodplain after being amended with organic material, and that the remainder of the floodplain soils, and sediment would be transported off-site for disposal in a non-TSCA landfill (TD 5A); and (2) assuming that all treated floodplain soils, and sediment would be transported off-site for disposal in a non-TSCA landfill (TD 5B). For the combinations that involve TD 5A, given the assumed reuse of treated material as backfill, the floodplain backfill costs were removed from the estimates; however, costs associated with the purchase and placement of topsoil were not removed from the combined cost estimates, and instead were assumed to represent the costs associated with the amendment of the thermally treated materials prior to use as backfill.

- For all combinations, it was assumed that none of the removed materials would constitute hazardous waste under RCRA criteria or comparable state criteria.

In addition to the total cost estimates, as required by the Permit, the present worth cost for each combination of SED/FP and TD alternatives is presented in Table 10-6, using a 7% discount rate.

Table 10-1 – Total Cost Estimates for SED and TD Combinations

Revised CMS Report, Housatonic River - Rest of River
General Electric Company - Pittsfield, MA

Alternative	Cost Estimates for SED and TD Combinations[1,2]						
	TD 1 Off-Site Disposal	TD 2 Confined Disposal Facility	TD 3 Upland Disposal Facility Woods Pond	TD 3 Upland Disposal Facility Rising Pond	TD 3 Upland Disposal Facility Forest Street	TD 4 Chemical Extraction	TD 5 Thermal Desorption
SED 1[3]	NA	NA	NA	NA	NA	NA	NA
SED 2[4]	$5 M	NA	$5 M	$5 M	$5 M	$5 M	$5 M
SED 3	$203 M	NA	$187 M	$181 M	$201 M	$232 M	$283 M
SED 4	$321 M	NA	$271 M	$267 M	$294 M	$355 M	$452 M
SED 5	$405 M	NA	$330 M	$327 M	$360 M	$443 M	$588 M
SED 6	$535 M	$409 M	$411 M	$409 M	$451 M	$552 M	$769 M
SED 7	$684 M	$529 M	$483 M	$483 M	$538 M	$691 M	$1,007 M
SED 8	$1,397 M	$985 M	NA	$916 M	NA	$1,468 M	$2,405 M
SED 9	$604 M	$433 M	$378 M	$381 M	$444 M	$567 M	$999 M
SED 10	$163 M	NA	$117 M	$110 M	$134 M	$163 M	$259 M

Notes:
1. Costs presented represent the sum of estimated capital/labor costs of implementation and the costs of post-remediation OMM and/or long-term monitoring.
2. Costs are presented in 2010 dollars. $ M = million dollars.
3. There are no costs associated with SED 1 as that alternative would not involve remedial activities in the Rest of River.
4. There are no treatment/disposition costs for SED 2; the cost listed represents the long-term monitoring costs associated with monitored natural recovery
5. The maximum capacities of the Forest Street Site and Woods Pond Site Upland Disposal Facilities are approximately 1 million cubic yards (cy) and 2 million cy, respectively. Since the SED 8 volume exceeds the maximum capacity at both sites, costs are not applicable (NA) for the combinations of SED 8 with implementation of TD 3 at these sites.

Table 10-2 – Present Worth Cost Estimates for SED and TD Combinations

Revised CMS Report, Housatonic River - Rest of River
General Electric Company - Pittsfield, MA

Alternative	Present Worth Cost Estimates for SED and TD Combinations[1,2,3]						
	TD 1 Off-Site Disposal	TD 2 Confined Disposal Facility	TD 3 Upland Disposal Facility Woods Pond	TD 3 Upland Disposal Facility Rising Pond	TD 3 Upland Disposal Facility Forest Street	TD 4 Chemical Extraction	TD 5 Thermal Desorption
SED 1[4]	NA	NA	NA	NA	NA	NA	NA
SED 2[5]	$2 M	NA	$2 M	$2 M	$2 M	$2 M	$2 M
SED 3	$151 M	NA	$128 M	$124 M	$138 M	$176 M	$228 M
SED 4	$202 M	NA	$163 M	$161 M	$177 M	$232 M	$313 M
SED 5	$231 M	NA	$182 M	$181 M	$198 M	$263 M	$375 M
SED 6	$277 M	$228 M	$210 M	$209 M	$231 M	$302 M	$461 M
SED 7	$307 M	$257 M	$214 M	$215 M	$239 M	$327 M	$534 M
SED 8	$377 M	$297 M	NA	$273 M	NA	$434 M	$896 M
SED 9	$379 M	$271 M	$229 M	$232 M	$264 M	$368 M	$734 M
SED 10	$134 M	NA	$85 M	$81 M	$99 M	$137 M	$234 M

Notes:
1. Costs presented represent the sum of estimated capital/labor costs of implementation and the costs of post-remediation OMM and/or long-term monitoring.
2. Costs are presented in 2010 dollars. $ M = million dollars.
3. Costs have been assessed for present worth, assuming a constant 7% discount factor.
4. There are no costs associated with SED 1 as that alternative would not involve remedial activities in the Rest of River.
5. There are no treatment/disposition costs for SED 2; the cost listed represents the long-term monitoring costs associated with monitored natural recovery
6. The maximum capacities of the Forest Street Site and Woods Pond Site Upland Disposal Facilities are approximately 1 million cubic yards (cy) and 2 million cy, respectively. Since the SED 8 volume exceeds the maximum capacity at both sites, costs are not applicable (NA) for the combinations of SED 8 with implementation of TD 3 at these sites.

Table 10-3 – Total Cost Estimates for FP and TD Combinations

Revised CMS Report, Housatonic River - Rest of River
General Electric Company - Pittsfield, MA

Alternative	Cost Estimates for FP and TD Combinations[1,2]							
	TD 1 Off-Site Disposal	TD 2[4] Confined Disposal Facility	TD 3 Upland Disposal Facility Woods Pond	TD 3 Upland Disposal Facility Rising Pond	TD 3 Upland Disposal Facility Forest Street	TD 4 Chemical Extraction	TD 5A Thermal Desorption (w/ Reuse)	TD 5B Thermal Desorption (w/o Reuse)
FP 1[3]	NA	NA	NA	NA	NA	NA	NA	NA
FP 2	$18 M	NA	$42 M	$34 M	$41 M	$36 M	$28 M	$33 M
FP 3	$56 M	NA	$63 M	$55 M	$63 M	$74 M	$79 M	$88 M
FP 4	$86 M	NA	$79 M	$71 M	$80 M	$105 M	$107 M	$138 M
FP 5	$91 M	NA	$74 M	$66 M	$74 M	$94 M	$93 M	$120 M
FP 6	$208 M	NA	$156 M	$151 M	$175 M	$250 M	$263 M	$346 M
FP 7	$371 M	NA	$263 M	$262 M	$300 M	$470 M	$514 M	$676 M
FP 8	$131 M	NA	$101 M	$95 M	$112 M	$145 M	$152 M	$198 M
FP 9	$22 M	NA	$43 M	$36 M	$43 M	$40 M	$31 M	$38 M

Notes:
1. Costs presented represent the sum of estimated capital/labor costs of implementation and the costs of post-remediation OMM and/or long-term monitoring.
2. Costs are presented in 2010 dollars. $ M = million dollars.
3. There are no costs associated with FP 1 as that alternative would not involve remedial activities in the Rest of River.
4. Floodplain alternatives have not been combined with TD 2 as the CDF has been assumed to be available only for the placement of hydraulically dredged sediments.

Table 10-4 – Present Worth Cost Estimates for FP and TD Combinations

Revised CMS Report, Housatonic River - Rest of River
General Electric Company - Pittsfield, MA

Alternative	Present Worth Cost Estimates for FP and TD Combinations[1,2,3]							
	TD 1 Off-Site Disposal	TD 2[5] Confined Disposal Facility	TD 3 Upland Disposal Facility Woods Pond	TD 3 Upland Disposal Facility Rising Pond	TD 3 Upland Disposal Facility Forest Street	TD 4 Chemical Extraction	TD 5A Thermal Desorption (w/ Reuse)	TD 5B Thermal Desorption (w/o Reuse)
FP 1[4]	NA	NA	NA	NA	NA	NA	NA	NA
FP 2	$17 M	NA	$29 M	$21 M	$29 M	$36 M	$34 M	$40 M
FP 3	$50 M	NA	$45 M	$39 M	$46 M	$67 M	$72 M	$88 M
FP 4	$77 M	NA	$57 M	$52 M	$58 M	$94 M	$106 M	$132 M
FP 5	$81 M	NA	$54 M	$48 M	$54 M	$84 M	$93 M	$116 M
FP 6	$142 M	NA	$95 M	$92 M	$106 M	$173 M	$201 M	$255 M
FP 7	$187 M	NA	$123 M	$123 M	$139 M	$240 M	$301 M	$379 M
FP 8	$88 M	NA	$63 M	$58 M	$71 M	$105 M	$127 M	$159 M
FP 9	$21 M	NA	$30 M	$24 M	$31 M	$39 M	$37 M	$43 M

Notes:
1. Costs presented represent the sum of estimated capital/labor costs of implementation and the costs of post-remediation OMM and/or long-term monitoring.
2. Costs are presented in 2010 dollars. $ M = million dollars.
3. Costs have been assessed for present worth, assuming a constant 7% discount factor.
4. There are no costs associated with FP 1 as that alternative would not involve remedial activities in the Rest of River.
5. Floodplain alternatives have not been combined with TD 2 as the CDF has been assumed to be available only for the placement of hydraulically dredged sediments.

Table 10-5 – Total Cost Estimates for SED/FP and TD Combinations

Revised CMS Report, Housatonic River - Rest of River
General Electric Company - Pittsfield, MA

Alternative	Cost Estimates for SED/FP and TD Combinations[1,2]							
	TD 1 Off-Site Disposal	TD 2 Confined Disposal Facility	TD 3 Upland Disposal Facility Woods Pond	TD 3 Upland Disposal Facility Rising Pond	TD 3 Upland Disposal Facility Forest Street	TD 4 Chemical Extraction	TD 5A Thermal Desorption (w/ Reuse)	TD 5B Thermal Desorption (w/o Reuse)
SED 2 / FP 1	$5 M	NA	$5 M	$5 M	$5 M	$5 M	$5 M	$5 M
SED 3 / FP 3	$251 M	NA	$210 M	$204 M	$228 M	$274 M	$337 M	$356 M
SED 5 / FP 4	$483 M	NA	$365 M	$362 M	$402 M	$509 M	$678 M	$709 M
SED 6 / FP 4	$612 M	$487 M	$446 M	$444 M	$493 M	$619 M	$860 M	$891 M
SED 8 / FP 7	$1,740 M	$1,337 M	NA	$1,160 M	NA	$1,826 M	$2,866 M	$3,026 M
SED 9 / FP 8	$729 M	$558 M	$435 M	$439 M	$512 M	$662 M	$1,132 M	$1,175 M
SED 10 / FP 9	$183 M	NA	$128 M	$121 M	$146 M	$181 M	$283 M	$290 M

Notes:
1. Costs presented represent the sum of estimated capital/labor costs of implementation and the costs of post-remediation OMM and/or long-term monitoring.
2. Costs are presented in 2010 dollars. $ M = million dollars.
3. The maximum capacities of the Forest Street Site and Woods Pond Site Upland Disposal Facilities are approximately 1 million cubic yards (cy) and 2 million cy, respectively. Since the SED 8/FP 7 volume exceeds the maximum capacity at both sites, costs are not applicable (NA) for the combinations of SED 8/FP 7 with implementation of TD 3 at these sites.

Table 10-6 – Present Worth Cost Estimates for SED/FP and TD Combinations

Revised CMS Report, Housatonic River - Rest of River
General Electric Company - Pittsfield, MA

Alternative	Present Worth Cost Estimates for SED/FP and TD Combinations[1,2]							
	TD 1 Off-Site Disposal	TD 2 Confined Disposal Facility	TD 3 Upland Disposal Facility Woods Pond	TD 3 Upland Disposal Facility Rising Pond	TD 3 Upland Disposal Facility Forest Street	TD 4 Chemical Extraction	TD 5A Thermal Desorption (w/ Reuse)	TD 5B Thermal Desorption (w/o Reuse)
SED 2 / FP 1	$2 M	NA	$2 M	$2 M	$2 M	$2 M	$2 M	$2 M
SED 3 / FP 3	$195 M	NA	$148 M	$145 M	$161 M	$214 M	$277 M	$293 M
SED 5 / FP 4	$299 M	NA	$211 M	$210 M	$232 M	$320 M	$449 M	$472 M
SED 6 / FP 4	$344 M	$296 M	$239 M	$239 M	$264 M	$358 M	$535 M	$558 M
SED 8 / FP 7	$534 M	$455 M	NA	$355 M	NA	$589 M	$1,122 M	$1,184 M
SED 9 / FP 8	$462 M	$355 M	$267 M	$270 M	$316 M	$432 M	$839 M	$869 M
SED 10 / FP 9	$152 M	NA	$95 M	$91 M	$110 M	$154 M	$257 M	$263 M

Notes:
1. Costs presented represent the sum of estimated capital/labor costs of implementation and the costs of post-remediation OMM and/or long-term monitoring.
2. Costs are presented in 2010 dollars. $ M = million dollars.
3. Costs have been assessed for present worth, assuming a constant 7% discount factor.
4. The maximum capacities of the Forest Street Site and Woods Pond Site Upland Disposal Facilities are approximately 1 million cubic yards (cy) and 2 million cy, respectively. Since the SED 8/FP 7 volume exceeds the maximum capacity at both sites, costs are not applicable (NA) for the combinations of SED 8/FP 7 with implementation of TD 3 at these sites.

11. Conclusions and Recommendations

Previous sections of this Revised CMS Report have presented detailed evaluations of each of the ten sediment remedial alternatives, nine floodplain soil remedial alternatives, seven selected combinations of sediment and floodplain alternatives, and five treatment/disposition alternatives under the three General Standards and six Selection Decision Factors specified in the Permit. This report has also considered the estimated combined costs of the sediment and floodplain alternatives when paired with the treatment/disposition alternatives. The Permit requires that GE "shall conclude the CMS Report with a recommendation as to which corrective measure or combination of corrective measures, in [GE's] opinion, is best suited to meet the [General Standards] in consideration of the [Selection Decision Factors], including a balancing of those factors against one another" (Special Condition II.G.3).

As noted in the Executive Summary of this Revised CMS Report, based on a critical analysis of the evidence regarding the potential human health and ecological effects of PCBs, as well as the severe ecological damage that would result from remedial construction activities in the River and floodplain, GE has concluded that continuing source control and remediation activities at and near the former GE plant site and monitoring the effect of those activities, along with the ongoing natural recovery processes in the Rest of River, constitute the best remedial alternative for the Rest of River. GE has reserved its rights (including its appeal rights under the CD and the Permit) on this issue and all other issues on which GE has presented its position to EPA during the process to date. Nevertheless, as required by the Permit, GE has conducted the evaluations presented in this Revised CMS Report taking into account EPA's HHRA and ERA and using assumptions, procedures, and other inputs that EPA directed GE to use.

In this context, GE concluded in Section 8 that, of the combinations of sediment and floodplain remedial alternatives under evaluation, the combination of SED 10/FP 9 would meet the General Standards of the Permit and would be "best suited" to meet those standards in light of the Selection Decision Factors, including a balancing of those factors against one another. In Section 9, GE concluded that, of the treatment/disposition alternatives, TD 3 is "best suited" to meet the General Standards of the Permit, based on consideration and balancing of the Selection Decision Factors, and would be the most cost-effective alternative.[558] Review of the combined cost information in Section 10 confirms those conclusions, including the conclusion that a combination of SED 10/FP 9 with TD 3

[558] As noted in Section 9, the extent to which TD 3 is better suited to meet the Permit criteria than TD 1 (off-site disposal) in light of these factors would increase with the volume of excavated materials to be disposed of and the duration of the implementation period, and is less pronounced with the volumes and durations at and near the lower end of the range, such as under SED 10/FP 9.

(estimated to cost $121 to $146 million, depending on the location of the Upland Disposal Facility) is the most cost-effective combination of alternatives. Accordingly, GE has concluded – taking into account EPA's HHRA and ERA and using EPA's directives for the Revised CMS, as required – that a combination of alternatives SED 10, FP 9, and TD 3 is best suited to meet the General Standards of the Permit, including protection of human health and the environment, in consideration of the Selection Decision Factors, including balancing of those factors against one another.

This combination of alternatives would constitute a major sediment and soil removal project. It would involve the removal of a total of approximately 268,000 cy of river sediments, bank soils, and floodplain soils over 76 acres of the River and floodplain, with disposition of the removed materials within a secure, engineered Upland Disposal Facility to be constructed in an area near the River but outside the 500-year floodplain. It is estimated that, following design and preparatory work, this combination of alternatives could be implemented within a 5-year period and, based on the cost estimates presented in Section 10, would cost approximately $121 to $146 million. However, given GE's reservations of rights noted above, this Report does not constitute a proposal to implement these alternatives.

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Appendix A

Updated Assessment of In Situ Treatment Technologies

Appendix A

Updated Assessment of *In Situ* Treatment Technologies

Section 3 of the *Corrective Measures Study Proposal Supplement* (CMS Proposal Supplement; ARCADIS BBL and QEA, 2007) submitted by the General Electric Company (GE) for the Rest of River in May 2007 presented a review and evaluation of *in situ* treatment technologies for sediment and soil. That section provided a justification for the screening of such technologies from further consideration in the Corrective Measures Study (CMS). A copy of that section is attached as Attachment A-1.

As part of the development of the Revised CMS Report, GE conducted a review of current innovative *in situ* treatment technologies for PCBs in sediment and soil to update the discussion included in the CMS Proposal Supplement. As with the prior review, potential *in situ* treatment options were evaluated using available information from several EPA websites (including EPA's Superfund Innovative Technology Evaluation [SITE] Program, Clu-in, and the Federal Remediation Technology Roundtable) and various other project and vendor websites. The information summarized below includes data and/or updates from projects that have become available since development of the CMS Proposal Supplement, and should be considered along with the information provided in the CMS Proposal Supplement (Attachment A-1).

Sediment

In situ treatment technologies (biological, physical, and chemical) for sediment sites continue to be under development, but none has been implemented full-scale at a PCB site. Research on *in situ* biological treatment of sediments is continuing, but at this time, it is unclear whether the limitations of this technology (as described in the CMS Proposal Supplement) can be overcome and, if so, when. The same is true for *in situ* chemical treatment technologies.

However, since submittal of the CMS Proposal Supplement, several efforts have been made to evaluate the effect of the application of activated carbon (AC) on bioavailability of contaminants in sediment. Laboratory studies by Sun and Ghosh (2008) have focused on the effects of AC amendment on bio-uptake reduction in PCB-containing sediment at four sites in the Great Lakes Area of Concern – Niagara River (NY), Grasse River (NY), and two locations on the Milwaukee River (WI). Results from these studies indicate that application of AC can reduce the aqueous dissolved PCB concentrations and bioavailable PCBs, resulting in reductions of PCB bioaccumulation by benthic organisms and, in turn, of PCB transfer up the food chain. Specifically, results from these studies showed that "[a]ctivated carbon addition at 0.5 times [the] native organic carbon to the sediments reduced PCB bioaccumulation by 42% for Niagara River sediment, 85% for Grasse River sediment, 74% for Milwaukee River sediment 1, and 70% for Milwaukee River sediment 2" (Sun and Ghosh, 2008). Sun and Ghosh (2008) concluded: "Although engineering challenges for amendment delivery remain to be addressed, these laboratory results indicate that AC application can be a potential *in situ* technology to reduce ecosystem exposure to PCBs."

Field pilot studies of AC have been performed at the Grasse River (NY) and Hunters Point (CA) (EPA, 2008; Sun and Ghosh, 2007; Cho et al., 2007, 2009; Luthy et al., 2009). These field studies included the placement and/or mixing of granular AC in the field over a relatively small treatment area. The data collected for the Grasse River (NY) field pilot study is currently under EPA review and have not been released to the public. A final report on the Hunters Point (CA) demonstration project was issued in 2009 (Luthy et al., 2009). In the initial field testing at Hunter's Point (CA), PCB bioaccumulation in clams exposed *in situ* to the treatment conditions for 28 days was evaluated 1 month and 7 months after adding AC to the sediment (Cho et al., 2007). By this analysis, PCB bioaccumulation was reduced by 24% and 53% in clams 1 and 7 months after treatment, respectively. After 18 months, PCB uptake by semi-permeable membrane devices, an analog for biological systems, was reduced by 50% to 65% in AC-amended plots compared to the unamended control plots (Cho et al., 2009). Sediment mixing and AC addition did not impact PCB bioaccumulation in amphipods among the treatments. It was postulated by these investigators that redeposition of contaminated sediments at the surface of the relatively small plots was the primary factor for inconsistencies between the laboratory and field bioassay results. Depth-discrete analysis of sediment cores illustrated significantly lower black carbon and higher aqueous equilibrium PCB concentrations in the surficial sediment after 24 months. In order to further assess the efficacy of this approach, *ex situ* tests were conducted at 24 months after AC application, using composite sediment samples collected from the site. Clams were added to these sediments and exposed for a period of 28 days. These tests showed a 30-50% reduction in PCB uptake by the clams in AC-treated sediment compared to the PCB uptake by clams in untreated control sediment (Luthy et al., 2009).

The Hunters Point (CA) demonstration project evaluated AC mixing technologies in a shallow, low-energy, depositional environment. These techniques may not be directly applicable to deeper or higher-energy sediment environments for technical feasibility reasons. Other recent developments in deployment technologies include a mechanical mixing apparatus (Chesner et al., 2008) and more passive methods that rely on bioturbation.[1] However, these techniques have not moved beyond pilot testing at this time.

Another new technique uses AC impregnated with reactive iron/palladium bimetallic nanoparticles (reactive activated carbon [RAC]) (Choi et al., 2008; 2009a; 2009b; Choi and Al-Abed, 2010). This treatment technology uses AC to physically sequester the PCBs and metals to dechlorinate the PCBs, since the use of metals in a zero-valent state has been documented to efficiently dechlorinate PCBs. This technology is currently being developed, and has not to date been demonstrated to degrade an Aroclor mixture of PCBs in a contaminated sediment environment.

In August 2008, the Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP) conducted a workshop focused on research and development needs related to the bioavailability of contaminants in soils and sediments. As a result of this workshop (SERDP and ESTCP, 2008), critical priorities were established for researching *in situ* remedies to reduce bioavailability of contaminants in sediments, with a high priority placed on better understanding the effect of black carbon on the bioavailability of contaminants in sediments. Long-term performance measures to evaluate the success of field-placed amendments in reducing bioavailability were also identified as a critical demonstration need.

Soil

As with sediment sites, *in situ* treatment technologies for soil sites continue to be under development. GE's recent re-evaluation of such potential technologies indicated that, as previously stated in the CMS Proposal Supplement, various studies are underway to understand the applicability of these treatment technologies to PCBs and other constituents in soils. However, these studies remain in the research stage, and no new *in situ* soil treatment technologies were identified which have been implemented full-scale at PCB sites.[2]

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[1] One such passive method is the Sedimite™ method being developed by Sediment Solutions, Baltimore, MD. Two other ongoing research projects that are further developing the passive deployment methodology are: Superfund Basic Research Program grant number R01ES16182 - Pilot-scale Research of Novel Amendment Delivery for *in situ* Sediment Remediation; and Environmental Security Technology Certification Program project number ER-0835 - Evaluating the Efficacy of a Low-Impact Delivery System for In Situ Treatment of Sediments Contaminated with Methylmercury and Other Hydrophobic Chemicals.

[2] This recent re-evaluation did indicate that a previously existing technology discussed in the CMS Proposal Supplement, cement-based *in situ* solidification/stabilization, has been demonstrated full-scale at an additional site, as discussed later in this appendix.

Chemical Treatment. An *in situ* chemical treatment technology identified since the submittal of the CMS Proposal Supplement reportedly uses persulfate and a surfactant to solubilize and subsequently destroy PCBs. This technology has been developed by VeruTEK® Technologies, Inc.; but to date, VeruTEK® has released only limited data from bench-scale tests for the treatment of PCBs in water (VeruTEK®, undated). The bench-scale data indicated that the surfactant-enhanced oxidant reduced the PCB concentration in the water from 1,700 milligrams per liter (mg/L) to approximately 250 mg/L (VeruTEK®, undated). However, no information was obtained regarding the testing of this technology on PCBs in soil; and no field-based (or peer-reviewed) studies, data, or literature have been made available to the scientific community on this technology.

A similar chemical treatment technology uses sodium persulfate ($Na_2S_2O_8$) and the related oxidant potassium peroxymonosulfate ($KHSO_5$), activated with heat and iron, which have been reported to degrade PCBs (EPA, 2006; Rastogi et al., 2009). Again, however, no field-scale reports of PCB-contaminated soil remediation using activated persulfate are publically available.

Any form of *in situ* chemical oxidation technology applied on floodplain soils would have similar limitations to those described in the CMS Proposal Supplement in 2007 (i.e., variable effectiveness depending on site stratigraphy, soil oxidant demand and pH; limitations due to land disposal restrictions and underground injection-related regulations; and the likelihood of leaving residuals [un-reacted oxidants] or byproducts in the floodplain soil).

Thermal Treatment. Since the evaluation of *in situ* thermal treatment in the CMS Proposal Supplement, the United States Army Corps of Engineers (USACE) published a design manual for *in situ* thermal remediation (USACE, 2009). That document provides guidance and background necessary for evaluating *in situ* thermal remediation. However, no new information regarding *in situ* thermal remediation appears to be presented; the document is consistent with previous guidance documents reviewed for the CMS Proposal Supplement and the case studies discussed by the USACE were conducted prior to 2001.

Solidification/Stabilization. EPA recently published a technology performance review of *in situ* solidification/stabilization (S/S) treatment (EPA, 2009), which involves the mixture of a stabilizing agent into the soil to physically or chemically bind the chemical of interest and reduce the potential for uptake or exposure by humans and biota. EPA's review states that "[t]here is potential to use S/S under a wide variety of site conditions." While not a new technology, information presented in Table 3-1 of that document shows that *in situ* S/S technology has been demonstrated as an effective treatment of PCBs in soil. The document describes the application of cement-based *in-situ* S/S at a Superfund site in Arkansas in 2000, where a cement-based stabilization agent was mixed in with approximately 40,000 cubic yards (cy) of soil containing PCBs at concentrations up to 14 mg/kg (other contaminants were also present) (EPA, 1994). Following implementation, the solidified mass extending over more than 4 acres was covered with 2 feet of soil and vegetated. Monitoring conducted 5 and 10 years following implementation showed that the relevant performance standards were achieved, including the standard of 0.0005 mg/kg PCBs in leachate from the S/S-treated soil (EPA, 1998, 2009, and 2010). EPA's technology performance review of S/S treatment (EPA, 2009) indicates that there are several future land use and environmental factors that could cause erosion of the solidified/stabilized soils, potentially leading to the release of PCBs.

While results from this application are similar to those at the Hialeah site (FL) and Caldwell Trucking site (NJ) discussed in the CMS Proposal Supplement, the drawbacks with applying this technology at the Rest of River site remain the same as noted in the CMS Proposal Supplement. Creation of a solidified mass of treated material like that performed at the Hialeah, Caldwell, and Arkansas sites would require placement of a soil cover over the treated material to support vegetative growth and provide habitat for floodplain organisms. The presence of the solidified mass would eliminate the flow of groundwater to the overlying soil cover and prevent the growth of deep rooted vegetation, greatly limiting vegetative restoration and future floodplain uses. Other drawbacks with in-situ S/S include potential flood storage or freeze/thaw issues due to volume expansion during implementation, and the higher costs and longer time frames for shallow-depth applications such as for the Rest of River floodplain soils.

Summary

Although several *in situ* treatment technologies have been, in part, demonstrated at a bench- or pilot-scale level, no new technologies have been successfully demonstrated full-scale with PCBs in sediment or soil since the development of the CMS Proposal Supplement;[3] and the limitations of the technologies that have been identified remain largely the same as described in that document. As noted by SERDP and ESTCP in November 2008 with regard to sediments: "Although several technologies for … in situ treatment have been developed, there remains a need for demonstration and validation of the effectiveness and permanence of these remedies" (SERDP and ESTCP, 2008). The same need for more successful bench/pilot-scale testing of technologies for PCB-contaminated soil is also necessary before full-scale implementation.

[3] As noted above, while not a new technology, cement-based *in situ* S/S was identified as having been demonstrated full-scale at an additional site.

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Attachment A-1

CMS Proposal Supplement
Section 3

3. Further Justification for Screening of In Situ Treatment Technologies

3.1 Introduction

This section provides additional justification for the screening of *in situ* treatment technologies and addresses the following EPA comment:

- **General Condition 2.** *GE shall provide further justification and discussion (in the Supplement) of the screening of* in situ *treatment technologies for sediment and soil.*

3.2 Overview of Screening Process

In the CMS Proposal, *in situ* sediment and soil treatment technologies for the Rest of River were identified and screened in a two-step process. This Supplement elaborates on this process and provides additional detail regarding the evaluation of potential *in situ* treatment technologies. Potential *in situ* treatment options were identified using available information from several EPA websites, including the EPA's Superfund Innovative Technology Evaluation (SITE) Program, Clu-in, and the Federal Remediation Technology Roundtable.

The two-step screening process used in the CMS Proposal consisted of an initial and secondary screening step. The initial screening generally consisted of an evaluation based on technical implementabilty to eliminate those technologies that are not appropriate based on site conditions or chemical/physical characteristics of the site media, or that have not been successfully applied on a full-scale basis at other PCB-impacted sites.

Those technologies that were retained as a result of the initial screening were then subject to a secondary screening based on effectiveness and implementability. The effectiveness of each treatment technology was evaluated based on: (a) its general ability to reduce the potential for human and/or ecological exposure to PCBs; and (b) the extent to which long-term maintenance and/or monitoring is required to ensure effectiveness. Implementability included consideration of both the technical and administrative feasibility of implementing a technology process option, as well as the availability of equipment, materials, and personnel.

An expanded and more detailed discussion of the identification and screening of potential *in situ* treatment technologies is provided below.

3.3 Overview of Identified *In Situ* Treatment Process Options

In situ treatment typically involves using physical, chemical, biological, or thermal processes to destroy or degrade contaminants or immobilize the contaminants in place within the soil or sediment. Each of these process options is summarized below, as it would apply to the Rest of River area.

- ***In situ* physical treatment** can be applied to sediment or soil and involves injecting and/or mixing an immobilization agent to reduce the mobility of PCBs. The agent can be coal, coke breeze, activated carbon, Portland cement, fly ash, limestone, or other additive. It is injected/mixed into the sediment or soil to encapsulate the contaminants in a solid matrix and/or chemically alter the contaminants by converting them into a less bioavailable, less mobile, or less toxic form.

- ***In situ* chemical treatment** can be applied to sediment or soil and involves injecting chemical surfactants/solvents or oxidants into the treatment area to remove or destroy PCB constituents. Chemical treatment processes may include common or proprietary solvents and other liquids.

- ***In situ* biological treatment** can be applied to sediment or soil and involves introducing microorganisms and/or nutrients into the treatment zone to increase ongoing biodegradation rates of PCBs. Biodegradation of PCBs may occur either in the absence of oxygen (anaerobic conditions) or with oxygen present (aerobic conditions).

- ***In situ* thermal treatment** is applicable only to soil media and involves heating the PCB-containing soil to high enough temperatures to remove and/or destroy PCBs in the floodplain soils. It could include the use of steam or direct heat (via heat elements) and thermal conductivity to heat soils and vaporize contaminants for collection and treatment/disposal. In addition, resistance heating could be employed, which uses electromagnetic waves to heat targeted soils in an effort to enhance contaminant removal. *In situ* vitrification, a higher energy form of thermal treatment, uses temperatures high enough to vitrify the soil (i.e., turn it into a stable glass-like material), destroying or immobilizing contaminants that are present. The success of any of these forms of *in situ* thermal treatment is highly dependent on soil homogeneity, subsurface conditions, and the effectiveness of the delivery system.

These treatment options are evaluated individually below for sediment and soil applications. However, as a general matter, all *in situ* treatment technologies, regardless of type, are subject to a number of general challenges that could make their application to the Rest of River problematic. Physical access to the area to be treated must be obtained. Additionally, for the floodplain soils, removal of all vegetation (including clearing and grubbing of root systems) would likely be required to achieve effective treatment. The effectiveness of *in situ* treatment technologies is also dependent upon subsurface characteristics, such as moisture content and material type, which can be highly variable, especially in the floodplain, and would make technologies such as *in situ* thermal treatment prohibitive for the sediments. Moreover, these technologies require an effective *in situ* delivery system and adequate process controls/containment, which have been shown to be difficult to design, effectively operate, and maintain. In addition, unreacted treatment reagents and/or byproducts generated by the reagents may remain in the subsurface, with potentially unknown environmental effects. Following remediation, treated areas would likely not be suitable for restoration without nutrient amendment or covering with clean materials, which could affect the flow of surface water or groundwater, flood storage capacity, and future use by both humans and wildlife. Finally, given the lack of full-scale use of most *in situ* technologies, little is known about their long-term effectiveness and permanence.

3.4 Evaluation of Identified *In Situ* Treatment Technologies for Sediment

Methods for *in situ* treatment of sediments are currently under development, but few options are commercially available. EPA has noted that "significant technical limitations currently exist for many of the treatment technologies," especially in terms of their effectiveness (EPA, 2005a). The efficiency of *in situ* treatment is summarized by Renholds (1998) as "almost always less than ex situ treatment." The EPA has also cited *in-situ* mixing as "most difficult alternative in terms of control of safety and environmental considerations" (EPA, 1986). In the CMS Proposal, each of the *in situ* treatment process options for sediments was screened out in the initial screening step. Additional information and justification for such screening are provided in the following subsections.

3.4.1 *In Situ* Physical Treatment

In situ physical treatment processes have not yet been sufficiently developed for sediment nor been successfully implemented full-scale for PCBs. The problems noted by others with implementation of *in situ* physical treatment processes for sediments include:

- Lack of an effective delivery system (EPA, 2005a), including difficulties in maneuvering about rocks and cobbles that may be on the river bottom;
- Lack of good process controls, particularly for mixing conditions and curing temperatures (Kita and Kubo, 1983);
- Lack of good quality control during the mixing process (EPA, 1986);
- Difficulty in controlling safety and environmental considerations during *in-situ* mixing since the entire process is open to the atmosphere, leading to environmental problems such as generation of odors, vapors, and fugitive dust (EPA, 1986);
- Potential need for frequent and potentially sizeable onshore staging areas to support application;
- Ability to control the mixing process to mitigate impacts to the water column and surrounding environment;
- High degree of sediment handling (EPA, 1994); and
- Potential to increase in place sediment volume due to the addition of a stabilizing agent.

Based on a review of two sediment projects (Fox River [WI], which included the field implementation of a stabilization treatment technology, and the Manitowoc River [WI], which consisted of a pilot-scale evaluation of a solidification treatment technology), Renholds (1998) noted that although there was a relatively high treatment efficiency observed in most laboratory studies for *in situ* physical treatments, there was difficulty in the implementation of the treatment and engineering controls in the field. The feasibility of *in situ* physical treatment must consider the technology's environmental impact on the water column and aquatic environment. For instance, *in situ* physical treatment technologies, which often include mixing processes, need to operate without dispersing the sediments or creating conditions more harmful to aquatic life than already exist (EPA, 1994). Significant issues with mixing were encountered during the Manitowoc River (WI) demonstration project. The river sediments contained polycyclic aromatic hydrocarbons (PAHs) and several heavy metals from a former coal gasification plant. During the demonstration project, good controls could not be established for the mixing of cement/fly ash slurry with the sediment (Renholds, 1998), resulting in the dispersal of sediments and little treatment (according to the Wisconsin Department of Natural Resources). On the Fox River, *in situ* stabilization was implemented on sediments containing lead in a small scale application (500 tons of sediment treated) using a shoreline-based crane and clamshell. While the mixing process was reportedly successful at stabilizing the lead to a sufficient degree that the material would not be classified as a hazardous waste under RCRA, several stages of mixing were required, and the stabilized material was subsequently removed and transported to an off-site landfill, precluding any opportunity to record/monitor this project as a true *in situ* process. Issues with resuspension were reported during mixing, and the need for containment was noted if a similar mixing process were to be considered on a larger scale (Renholds, 1998).

According to the National Research Council in *A Risk Management Strategy for PCB-Contaminated Sediments,* (NRC, 2001), the lack of adequate process controls has relegated the use of *in situ* physical treatment to instances when the contaminated sediment can be isolated from the water body. Even if some sort of containment system such as cofferdams were used, the effects on groundwater/surface water interaction beneath the river bottom would need to be considered and its use may be limited by water depth and river bottom conditions. In addition, other substantial issues associated with using a containment system include: the presence of variable river bottom and debris which would interfere with the mixing process; the potential need for removal following stabilization to address any concerns regarding loss in flow capacity resulting from the addition of a stabilization agent; and the potential need to add cover material to provide a viable habitat for biota. It is likely that *in situ* physical treatment has not been attempted full-scale on river sediments because of the many factors that preclude effective implementation.

In light of the fact that *in situ* physical treatment processes have not yet been sufficiently developed to treat sediment *in situ* nor been successfully implemented full-scale for PCBs, coupled with the potential concerns regarding implementation noted above, there is insufficient precedent or technical information available to retain this technology as a potentially viable remedial option for the Housatonic River sediments at this time.

3.4.2 *In Situ* Chemical Treatment

In situ chemical treatment processes have not been successfully demonstrated full-scale for PCBs in sediment. The problems associated with implementation of *in situ* chemical treatment processes include:

- Lack of an effective delivery and homogenization system;
- Addressing toxicity associated with the chemical additives and/or byproducts of the treatment process;
- Difficulties in maneuvering about rocks and cobbles that may be on the river bottom for reagent delivery;
- Potential need for frequent and potentially sizeable on-shore staging areas to support application;
- Elevated biological oxygen demand that requires more oxidant than expected (Murphy et al., 1995);
- Difficulty in controlling the mixing reagent from spreading outside the targeted treatment area; and
- Lack of ability to control the mixing process such that mixing reagents and sediments are not released to the environment (EPA, 1994).

Current studies are underway at the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), founded by the National Oceanic and Atmospheric Administration (NOAA) and the University of New Hampshire, on an *in situ* sediment ozonator that may eventually have the potential to remediate PCBs *in situ*. However, at this time, the project remains in the research stages and has not been applied full-scale (Hong and Hayes, 2006). In addition, investigators at the University of New Hampshire are currently carrying out studies on *in situ* dechlorination of PCBs through application of zero-valent iron (ZVI) or magnesium. While these investigators' laboratory testing on sediments from the Housatonic River has shown promising results (e.g., 84% PCB removal in one day), mass balance analyses have not yet been able to account for all PCBs removed from the sediment (Mikszewski, 2004). As this technology is still in the experimental stage, no information is yet available on the performance of a demonstration-scale or full-scale application.

Oil-Free Technologies, Inc. (Oil-Free) has developed a proprietary enzyme mixture (Enzymmix) that is reported to be able to break down PCBs. Although this technology has not been demonstrated in a full-scale application for sediments, laboratory tests on soils have been performed. These tests have reportedly shown that Enzymmix, with multiple applications in a laboratory setting using soils, reduced PCB concentrations approximately 43% from an initial average concentration of 117 parts per million (ppm) (University at Albany, 2006); however, it is unknown what fraction of PCBs were lost to volatilization since the experiment was not conducted under air-tight conditions (EPA, 2005b). The vendor has indicated that diversion of river water with installation of a series of pipes installed in a 10-foot grid would be necessary as a potential procedure for applications to sediment. In fact, the Housatonic River Initiative (HRI) submitted a request to EPA to evaluate Enzymmix for possible application at the Housatonic River as part of EPA's SITE Demonstration Program.[8] Based on the information provided by HRI and the vendor, EPA concluded that the Oil-Free process would not be evaluated under the SITE Program due to incomplete data from previous studies and an absence of demonstrated performance (EPA, 2005c).

Further, the pilot-scale *in situ* chemical/biological study (via chemical injection of oxidants and/or nutrients) conducted on sediments from Hamilton Harbor (Canada) and the 1991 field research study conducted on Hudson River sediments to study the potential for *in situ* biological/chemical treatment of sediment both resulted in approximately 50% treatment efficiencies, which are low compared to treatment efficiencies of *ex situ* processes (Renholds, 1998).

In light of the fact that *in situ* chemical treatment processes have not yet been sufficiently developed for sediment *in situ* nor been successfully implemented full-scale for PCBs, coupled with the potential concerns regarding implementation noted above, there is insufficient precedent or technical information available to retain this technology as a potentially viable remedial option for the Housatonic River sediments at this time.

3.4.3 *In Situ* Biological Treatment

In situ biological treatment processes have not been successfully demonstrated full-scale for PCBs in sediment. The problems associated with implementation of *in situ* biological treatment processes include:

- Lack of an effective delivery system, including difficulties in maneuvering about rocks and cobbles that may be on the river bottom;
- Difficulty in identifying the microbes responsible for PCB biodegradation/dechlorination;

[8] EPA's SITE Demonstration Program was established by EPA's Office of Solid Waste and Emergency Response and Office of Research and Development (ORD), and is administered by ORD National Risk Management Research Laboratory in the Land Remediation and Pollution Control Division (LRPCD). The SITE Demonstration Program encourages the development and implementation of innovative treatment technologies for remediating hazardous waste sites, as well as measurement and monitoring technologies. In the demonstration program, a technology is field-tested and engineering and cost data are collected. EPA then documents the testing, including performance and cost data, provides an evaluation of all available information on the technology, and analyzes its overall applicability to other site characteristics/wastes (EPA, 2007a).

- Bioavailability of key contaminants such that the microorganisms feed on the target compounds rather than other substrates (Renholds, 1998);
- Lack of ability to achieve low ppm residual PCB concentrations in sediments;
- Lack of ability to establish/enhance variable sediment conditions (e.g., aerobic versus anaerobic, pH, etc.) sufficient to effectively support microbial degradation and/or dechlorination;
- Lack of ability to control the mixing process to mitigate impacts to the water column and surrounding environment;
- Potential need for frequent and potentially sizeable onshore staging areas to support application; and
- Overall resistance of PCBs to microbial degradation.

A field study was performed by GE in the Housatonic River to assess chemical activation of microbial dechlorination on Woods Pond sediments for approximately one year (Bedard et al., 1995, 1998). In this study, two caissons were driven 18 to 24 inches into the sediment, and the sediments in each caisson were mixed for homogenization twice prior to treatment. One cell was treated with 2,6-dibromobiphenyl (2,6-BB) as a microbial primer and the other was left untreated as a control. The preliminary results indicated that some dechlorination of highly chlorinated PCB congeners could be performed by native microbial populations with the addition of 2,6-BB, but significant changes in PCB concentration were not noted (Bedard et al., 1995). Further research exhibited positive results for accelerated *in situ* microbial dehalogenation of PCBs through use of brominated biphenyls, but progress was slowed by lack of naturally occurring and effective priming compounds, and again significant changes in PCB concentration were not noted (Bedard et al., 1998). Reasons that PCBs are resistant to microbial degradation include the following (Renholds, 1998):

- Preferential feeding of microorganisms on other substrates;
- Microorganisms’ inability to use a compound as a source of carbon and energy;
- Unfavorable environmental conditions in sediments for propagation of appropriate microorganisms; and
- Poor contaminant bioavailability to microorganisms.

Recent research has identified specific anaerobic microorganisms (*Dehalococcoides*) that are capable of partially dechlorinating PCBs and obtain energy from this process (Bedard et al., 2007). However, this research is still in the early stages and the authors have indicated that more research is necessary before it can be determined if this technology can be implemented for full-scale *in situ* applications. In addition, the subject experiment looked at only an aqueous medium and did not consider any factors that would affect *in situ* sediment applications (e.g., desorption of PCBs). Further, the experiment used a fresh source of PCBs, but the PCBs found in the environment have been "aged," which may affect the microorganisms' ability to dechlorinate the biphenyl ring.

Overall, this recent research has shown that the microorganisms only partially dechlorinate PCBs, which may mean that the form of the PCBs might be altered without reduction in total PCB concentrations in the sediment. The research indicates that another mixed culture of organisms previously studied could continue the PCB dechlorination process; however, these two groups of microorganisms were not obtained from the same source/location (i.e., they have not been found together in the environment). Therefore, it is likely that the sediments of the Rest of River would need to be amended with non-native microorganisms for the dechlorination process to occur. In addition, the microorganism population had to grow to a minimum level before measurable dechlorination occurred in this study. The investigators indicated that this microorganism population level is not likely to occur naturally in a sediment environment (such as the Rest of River) and that further research would be required to determine the necessary changes to environmental conditions that could increase the microorganism population (Bedard et al., 2007).

In light of the fact that *in situ* biological treatment processes have not yet been sufficiently developed for sediments nor been successfully implemented full-scale for PCBs, coupled with the potential concerns regarding implementation noted above, there is insufficient precedent or technical information available to retain this technology as a potentially viable remedial option for the Housatonic River sediments at this time.

3.4.4 Summary of Evaluation of *In Situ* Treatment Technologies for Sediment

Based on the above evaluation, none of the *in situ* treatment technologies that were evaluated is considered a potentially viable remedial option for the Rest of River sediments at the present time. Although several of the technologies have been, in part, demonstrated at a bench- or pilot-scale level, none of the technologies has been successfully demonstrated full-scale with PCBs in sediment. The lack of success of these technologies in reducing PCB concentrations is governed in part by the fact that, by their nature, PCBs are persistent compounds.

Although each technology presents its own individual challenges, in general adding media (e.g., stabilization agent, chemical reagent, microorganisms, etc.) to sediment through the water column is difficult at best. According to the EPA, "developing an effective in-situ delivery system to add and mix the needed levels of reagents to contaminated sediment is more problematic" (EPA, 2005a). Delivery systems are affected by the depth of water and river bottom substrate; a layer of cobble and/or gravel at the sediment surface will likely be difficult to penetrate in these application situations. Many of these technologies may require multiple on-shore staging areas to promote application. Further, once the added media are introduced into a dynamic river system, it is difficult to control the endpoint of the application. Several of these technologies require significant mixing of sediment in order to promote success, and resuspension created by the mixing process may be difficult to control or manage in areas of variable river conditions (e.g., increased river velocities, uneven river bottom, deep water, etc.) There is a need for more successful bench/pilot-scale testing showing some promise at overcoming the challenges noted above before full-scale implementation is considered. However, GE will re-evaluate these technologies during the CMS if future information or test results become available indicating that any of them may prove to be a potentially effective and implementable option for application to the Rest of River sediments.

3.5 Evaluation of Identified *In Situ* Treatment Technologies for Soil

In the CMS Proposal, *in situ* physical treatment of floodplain soil was carried forward for secondary screening because it has been used at a limited number of sites with PCB-impacted soils. However, that process option was not retained for further evaluation in the CMS due a number of issues relating to its effectiveness and implementability. *In situ* chemical and thermal treatment processes for soil were screened out in the initial screening step because such process have not been successfully demonstrated full-scale to address PCBs in soil. Similarly, although aerobic and anaerobic biodegradation of PCBs are known to occur both naturally and through enrichment, *in situ* biological treatment for soil was also screened out in the initial screening step because no *in situ* biological processes or sites were identified in the literature where significant reductions in PCB concentrations have been documented. Additional information and justification for the screening of each of these *in situ* treatment process options for floodplain soil are provided in the following subsections.

3.5.1 *In Situ* Physical Treatment

In situ physical treatment (via immobilization) has been applied at a number of sites employing a variety of deep and shallow mixing techniques using Portland cement or some other stabilization agent to reduce the potential mobility of contaminants in soils through physical and/or chemical fixation of the contaminants (Lehr, 2004). Most of the documented *in situ* applications have been at sites containing a variety of PAHs and metals, and were done to address deep soils that would be difficult to excavate and/or performed in part to improve the geotechnical characteristics of the soil for subsequent redevelopment (Carleo et. al, 2006; Wilk, 2005; Wilk and DeLisio, 2002). The use of *in situ* physical treatment to address soils containing PCBs appears to be very limited, with only one site demonstration and one full-scale project identified through a literature search and discussions with vendors. A summary of those projects is provided below..

Physical immobilization was evaluated in 1988 through EPA's SITE Demonstration Program at a GE service shop in Hialeah, FL. Contaminants of concern included PCBs at concentrations ranging up to 950 mg/kg, as well as a variety of volatile organic compounds (VOCs) and metals. The demonstration process involved deep soil mixing using Geo-Con equipment and International Waste Technologies (IWT) HWT-20 cementitious additive. The mixing process was based on a combination of an auger and caisson, which operated in the waste. The stabilization/solidification agent was fed into the auger and then into the waste through a hollow stem. Inside the caisson, the auger mixed the agent with the waste by a lifting and turning action (EPA, 1989). The test was performed on two 10x20 ft areas to depths up to 18 feet. Among the objectives, the study was designed to evaluate the extent to which the Geo-Con process could immobilize (i.e., reduce the leachability of) the PCBs in the soil, evaluate the performance and effectiveness of the mixing process, and assess the potential long term durability of the solidified mass. The conclusions drawn (EPA, 1990) were that:

(a) immobilization of PCBs appeared likely, although this could not be confirmed due to low PCB concentrations in the mixed soil (due to dilution through mixing with lower concentration soils and some dilution from the additive) and in the leachate from the treated and untreated soils;

(b) a modest volume increase of 8.5% occurred, which could provide land contouring difficulties in many locations;

(c) the solidified material showed satisfactory physical properties (e.g., unconfined compressive strengths, permeability, and integrity) indicating a potential for long-term durability, but unsatisfactory integrity for the freeze/thaw samples, with cumulative relative weight losses ranging from 0.5% to 30 % and averaging 6.3%; and

(d) a dense, low-porosity, monolithic block of treated waste was produced, which groundwater would flow around, not through.

In situ stabilization was also implemented as a final remedial component to address in-place soils at the Caldwell Trucking Site (NJ) (EPA, 2006a). The primary constituents of concern at the Caldwell site were lead, cadmium, and VOCs. PCBs were also detected in soil stabilized at the site at concentrations below 50 mg/kg. In total, approximately 40,000 cubic yards of soil were stabilized in place using an excavator, to depths up to 35 feet, using Portland cement. The stabilization process was suspended for 17 months due to high levels of odors and emissions coming from the soils, which were addressed through construction of a soil vapor extraction system. The treatment process created a large monolithic block of concrete/soil, which was bulked by approximately 20% (protruding above grade) due to the addition of concrete slurry. Once complete, a 2-foot soil cover was placed over the treatment area and seeded (Hebert, 2007). Although no specific data were found, review of a 5-year review report by EPA indicated that the stabilization of contaminated soil was "intact and in good repair," and that it "has greatly reduced the potential for exposure and mobility of site related contaminants" (EPA, 2002b).

Given its prior use at these sites (despite the considerations discussed above), *in situ* physical treatment of soils (via immobilization) was retained for secondary screening under the effectiveness and implementability criteria, as discussed below.

If applied to the Housatonic River floodplain soils, physical immobilization would involve mixing the floodplain soils *in situ* with Portland cement or some other stabilization agent to reduce the bioavailability of PCBs in the soils. For areas with extensive vegetation, clearing, grubbing, and site grading would be required prior to implementation. This option could be implemented alone or may need to be combined with other technologies/process options. For example, to maintain flood storage capacity in the area, soil removal might be required prior to soil stabilization so as to accommodate the increased volume that would be caused by the addition of the stabilization agent and/or to accommodate a soil cover, which may need to be placed over the stabilized soils to support vegetative growth. The impact of using certain stabilization agents on surface water/groundwater movement and interaction would also need to be considered.

Effectiveness – Physical immobilization could reduce the bioavailability of PCBs in floodplain soils, thereby reducing the potential for human or ecological exposure. For those sites noted above where *in situ* physical treatment has been implemented, the bioavailability was essentially reduced by converting the soils into a cement-like monolithic block. While a cement-like product may be acceptable at an industrial site where the potential for leaching to groundwater is the primary driver, use of such a product in the Housatonic floodplain would greatly inhibit the functional value of the soils, requiring a new soil cover to be placed over the top of the solidified material to sustain vegetation and provide habitat for floodplain organisms. Since the concentration of PCBs in the soil matrix is not significantly reduced through the physical immobilization process, the effectiveness of this technology using non-cement additives (if one were identified) at reducing the bioavailability to organisms which ingest soil is questionable, and would likely also require placement of a clean soil cover. Additional problems and challenges noted at the Hialeah site, which would also need to be considered for the Housatonic River floodplain soils, include volume increase and freeze/thaw integrity issues.

Implementability – It is currently assumed that the equipment, materials, and operating personnel needed to implement *in situ* physical treatment in the Housatonic River floodplain would be readily available. However, there could be some technical and administrative issues, such as incompatibility with future uses of floodplain soils and restoration options (i.e., may not be able to support vegetative growth), flood storage issues due to volume expansion during implementation of this option, and potential difficulty obtaining permission from property owners to carry out the immobilization on their properties. None of these were issues at the Hialeah, FL. and Caldwell, NJ sites, because both are industrial sites, and physical treatment was performed to support future site use without consideration for use and inhabitance by wildlife or potential wetlands restoration. Also, this option is best suited for deeper applications within a relatively small footprint, rather than a potentially large, shallow-depth application such as the floodplain soils of the Housatonic River. Unlike the Housatonic River floodplain soils, the use of *in situ* physical treatment at the Hialeah, FL. and Caldwell, NJ sites was driven by the presence of deep soils requiring remediation (up to 35 feet deep) and the fact that excavation to such depths was deemed impracticable. Finally, this option would be costly to implement given the relatively shallow vertical distribution of PCBs in the floodplain soil (which would make this an expensive remedy per unit area applied) and the likely need to remove material prior to or following implementation to accommodate flood storage capacity.

Due to potential effectiveness and implementation issues noted above and the relatively high implementation costs compared to other more proven and effective floodplain soil remedial options, physical immobilization has not been retained for further evaluation as a floodplain soil remedial option at this time.

3.5.2 *In Situ* Chemical Treatment

In situ chemical treatment processes have not been successfully demonstrated full-scale for PCBs in soil. EPA has noted that while injecting chemical surfactants/solvents to treat soils is common in oil field applications, "it has found limited application in the environmental arena" (EPA, 2006b).

Several chemicals that are known to break down PCBs have been identified in the laboratory. Fenton's reagent, a form of chemical oxidation, has been found to be an effective method of remediating PCB-impacted soils through oxidation by hydroxyl radicals. The toxicity of the parent PCB, potential Fenton's remediation byproducts, and the byproduct mixture may require further evaluation (Satoh et al., 2003). As another example, nanoscale zero-valent iron has been shown to dechlorinate PCB; however, a study reporting this noted that pilot and full-scale field tests are ultimately needed to further assess the appropriateness of these technologies (Mikszewski, 2004).

In addition, Oil-Free Technologies, Inc. has developed a proprietary enzyme mixture (Enzymmix) which is reported to be able to break down PCBs and which has been demonstrated in laboratory tests on soils. That technology was discussed in Section 3.4.2. As explained in that section, the effectiveness of this technology is uncertain since the tests were not conducted under air-tight conditions and hence the faction of PCBs lost to volatilization is unknown (EPA, 2005b). In addition, there is no documentation regarding the toxicological effects of the enzyme mixture, and it is unclear how its migration would be controlled or how it would be recovered from the subsurface. As noted above, in response to a request from HRI to evaluate Enzymmix for possible application at the Housatonic River site, EPA concluded that this process would not be evaluated under the SITE Demonstration Program due to incomplete data from previous studies and an absence of demonstrated performance (EPA, 2005c).

General problems associated with the implementation of *in situ* chemical treatment processes in soils include the following:

- Effectiveness can be greatly affected by site stratigraphy, soil oxidant demand, and pH;
- Multiple applications are needed when using chemical oxidants; some unreacted oxidants may remain in the subsurface (EPA, 2006b);

- Land disposal restrictions and underground injection-related regulations may limit the viability of using chemical treatment (EPA, 2006b); and
- Byproducts from oxidation may present additional toxicity issues that would need to be further evaluated as part of a bench scale and/or pilot study.

Given these problems, *in situ* chemical treatment is not considered a potentially viable remedial option for the Housatonic River floodplain soils at this time.

3.5.3 *In Situ* Biological Treatment

In situ biological treatment processes have not been successfully demonstrated full-scale for PCBs in soil. While aerobic and anaerobic biodegradation of PCBs are known to occur both naturally and through enrichment (e.g., through addition of nutrients and/or microbes which are know to degrade PCBs), no processes or sites were identified in the literature where significant reductions in PCB concentrations have been documented.

One study (Mikszewski, 2004) assessed the potential for anaerobic and aerobic biodegradation of PCBs. The study concluded that, despite years of research and many promising leads, an effective biodegradation *in situ* remediation technique for PCB-contaminated soils and sediments does not exist. It was also recognized by the author that the controversial use of genetically modified organisms (such as used in this research) must be carefully monitored.

In 1998, Green Mountain Laboratories, Inc. (GML) and the EPA conducted a SITE project to evaluate the effectiveness of a bioremediation process for the treatment of PCB contaminated soils at the Beede Waste Oil/Cash Energy Superfund site in Plaistow, NH. The treatment process involved inoculation/augmenting of the PCB contaminated soils with bulk microbial inoculum and nutrients, allowing the microbes to aerobically degrade the PCBs. The bulk inoculum was produced on-site by the developer using animal feed-grade oatmeal as the substrate, shredded pine needles that provided certain specific co-metabolite compounds, nutrients and a proprietary consortium of microorganisms believed capable of degrading the PCBs to their eventual endpoints (carbon dioxide and mineral halides). The results of the field evaluation of the technology, which are based on the data collected from the treatability study conducted in the third quarter of 1998, indicated no removal/degradation of the PCBs (EPA, 2005a).

In general, the problems associated with implementation of *in situ* biological treatment processes in soils include:

- Lack of an effective nutrient/chemical delivery and containment system for materials injected or mixed into the soils to promote degradation (Renholds, 1998);
- Difficulty in identifying the microbes responsible for PCB biodegradation/dechlorination;
- Inability to achieve low ppm residual PCB concentrations;
- Inability to establish/enhance variable sediment conditions (e.g., aerobic versus anaerobic, pH, etc.) to a sufficient degree to effectively support microbial degradation and/or dechlorination; and
- Overall resistance of PCBs to microbial degradation.

Given these problems, *in situ* biological treatment of soils has not been retained as a potentially viable remedial option for the Housatonic River floodplain soils at this time.

3.5.4 *In Situ* Thermal Treatment

In situ thermal treatment has been pilot tested at several sites containing PCBs. The technology was applied in a field application in Glens Falls (NY), where near-surface PCBs were detected at concentrations up to 5,000 ppm. Following treatment, PCB concentrations were reportedly reduced to less than 2 ppm (TerraTherm Environmental Services, 1997). In another case study, *in situ* thermal treatment was tested at a 30-acre Naval facility in Ferndale, CA, which contained PCBs in soils at concentrations up to 860 ppm. From September 1998 to February 1999, approximately 1,000 cubic yards (cy) of PCB-impacted soils were treated using *in situ* thermal treatment. Treatment goals were met in the bulk of the treatment area with the exception of one portion (178 cy) where elevated PCB concentrations remained (EPA, 2007b).

Despite these pilot tests, *in situ* thermal treatment processes have not been implemented full-scale to address PCBs in floodplain soils similar to those in the Rest of River. The problems with such application of *in situ* thermal treatment processes include the following:

- The process boils off water in the soil before it boils off the contaminants (the maximum achievable temperature is 212 degrees Fahrenheit (°F) until all of the water is boiled off). In locations where the control of soil moisture would be difficult (e.g., such as in soils that are saturated by surface waters), this technology cannot be used effectively unless the soils are excavated and treated above ground. Therefore, the high temperatures would likely need to be applied over a period of days depending on the water content of the soils being treated (Iben et al., 1996).

- *In situ* thermal treatment would require the installation of numerous electrodes and/or injection/extraction wells to allow for sufficient coverage. If thermal treatment were applied to the floodplain soils at temperatures sufficient to volatilize or destroy the PCBs (700 to 900 degrees Celsius [°C]), the soils would need to be amended with nutrients or removed/covered with new soil (if vitrified) following treatment to support vegetative growth.

- The effectiveness of *in situ* thermal treatment can be limited by the presence of large inclusions in the area to be treated. Inclusions are highly concentrated contaminant layers, void volumes, containers, metal scrap, general refuse, demolition debris, rock, or other heterogeneous materials within the treatment volume.

- Thermal treatment could vitrify the soils, which would form a glass-like monolithic product. The treated material may not readily support vegetative growth following treatment. If needed, the addition of soil on top of the treated material to support vegetative growth would reduce the available floodplain storage capacity.

Given these problems and potential drawbacks with applying *in situ* thermal treatment to floodplain soils, coupled with the lack of use of this technology full-scale at a similar site, *in situ* thermal treatment of soil has not been retained at this time as a potentially viable remedial option for the Rest of River floodplain soils.

3.5.5 Summary of Evaluation of *In Situ* Treatment Technologies for Soil

Since *in situ* physical treatment (immobilization) has been applied at a limited number of PCB sites, it was subject to secondary screening. However, it was eliminated during the secondary screening because it may be incompatabile with future floodplain uses and vegetative restoration options, may cause flood storage or freeze/thaw issues due to volume expansion during implementation, and is best suited for deeper applications within a relatively small footprint, rather than a potentially large, shallow-depth application such as the Rest of River floodplain soils. *In situ* biological, chemical, and thermal treatment processes were eliminated during initial screening because none of these technologies has been applied full-scale for soils containing PCBs at a site similar to the Housatonic River floodplain and because each has additional implementation issues as described above. Nevertheless, GE will re-evaluate these technologies during the CMS if future information or analyses become available indicating that any of them may prove to be a potentially effective and implementable option for application to the Rest of River floodplain soils.

Appendix B

Evaluation of Rail Transport Option

APPENDIX B

Evaluation of Rail Transport Option

In its September 9, 2008 comments on the CMS Report, EPA, in General Comment 5, directed GE to "submit an evaluation of the use of rail as a transportation option for potential offsite disposal." To assist in responding to this comment, GE retained the services of R.L. Banks and Associates, Inc. (RLBA), of Arlington, Virginia, a rail consulting firm, to evaluate the feasibility of transporting excavated materials from the Housatonic River and floodplain by rail to an appropriate off-site disposal facility or facilities. RLBA's evaluation was limited to the physical/technical feasibility of rail transportation of these materials. Based on its evaluation, RLBA concluded that rail transport of the excavated materials would be technically feasible. The bases for that conclusion were previously provided in GE's Response to General Comment 5 in its *Response to EPA's Interim Comments on CMS Report* (Interim Response; March 2009) and are reiterated below.

The initial question in this evaluation related to the availability of suitable rail service in the Rest of River area. It was found that the Housatonic Railroad Company, Inc. (HRRC) operates regularly scheduled freight train operations over its tracks in close proximity to the Housatonic River in the area between Pittsfield and Housatonic, Massachusetts. In preliminary discussions, HRRC indicated that it has adequate rail infrastructure and locomotive power to handle the anticipated volumes of materials at the anticipated production rates under the CMS alternatives. HRRC's main line is capable of handling cars of 286,000 pounds (lbs) gross loading, the *de facto* industry standard. The trackage that would support project shipments is maintained to a mixture of Federal Railway Administration (FRA) Class 1 and Class 2 standards, permitting freight operations at 10 and 25 miles per hour (mph), respectively. Based on RLBA's spot checks and conversations with HRRC, this trackage is actively maintained and would appear to be adequate to handle rail cars containing project materials, although this would need to be confirmed by an on-track inspection.

While the HRRC maintains tracks in relatively close proximity to the River in some sections, it is important to note that it is impractical to load railroad cars when they are located on an active railroad line because it is inherently unsafe and would interfere with existing operations. Therefore, another important factor is the availability of loading areas that either exist or could be constructed to facilitate the staging of empty railcars, the loading of railcars, and the switching/movement of loaded cars into the traffic flow of the rail line. A preliminary review indicated that potential loading sites exist adjacent to or in very close proximity to the HRRC tracks, some of which already feature at least some rail infrastructure. If one of these potential sites were viable, it would limit the need to construct entirely new staging/loading tracks, although some new tracks would likely need to be constructed. At this time, it is anticipated that a single rail loading site would be selected and then configured appropriately to allow the loading of railcars. RLBA estimates that about 3.5 acres would be needed for the construction of the loading areas, with an additional four acres in an elongated shape to support the construction of new tracks.

Once dewatered (as necessary) at the temporary staging areas near the River, the excavated materials would be transported by trucks to the rail loading site, using trucks similar to those considered for transport to off-site landfills. Materials subject to regulation under the Toxic Substances Control Act (TSCA) and non-TSCA materials would be segregated in separate storage and loading areas. The TSCA and non-TSCA materials would then be loaded into conventional open-top, low-side gondola railcars, again keeping those materials segregated. It is anticipated that the cars would be lined with a “Super Sack” or similar plastic disposable liner, which would be closed over the top to form a watertight wrapping. It is unlikely that railcars would be provided by the railroads; therefore GE would need to procure the cars elsewhere through either purchase or lease.

Rail service to and from the loading site would be provided by HRRC. After loading, the outbound loaded railcars would need to be moved by HRRC to an interchange with a longer-haul railroad. HHRC has an existing interchange with CSX Transportation, Inc. (CSX) in Pittsfield, to which HHRC currently sends (and receives) a train every day (averaging about 30 to 35 cars per day). The additional railcars holding project materials could be added to that train. That interchange track can hold over 200 cars, which should be sufficient to handle the movement of project materials as well as the existing freight volume. From that interchange, the loaded cars would be moved by CSX, and perhaps subsequently other railroads, to an appropriate off-site landfill or landfills, as discussed below.

In assessing the feasibility of rail transport as described above, RLBA considered a range of removal volumes and corresponding project durations, based on the sediment and floodplain remedial alternatives under evaluation. The minimum volume was based on a combination of alternatives SED 3 and FP 2 (approximately 190,000 *in situ* cy of removal), with an estimated overall project duration of slightly less than 10 years. The maximum volume was based on a combination of SED 8 and FP 7 (approximately 2.9 million *in situ* cy of removal), with an estimated overall project duration of approximately 50 years. It was estimated that the minimum material volume generated by the project would result in about 660 carloads of TSCA material (about one-half carload per day) and about 3,400 carloads of non-TSCA material (about two carloads per day during most of the project, peaking at three carloads per day in the last year). RLBA concluded that these are acceptable volumes for rail transport. Under the maximum removal scenario, it was estimated that the project would result in about 9,900 carloads of TSCA material (ranging from about one to four carloads per day) and about 37,000 carloads of non-TSCA material (ranging from three to eight carloads per day during most of the project to 12 carloads per day late in the project). It was concluded that these volumes could be handled by the railroads and would not overwhelm their capacities. It was further concluded that rail service would likely be available for the duration of the project, even up to the maximum duration of approximately 50 years, although projections that far into the future are uncertain.

The estimated volumes for this project would not be sufficient to warrant the use of unit trains (in which all cars in a train are dedicated to carrying project materials). Instead, at the HRRC/CSX interchange, project cars would be included on trains in general freight service and would be forwarded as part of general freight trains along the various routes of CSX and potentially other long-haul Class 1 railroads (with additional interchanges as necessary) until the selected landfill location(s) were reached.

Finally, the evaluation of rail feasibility included an assessment of the availability of rail-served landfills with the physical capability and regulatory approvals to unload, handle, and dispose of TSCA and non-TSCA materials. RLBA confirmed the availability of numerous such landfills at the present time, including both TSCA and non-TSCA landfills, located in a number of states outside of Massachusetts. Upon arrival of the loaded railcars at the selected landfill(s), the contained materials would be unloaded and disposed of by the landfill operator. The empty railcars would then be returned to the loading facility via the reverse route. However, the potential availability of off-site landfills served by rail over project durations as long as 50 years is uncertain.

Based on the foregoing considerations, RLBA concluded that rail transport of the excavated Rest of River sediments and soils to off-site landfill(s) appears to be a technically feasible option.

Appendix C

ARARs Tables

Sediment Alternative Tables

Table S-1.a: Alternative SED 1 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 1 (no action) would not achieve chronic aquatic life criterion in MA, but would in CT. Where not achieved, this criterion should be waived under CERCLA and National Contingency Plan (NCP) on ground that actions necessary to achieve it would result in greater risk to the environment than SED 1 (CERCLA § 121(d)(4)(B); 40 CFR § 300.430(f)(1)(ii)(C)*(2)*). See Revised CMS Report, Section 6.1.4. Model also indicates that SED 1 would not achieve human health criterion in any reaches. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Section 6.1.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-1.a: Alternative SED 1 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 1 would achieve chronic aquatic life criterion in CT impoundments. The current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Develop-ment, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-1.a: Alternative SED 1 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDHP), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	Would be considered in SED 1 through continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	Would be considered in SED 1 through continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-1.a: Alternative SED 1 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from "do not eat" to "one meal per week." Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	Would be considered in SED 1 through continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

Table S-1.b: Alternative SED 1 – Potential Location-Specific ARARs

Statute/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
None				

Table S-1.c: Alternative SED 1 – Potential Action-Specific ARARs

Statute/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
None				

Table S-2.a: Alternative SED 2 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 2 would not achieve chronic aquatic life criterion in MA, but would in CT. Where not achieved, this criterion should be waived under CERCLA and NCP on ground that actions necessary to achieve it would result in greater risk to the environment than SED 2 (CERCLA § 121(d)(4)(B); 40 CFR § 300.430(f)(1)(ii)(C)*(2)*). See Revised CMS Report, Sections 6.1.4 and 6.2.4. Model also indicates that SED 2 would not achieve human health criterion in any reaches. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.2.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-2.a: Alternative SED 2 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 2 would achieve chronic aquatic life criterion in CT impoundments. Current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Develop-ment, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-2.a: Alternative SED 2 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 2 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 2 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-2.a: Alternative SED 2 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from “do not eat” to “one meal per week.” Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 2 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

Table S-2.b: Alternative SED 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
None				
State ARARs				
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas. In addition, under 310 CMR 10.59, they must have no adverse effect on estimated habitat of rare species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these regulations. See 310 CMR 10.02(2)(b)1.g.	Applicable to sampling and monitoring activities within waterbodies, stream/pond banks, wetlands, or floodplains	For sampling and monitoring activities under SED 2, there is no practicable alternative that would be less damaging to resource areas; and those activities would be conducted in accordance with the applicable requirements under the Wetlands Protection Act.
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on Housatonic River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.

* ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table S-2.b: Alternative SED 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			relate to responsibilities of those dam owners and are not ARARs for SED 2.	
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation.	Applicable to investigations on state or local government lands in MA.	If any archaeological, paleontological, or historical site or object is discovered during sampling activities under SED 2, this requirement for notification and preservation would be met.
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 2.	Not applicable.
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.

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Table S-2.c: Alternative SED 2 – Potential Action-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in sampling of PCB-containing materials.	Would be attained through use of proper decontamination procedures on sampling/monitoring equipment.
State ARARs				
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.

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Table S-3.a: Alternative SED 3 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 3 would achieve chronic aquatic life criterion in all reaches using block averaging approach (and would achieve that criterion using rolling average approach in all reaches except for 1 extra exceedance in Reaches 5A and 7G and 4 extra exceedances in Rising Pond). See Revised CMS Report, Section 6.3.4. Model indicates that SED 3 would not achieve human health criterion in any reaches. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.3.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-3.a: Alternative SED 3 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 3 would achieve chronic aquatic life criterion in CT impoundments. Curent CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Develop-ment, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-3.a: Alternative SED 3 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 3 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 3 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-3.a: Alternative SED 3 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from "do not eat" to "one meal per week." Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 3 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	(a) There are praticable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Hence, the requirement that there be no such alternative would not be met. (b) SED 3 would not meet requirement that discharge not contribute to violation of state water quality standards, since Housatonic River does not currently meet numerical MA water quality criteria for PCBs; hence, that requirement should be waived as technically impracticable to attain. (c) Review of available information indicates that SED 3 would not affect any federally listed T&E species. (d) SED 3 would cause significant adverse effects on aquatic life, aquatic ecosystem, and recreational and aesthetic values, as described in the Revised CMS Report (Sections 6.3.5.3 and 6.3.8). Hence, the prohibition on actions with such effects would not be met. (e) SED 3 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on aquatic ecosystem. Despite such steps, however, SED 3 would have substantial adverse effects on the aquatic ecosystem, as noted above.

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	Where SED 3 would have unavoidable adverse impacts on the aquatic ecosystem, these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, considerable adverse impacts would remain. See Revised CMS Report, Sections 6.3.5.3 and 6.3.8.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to dredging in, and discharge of dredge and fill material to, navigable waters of the U.S., but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding work in Housatonic River.
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to work in river.	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	In the unlikely event that some excavated materials were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy . For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA; URS Corporation, March 13, 2008).

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by SED 3 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of SED 3, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody (below high water mark). Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (9.37) and standards for dredging (9.40), including prohibition on dredging in an Area of Critical Environmental Concern (ACEC) except for sole purpose of fisheries or wildlife enhancement. Also requires compliance with other specified environmental regulatory programs (9.33).	Applicable to excavation/removal of sediments from Housatonic River, placement of caps or backfill in river, and placement of structures in river below high water mark to aid in excavation, address erosion, or restore habitat.	Since Reach 5A is part of the Upper Houatonic ACEC, SED 3 would not comply with the prohibition on dredging in an ACEC. SED 3 would be designed to meet the other specified standards and requirements of these regulations. (The other relevant environmental regulatory programs referenced in Section 9.33 are discussed separately in these ARARs tables.)

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for SED 3.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: (a) no dredging is allowed if there is practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse effects on land under water; (c) dredging must be conducted to meet performance standards designed to minimize impacts on the aquatic ecosystem and protect human health; and (d) placement of dredged material in an intermediate facility for sediment management (dewatering, processing, etc.) prior to disposal or reuse must meet certain requirements, including requirements governing method of placement/storage of	Applicable to excavation/removal of sediments and bank soils, discharge of dredged or fill material to waters or wetlands, and dredged material management at temporary staging areas.	As noted above, there are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Thus, the requirement that there be no such alternative would not be met. SED 3 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on land under water and on wetlands, but such steps would not prevent harm to these resource areas (see Revised CMS Report, Sections 6.3.5.3 and 6.3.8). Under SED 3, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), and stormwater discharges would be controlled through BMPs. However, SED 3 would adversely affect estimated habitat of rare wildlife species, because all excavation and almost all supporting activities would occur within such habitat (see Figure S-3); and SED 3 would have substantial adverse impacts on biological conditions in the River. Hence, the prohibition on actions with such effects would not be met. Excavation activities under SED 3 would be designed to meet the specified dredging performance standards to the extent practical, but would not avoid adverse impacts on the aquatic ecosystem or minimize such impacts relative to other alternatives (e.g., SED 10). The temporary staging areas may not meet the requirements that intermediate facilities cannot have a permanent adverse impact on state-listed rare species or on an ACEC. Almost all temporary staging areas under SED 3 would be located in state-mapped Priority Habitat of rare species (see Figure S-3) and in the Upper Housatonic ACEC, and the permanence of their impacts would depend on the uncertain success of restoration. The staging areas would meet the

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		dredged material and siting criteria.		other placement and siting requirements for intermediate facilities.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 - 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to SED 3 response actions that take place in waterbodies or in, or within 100 feet (buffer zone) of, stream/pond banks or wetlands or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since SED 3 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ There are practicable sediment and riverbank remediation alternatives that would be less damaging to resource areas – e.g., SED 10. Thus, the requirement that there be no such practicable alternative would not be met. ▪ SED 3 would include practicable measures to minimize impacts to resource areas, including actions to minimize impact of hydrological changes during construction, control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 6.3.5.3 and 6.3.8), these measures would not prevent substantial adverse impacts of SED 3 on resource areas. As also discussed in that report (Section 6.3.9.1), SED 3 is not anticipated to produce any significant loss of flood storage capacity of floodplain or to cause an increase in flood stage or velocities on river. ▪ SED 3 would adversely affect estimated habitat of rare wildlife species, because all excavation and almost all supporting activities would occur within such habitat (see Figure S-3). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if SED 3 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would relate to responsibilities of those dam owners and are not ARARs for SED 3.	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute state hazardous waste subject to these standards. Further, even if some excavated ***sediments*** did constitute such hazardous waste, these requirements would not apply to	In the unlikely event that some excavated bank soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain, given the need for staging areas to be near the river. In such cases, that requirement should be waived as technically impracticable to attain.

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			temporary staging areas for such ***sediments***, due to exemption from hazardous waste regulations for dredged materials temporarily stored at intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)) (see Table S-3.c). However, if some excavated ***bank soils*** were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which SED 3 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		proponent responds to the MHC.		
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 3.	Not applicable.

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 3 would involve some construction activities in wetlands (e.g., excavation in Reach 5A, thin-layer capping in Reach 5C and Woods Pond, construction of access roads and staging areas in wetlands). Although there may be no practicable alternative (other than MNR) to some construction in wetlands, there are practicable alternatives with less adverse effect on wetlands – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 3 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent considerable harm to wetlands, as discussed in the Revised CMS Report, Sections 6.3.5.3 and 6.3.8..
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it	SED 3 would involve construction of access roads and staging areas in the floodplain. Since these facilities must be located near sediment removal areas, they cannot be relocated to avoid

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Table S-3.b: Alternative SED 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	design or modify the action to minimize harm to or within the floodplain.	is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	any construction in the floodplain. However, there are practicable alternatives with less adverse effects on the floodplain – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 3 would include practicable measures to minimize harm to the floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of the floodplain. However, these measures would not prevent considerable harm to the floodplain, as discussed in the Revised CMS Report, Sections 6.3.5.3 and 6.3.8.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing sediments and soils. Options include self-implementing provisions (not applicable to sediments) and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated Housatonic River sediments and bank soils with PCBs ≥ 50 ppm).	It is anticipated that, if SED 3 is selected, these requirements would be met through EPA determination that SED 3 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	Water treatment facilities would be designed to meet this requirement.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L. for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including construction of access roads and temporary staging areas, bank remediation, and temporary staging of excavated materials at staging areas.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that SED 3 would not adversely affect any federally listed T&E species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or bank soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some excavated materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste in piles	40 CFR Part 264, Subpart L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.		In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy does not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy does not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: Listed as location-specific ARAR in Table S-3.b, but also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table S-3.b.	Applicable to excavation/removal of sediments, discharge of dredged or fill material to waters and wetlands, and temporary staging areas for excavated sediments.	Same as described for these regulations in Table S-3.b.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	SED 3 would include use of stormwater BMPs during construction of access roads and staging areas, bank soil removal and stabilization, and operation of staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards and would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible for BMPs for bank remediation and in areas (if any) where there is no practical alternative to siting the staging areas in or adjacent to wetlands. Stormwater BMPs would not be necessary or practical for sediment excavation or thin-layer capping, since those activities would take place within the River. Any applicable stormwater management requirements that could not practicably be met should be waived as technically impracticable.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All excavation and thin-layer capping activities and almost all access roads and temporary staging areas in SED 3 would occur within Priority Habitat, as shown on Figure S-3. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 23 state-listed species. Thus, the prohibition on a "take" would not be met.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") The state hazardous waste management regulations also exempt dredged material (even if it constitutes non-PCB state hazardous waste) that is temporarily stored at an intermediate facility (pursuant to 314 CMR 9.07(4)) and managed in accordance with a state water quality certification and § 404 requirements under the Clean Water Act (see 310 CMR 30.104(3)(f)).	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
Note: It is not expected that excavated materials would constitute non-PCB state hazardous waste. However, for ***sediments***, even if some excavated sediments did constitute such hazardous waste, the following Massachusetts hazardous waste management requirements are considered inapplicable to temporary staging areas for such sediments due to the exemption from the hazardous waste regulations for dredged materials temporarily stored at an intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)). Hence, these requirements have been evaluated based solely on their potential applicability to temporary staging areas that are used for excavated ***bank soils***.				

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table S-3.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain (given the need for proximity to the river) or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) it is not certain whether some areas could be designed and constructed with a 200-foot buffer zone to fenceline. Any such requirements that could not feasibly be met should be waived as technically impracticable.
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while these areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas, or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable, could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
Connecticut Endangered Species Act	Conn. Gen. Stat. 26-303 through 26-316	Requires state agency to: (a) ensure that any action authorized or performed by it does not threaten the continued existence of a listed endangered or threatened species or result in destruction or adverse modification of habitat essential to such species, unless an exemption is granted; and (b) take all reasonable measures to mitigate any adverse impacts of the proposed action on such species or habitat. Prohibits "taking" of endangered or threatened species, except where State determines that a proposed action would not appreciably reduce likelihood of survival or recovery of the species.	This statute is not applicable or relevant and appropriate to SED 3 because implementation of SED 3 is not expected to have any adverse impact on endangered or threatened species or their habitat in Connecticut, or to cause a "taking" of such species.	Not applicable.

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Table S-3.c: Alternative SED 3 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of SED 3.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an area of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated sediments or bank soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table S-4.a: Alternative SED 4 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 4 would achieve chronic aquatic life criterion in all reaches using block averaging approach (and would achieve that criterion using rolling average approach in all reaches except for 1 extra exceedance at 2 locations in PSA and 1-4 extra excedances at 4 locations in Reaches 7 and 8). See Revised CMS Report, Section 6.4.4. Model indicates that SED 4 would not achieve human health criterion in any reaches. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.4.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-4.a: Alternative SED 4 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 4 would achieve chronic aquatic life criterion in CT impoundments. The current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-4.a: Alternative SED 4 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 4 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 4 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-4.a: Alternative SED 4 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from "do not eat" to "one meal per week." Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 4 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	(a) There are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Hence, the requirement that there be no such alternative would not be met. (b) SED 4 would not meet requirement that discharge not contribute to violation of state water quality standards, since Housatonic River does not currently meet numerical MA water quality criteria for PCBs; hence, that requirement should be waived as technically impracticable to attain. (c) Review of available information indicates that SED 4 would not affect any federally listed T&E species. (d) SED 4 would cause significant adverse effects on aquatic life, aquatic ecosystem, and recreational and aesthetic values, as described in the Revised CMS Report (Sections 6.4.5.3 and 6.4.8). Hence, the prohibition on actions with such effects would not be met. (e) SED 4 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on aquatic ecosystem. Despite such steps, however, SED 4 would have substantial adverse effects on the aquatic ecosystem, as noted above.

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	Where SED 4 would have unavoidable adverse impacts on the aquatic ecosystem, these regulations would require a compensatory mitigation plan would be necessary to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 6.4.5.3 and 6.4.8.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to dredging in, and discharge of dredge and fill material to, navigable waters of the U.S., but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding work in Housatonic River.
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to work in river.	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	In the unlikely event that some excavated materials were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by SED 4 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of SED 4, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody (below high water mark). Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (9.37) and standards for dredging (9.40), including prohibition on dredging in an Area of Critical Environmental Concern (ACEC) except for sole purpose of fisheries or wildlife enhancement. Also requires compliance with other specified environmental regulatory programs (9.33).	Applicable to excavation/removal of sediments from Housatonic River, placement of caps or backfill in river, and placement of structures in river below high water mark to aid in excavation, address erosion, or restore habitat.	SED 4 would not comply with the prohibition on dredging in an ACEC. SED 4 would be designed to meet the other specified standards and requirements of these regulations. (The other relevant environmental regulatory programs referenced in Section 9.33 are discussed separately in these ARARs tables.)

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for SED 3.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: (a) no dredging is allowed if there is practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse effects on land under water; (c) dredging must be conducted to meet performance standards designed to minimize impacts on the aquatic ecosystem and protect human health; and (d) placement of dredged material in an intermediate facility for sediment management (dewatering, processing, etc.) prior to disposal or reuse must meet certain requirements, including requirements governing method of placement/storage of dredged material and siting criteria.	Applicable to excavation/removal of sediments and bank soils, discharge of dredged or fill material to waters or wetlands, and dredged material management at temporary staging areas.	As noted above, there are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Thus, the requirement that there be no such alternative would not be met. SED 4 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on land under water and on wetlands, but such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 6.4.5.3 and 6.4.8). Under SED 4, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), and stormwater discharges would be controlled through BMPs. However, SED 4 would adversely affect estimated habitat of rare wildlife species, because all remediation and nearly all supporting activities would occur within such habitat (see Figure S-4); and SED 4 would have substantial adverse impacts on biological conditions in the River. Hence, the prohibition on actions with such effects would not be met. Excavation/dredging activities under SED 4 would be designed to meet the specified dredging performance standards to the extent practical, but would not avoid adverse impacts on the aquatic ecosystem or minimize such impacts relative to other alternatives (e.g., SED 10). The temporary staging areas may not meet the requirements that intermediate facilities cannot have a permanent adverse impact on a state-listed rare species or on an ACEC. Almost all temporary staging areas under SED 4 would be located in state-mapped Priority Habitat of rare species (see Figure S-4) and in the Upper Housatonic ACEC, and the permanence of their impacts would depend on the uncertain success

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				of restoration. The staging areas would meet the other placement and siting requirements for intermediate facilities.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to SED 4 response actions that take place in waterbodies or in or within 100 feet (buffer zone) of stream/pond banks or wetlands or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since SED 4 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ As noted above, there are practicable sediment and riverbank remediation alternatives that would be less damaging to resource areas (e.g., SED 10). Thus, the requirement that there be no such practicable alternative would not be met. ▪ SED 4 would include practicable measures to minimize impacts to resource areas, including actions to minimize impact of hydrological changes during construction, control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 6.4.5.3 and 6.4.8), these measures would not prevent substantial adverse impacts of SED 4 on resource areas. Further, as also discussed in the Revised CMS Report (Section 6.4.9.1), the caps placed in Reaches 5B and 5C could have a limited impact on flood storage capacity of the floodplain, while the caps placed in the backwaters and Woods Pond would not be expected to have a significant effect on flood storage capacity. The effect of the placement of caps (without removal) on flood storage capacity and on flood water elevations and velocity, as well as the need for and scope of flood storage compensation, would be further evaluated further during design.

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				▪ SED 4 would adversely affect estimated habitat of rare wildlife species, because all remediation and nearly all supporting activities would occur within such habitat (see Figure S-4). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if SED 4 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would relate to responsibilities of those dam owners and are not ARARs for SED 4.	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile or surface impoundment may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the hazardous waste.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute state hazardous waste subject to these standards. Further, even if some excavated ***sediments*** did constitute such hazardous waste, these requirements would not apply to temporary staging areas for such ***sediments***, due to exemption from hazardous waste regulations for dredged materials temporarily stored at intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)) (see Table S-4.c). However, if some excavated ***bank soils*** were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	In the unlikely event that some excavated bank soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain, given the need for staging areas to be near the river. . In such cases, that requirement should be waived as technically impracticable to attain. The requirement for floodproofing tanks, containers, and similar units used to store hazardous waste (if any) would be met.

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which SED 4 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 4.	Not applicable.
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 4 would involve construction activities in wetlands. Although there may be no practicable alternative (other than MNR) to some construction in wetlands, there are practicable alternatives with much less adverse effect on wetlands (e.g., SED 10). Hence, the requirement that there be no such practicable alternative would not be met. SED 4 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands

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Table S-4.b: Alternative SED 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 6.4.5.3 and 6.4.8.
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 4 would involve construction of access roads and staging areas in the floodplain. Since these facilities must be located near sediment removal areas, they cannot be relocated to avoid any construction in the floodplain. However, there are practicable alternatives with less adverse effects on the floodplain – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 4 would include practicable measures to minimize harm to floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of floodplain. However, restoration measures would not prevent substantial harm to floodplain, as discussed in the Revised CMS Report, Sections 6.4.5.3 and 6.4.8.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing sediments and soils. Options include self-implementing provisions (not applicable to sediments) and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated Housatonic River sediments and bank soils with PCBs ≥ 50 ppm).	It is anticipated that, if SED 4 is selected, these requirements would be met through EPA determination that SED 4 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	Water treatment facilities would be designed to meet this requirement.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L. for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including construction of access roads and temporary staging areas, bank remediation, and temporary staging of excavated materials at staging areas.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that SED 4 would not adversely affect any federally listed T&E species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or bank soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some excavated materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for less than 90 day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some sediments removed in the wet did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such dredged sediments.	In the unlikely event that any sediments removed in the wet were found to constitute RCRA hazardous waste, any tanks used for < 90-day accumulation of such dredged sediments would meet these requirements.
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subparts J, K, and L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in tanks (Subpart J), surface impoundments (Subpart K) and waste piles outside structures (Subpart L). Note: In addition to the requirements for waste piles, the requirements relating to tanks and surface impoundments are identified due to the possibility that such types of facilities would be used at the		In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, any waste piles, tanks, or surface impoundments used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While the waste piles and surface impoundments (if any) would meet the single liner/leachate collection requirements of §§ 264.251(a) and 264.221(a), they would not meet the requirements of §§ 264.251(c) and 264.221(c)

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		temporary staging areas for holding of liquid sediments removed in the wet.	staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to these types of facilities used for staging of those materials.	for a double liner/leachate collection system at "new waste pile units" and "new surface impoundment units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: These were listed as location-specific ARAR in Table S-4.b, but are also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table S-4.b.	Applicable to excavation/removal of sediments, discharge of dredged or fill material to waters and wetlands, and temporary staging areas for excavated sediments.	Same as described for these regulations in Table S-4.b.
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during remediation activities and at temporary staging areas.	SED 4 would include use of stormwater BMPs during construction of access roads and staging areas, bank soil removal and stabilization, and operation of staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible for BMPs for bank remediation or in areas (if any) where there would be no practical alternative to siting the staging areas in or adjacent to wetlands. Stormwater BMPs would not be necessary or practical for sediment excavation/dredging or capping, since those activities would take place within the River. Any applicable stormwater management requirements that could not practically be met should be waived as technically impracticable.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All excavation, capping, and thin-layer capping activities, as well as nearly all access roads and temporary staging areas, in SED 4 would occur within Priority Habitat, as shown on Figure S-4. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 23 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.")	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		The state hazardous waste management regulations also exempt dredged material (even if it constitutes non-PCB state hazardous waste) that is temporarily stored at an intermediate facility (pursuant to 314 CMR 9.07(4)) and managed in accordance with a state water quality certification and § 404 requirements under the Clean Water Act (see 310 CMR 30.104(3)(f)).		
Note: It is not expected that excavated materials would constitute non-PCB state hazardous waste. However, for ***sediments***, even if some excavated sediments did constitute such hazardous waste, the following Massachusetts hazardous waste management requirements are considered inapplicable to temporary staging areas for such sediments due to the exemption from the hazardous waste regulations for dredged materials temporarily stored at an intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)). Hence, these requirements have been evaluated based solely on their potential applicability to temporary staging areas that are used for excavated ***bank soils***.				
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			excavated bank soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table S-4.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain (given the need for proximity to the river) or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) it is not certain whether some areas could be designed and constructed with a 200-foot buffer zone to fenceline. Any requirements that could not feasibly be met should be waived as technically impracticable.
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while these areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				have such systems capable of preventing flow onto those areas, or controlling runoff, during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable, could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements because they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during active remediation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut Endangered Species Act	Conn. Gen. Stat. 26-303 through 26-316	Requires state agency to: (a) ensure that any action authorized or performed by it does not threaten the continued existence of a listed endangered or threatened species or result in destruction or adverse modification of habitat essential to such species, unless an exemption is granted; and (b) take all reasonable measures to mitigate any adverse impacts of the proposed action on such species or habitat. Prohibits "taking" of endangered or threatened species, except where State determines that a proposed action would not appreciably reduce likelihood of survival or recovery of the species.	This statute is not applicable or relevant and appropriate to SED 4 because implementation of SED 4 is not expected to have any adverse impact on endangered or threatened species or their habitat in Connecticut, or to cause a "taking" of such species.	Not applicable.
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of SED 4.

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Table S-4.c: Alternative SED 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated sediments or bank soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table S-5.a: Alternative SED 5 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 5 would achieve chronic aquatic life criterion in all reaches using block averaging approach (and would achieve that criterion using rolling average approach in all reaches except for 1 extra exceedance in Reach 5A, 2 extra exceedances in Reach 7G, and 3 extra exceedances in Rising Pond). See Revised CMS Report, Section 6.5.4. Model indicates that SED 5 would not achieve human health criterion in any reaches in MA and in 2 of 4 impoundments in CT. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.5.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-5.a: Alternative SED 5 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 5 would achieve chronic aquatic life criterion in CT impoundments. The current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Develop-ment, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-5.a: Alternative SED 5 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 5 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 5 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-5.a: Alternative SED 5 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from “do not eat” to “one meal per week.” Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 5 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	(a) There are praticable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Hence, the requirement that there be no such alternative would not be met. (b) SED 5 would not meet requirement that discharge not contribute to violation of state water quality standards, since Housatonic River does not currently meet numerical MA water quality criteria for PCBs; hence, that requirement should be waived as technically impracticable to attain. (c) Review of available information indicates that SED 5 would not affect any federally listed T&E species. (d) SED 5 would cause significant adverse effects on aquatic life, aquatic ecosystem, and recreational and aesthetic values, as described in the Revised CMS Report (Sections 6.5.5.3 and 6.5.8). Hence, the prohibition on actions with such effects would not be met. (e) SED 5 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on aquatic ecosystem. Despite such steps, however, SED 5 would have substantial adverse effects on the aquatic ecosystem, as noted above.

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	Where SED 5 would have unavoidable adverse impacts on the aquatic ecosystem, these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, considerable adverse impacts would remain. See Revised CMS Report, Sections 6.5.5.3 and 6.5.8.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to dredging in, and discharge of dredge and fill material to, navigable waters of the U.S., but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding work in Housatonic River.
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to work in river.	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	In the unlikely event that some excavated materials were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by SED 5 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of SED 5, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody (below high water mark). Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (9.37) and standards for dredging (9.40), including prohibition on dredging in an Area of Critical Environmental Concern (ACEC) except for sole purpose of fisheries or wildlife enhancement. Also requires compliance with other specified environmental regulatory programs (9.33).	Applicable to excavation/removal of sediments from Housatonic River, placement of caps or backfill in river, and placement of structures in river below high water mark to aid in excavation, address erosion, or restore habitat.	SED 5 would not comply with the prohibition on dredging in an ACEC. SED 5 would be designed to meet the other specified standards and requirements of these regulations. (The other relevant environmental regulatory programs referenced in Section 9.33 are discussed separately in these ARARs tables.)

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for SED 3.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated “Outstanding Resource Waters,” including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters. For dredging and dredged material manage-ment: (a) no dredging is allowed if there is practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse effects on land under water; (c) dredging must be conducted to meet performance standards designed to minimize impacts on the aquatic ecosystem and protect human health; and (d) placement of dredged material in an intermediate facility for sediment management (dewatering, processing, etc.) prior to disposal or reuse must meet certain requirements, including requirements governing method of placement/storage of dredged material and siting criteria.	Applicable to excavation/removal of sediments and bank soils, discharge of dredged or fill material to waters or wetlands, and dredged material management at temporary staging areas.	As noted above, there are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Thus, the requirement that there be no such alternative would not be met. SED 5 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on land under water and on wetlands, but such steps would not prevent harm to these resource areas (see Revised CMS Report, Sections 6.5.5.3 and 6.5.8). Under SED 5, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), and stormwater discharges would be controlled through BMPs. However, SED 5 would adversely affect estimated habitat of rare wildlife species, because all excavation and almost all supporting activities would occur within such habitat (see Figure S-5); and SED 5 would have substantial adverse impacts on biological conditions in the River. Hence, the prohibition on actions with such effects would not be met. Excavation activities under SED 5 would be designed to meet the specified dredging performance standards to the extent practical, but would not avoid adverse impacts on the aquatic ecosystem or minimize such impacts relative to other alternatives (e.g., SED 10). The temporary staging areas may not meet the requirements that intermediate facilities cannot have a permanent adverse impact on state-listed rare species or on an ACEC. Almost all temporary staging areas under SED 5 would be located in state-mapped Priority Habitat of rare species (see Figure S-5) and in the Upper Housatonic ACEC, and the permanence of their impacts would depend on the uncertain success of restoration. The staging areas would meet the

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				other placement and siting requirements for intermediate facilities.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to SED 5 response actions that take place in waterbodies or in, or within 100 feet (buffer zone) of, stream/pond banks or wetlands or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since SED 5 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ There are practicable sediment and riverbank remediation alternatives that would be less damaging to resource areas – e.g., SED 10. Thus, the requirement that there be no such practicable alternative would not be met. ▪ SED 5 would include practicable measures to minimize impacts to resource areas, including actions to minimize impact of hydrological changes during construction, control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 6.5.5.3 and 6.5.8), these measures would not prevent substantial adverse impacts of SED 5 on resource areas. ▪ Further, as discussed in CMS Report (Section 6.5.9.1), the cap placed in Reach 5C could have a limited impact on flood storage capacity of the floodplain, while the caps placed in the backwaters, Woods Pond, and Rising Pond would not be expected to affect flood storage capacity. The effect of the placement of caps (without removal) on flood storage capacity and on flood water elevations and velocity, as well as the need for and scope of flood storage compensation, would be further evaluated further during design. ▪ SED 5 would adversely affect estimated habitat of rare wildlife species, because all

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				excavation and almost all supporting activities would occur within such habitat (see Figure S-5). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if SED 5 was not considered a “limited project,” it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would relate to responsibilities of those dam owners and are not ARARs for SED 5.	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile or surface impoundment may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the hazardous waste.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute state hazardous waste subject to these standards. Further, even if some excavated ***sediments*** did constitute such hazardous waste, these requirements would not apply to temporary staging areas for such ***sediments***, due to exemption from hazardous waste regulations for dredged materials temporarily stored at intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)) (see Table S-4.c). However, if some excavated ***bank soils*** were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	In the unlikely event that some excavated bank soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain, given the need for staging areas to be near the river. In such cases, that requirement should be waived as technically impracticable to attain
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural,	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on	Extent to which SED 5 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	property(ies) listed in State Register.	
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were	Not applicable.

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 5.	
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 5 would involve construction activities in wetlands. Although there may be no practicable alternative (other than MNR) to some construction in wetlands, there are practicable alternatives with less adverse effect on wetlands – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 5 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 6.5.5.3 and 6.5.8.

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Table S-5.b: Alternative SED 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 5 would involve construction of access roads and staging areas in the floodplain. Since these facilities must be located near sediment removal areas, they cannot be relocated to avoid any construction in the floodplain. However, there are practicable alternatives with less adverse effects on the floodplain – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 5 would include practicable measures to minimize harm to floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of floodplain. However, restoration measures would not prevent substantial harm to floodplain, as discussed in the Revised CMS Report, Sections 6.5.5.3 and 6.5.8.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing sediments and soils. Options include self-implementing provisions (not applicable to sediments) and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated Housatonic River sediments and bank soils with PCBs ≥ 50 ppm).	It is anticipated that, if SED 5 is selected, these requirements would be met through EPA determination that SED 5 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allows for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	Water treatment facilities would be designed to meet this requirement.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L. for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including construction of access roads and temporary staging areas, bank remediation, and temporary staging of excavated materials at staging areas.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that SED 5 would not adversely affect any federally listed T&E species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or bank soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for less than 90 day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some sediments removed in the wet did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such dredged sediments.	In the unlikely event that any sediments removed in the wet were found to constitute RCRA hazardous waste, any tanks used for < 90-day accumulation of such dredged sediments would meet these requirements.
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subparts J, K, and L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in tanks (Subpart J), surface impoundments (Subpart K) and waste piles outside structures (Subpart L). Note: In addition to the requirements for waste piles, the requirements relating to tanks and surface impoundments are identified due to the possibility that such		In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, any waste piles, tanks, or surface impoundments used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While the waste piles and surface impoundments (if any) would meet the single liner/leachate collection requirements of §§ 264.251(a) and 264.221(a), they would not meet

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		types of facilities would be used at the temporary staging areas for holding of liquid sediments removed in the wet.	hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to these types of facilities used for staging of those materials.	the requirements of §§ 264.251(c) and 264.221(c) for a double liner/leachate collection system at "new waste pile units" and "new surface impoundment units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: These were listed as location-specific ARAR in Table S-5.b, but are also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table S-4.b.	Applicable to excavation/removal of sediments, discharge of dredged or fill material to waters and wetlands, and temporary staging areas for excavated sediments.	Same as described for these regulations in Table S-5.b.
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during remediation activities and at temporary staging areas.	SED 5 would include use of stormwater BMPs during construction of access roads and staging areas, bank soil removal and stabilization, and operation of staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible for BMPs for bank remediation or in areas (if any) where there would be no practical alternative to siting the staging areas in or adjacent wetlands. Stormwater BMPs would not be necessary or practical for

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				sediment excavation or dredging or capping, since those activities would take place within the River. Any applicable stormwater management requirements that could not practically be met should be waived as technically impracticable.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All excavation, capping, and thin-layer capping activities, as well as nearly all access roads and temporary staging areas, in SED 5 would occur within Priority Habitat, as shown on Figure S-5. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 23 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs > 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") The state hazardous waste management regulations also exempt dredged material (even if it constitutes non-PCB state hazardous waste) that is temporarily stored at an intermediate facility (pursuant to 314 CMR 9.07(4)) and managed in accordance with a state water quality certification and § 404 requirements under the Clean Water Act (see 310 CMR 30.104(3)(f)).	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
Note: It is not expected that excavated materials would constitute non-PCB state hazardous waste. However, for ***sediments***, even if some excavated sediments did constitute such hazardous waste, the following Massachusetts hazardous waste management requirements are considered inapplicable to temporary staging areas for such sediments due to the exemption from the hazardous waste regulations for dredged materials temporarily stored at an intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)). Hence, these requirements have been evaluated based solely on their potential applicability to temporary staging areas that are used for excavated ***bank soils***.				
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			excavated bank soils did constitute such hazardous waste, these requirements would apply.	
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table S-5.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain (given the need for proximity to the river) or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) it is not certain whether some areas could be designed and constructed with a 200-foot buffer zone to fenceline. Any requirements that could not feasibly

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				be met should be waived as technically impracticable.
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while these areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas, or controlling runoff, during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable, could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements because they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during active remediation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
Connecticut Endangered Species Act	Conn. Gen. Stat. 26-303 through 26-316	Requires state agency to: (a) ensure that any action authorized or performed by it does not threaten the continued existence of a listed endangered or threatened species or result in destruction or adverse modification of habitat essential to such species, unless an exemption is granted; and (b) take all reasonable measures to mitigate any adverse impacts of the proposed action on such species or habitat. Prohibits "taking" of endangered or threatened species, except where State determines that a proposed action would not appreciably reduce likelihood of survival or recovery of the species.	This statute is not applicable or relevant and appropriate to SED 5 because implementation of SED 5 is not expected to have any adverse impact on endangered or threatened species or their habitat in Connecticut, or to cause a "taking" of such species.	Not applicable.
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.

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Table S-5.c: Alternative SED 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of SED 5.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered “placement,” such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated sediments or bank soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table S-6.a: Alternative SED 6 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 6 would achieve chronic aquatic life criterion in all reaches using block averaging approach (and would achieve that criterion using rolling average approach in all reaches except for 1 extra exceedance in Reach 5A). See Revised CMS Report, Section 6.6.4. Model indicates that SED 6 would not achieve human health criterion in any reaches in MA and in 2 of 4 impoundments in CT. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.6.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-6.a: Alternative SED 6 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 6 would achieve chronic aquatic life criterion in CT impoundments. The current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-6.a: Alternative SED 6 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 6 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 6 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-6.a: Alternative SED 6 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from "do not eat" to "one meal per week." Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 6 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	(a) There are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Hence, the requirement that there be no such alternative would not be met. (b) SED 6 would not meet requirement that discharge not contribute to violation of state water quality standards, since Housatonic River does not currently meet numerical MA water quality criteria for PCBs; hence, that requirement should be waived as technically impracticable to attain. (c) Review of available information indicates that SED 6 would not affect any federally listed T&E species. (d) SED 6 would cause significant adverse effects on aquatic life, aquatic ecosystem, and recreational and aesthetic values, as described in the Revised CMS Report (Sections 6.6.5.3 and 6.6.8). Hence, the prohibition on actions with such effects would not be met. (e) SED 6 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on aquatic ecosystem. Despite such steps, however, SED 6 would have substantial adverse effects on the aquatic ecosystem, as noted above.

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	Where SED 6 would have unavoidable adverse impacts on the aquatic ecosystem, these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, considerable adverse impacts would remain. See Revised CMS Report, Sections 6.6.5.3 and 6.6.8.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to dredging in, and discharge of dredge and fill material to, navigable waters of the U.S., but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding work in Housatonic River.
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to work in river.	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	In the unlikely event that some excavated materials were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by SED 6 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of SED 6, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody (below high water mark). Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (9.37) and standards for dredging (9.40), including prohibition on dredging in an Area of Critical Environmental Concern (ACEC) except for sole purpose of fisheries or wildlife enhancement. Also requires compliance with other specified environmental regulatory programs (9.33).	Applicable to excavation/removal of sediments from Housatonic River, placement of caps or backfill in river, and placement of structures in river below high water mark to aid in excavation, address erosion, or restore habitat.	SED 6 would not comply with the prohibition on dredging in an ACEC. SED 6 would be designed to meet the other specified standards and requirements of these regulations. (The other relevant environmental regulatory programs referenced in Section 9.33 are discussed separately in these ARARs tables.)

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for SED 3.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated “Outstanding Resource Waters,” including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: (a) no dredging is allowed if there is practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse effects on land under water; (c) dredging must be conducted to meet performance standards designed to minimize impacts on the aquatic ecosystem and protect human health; and (d) placement of dredged material in an intermediate facility for sediment management (dewatering, processing, etc.) prior to disposal or reuse must meet certain requirements, including requirements governing method of placement/storage of dredged material and siting criteria.	Applicable to excavation/removal of sediments and bank soils, discharge of dredged or fill material to waters or wetlands, and dredged material management at temporary staging areas.	As noted above, there are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Thus, the requirement that there be no such alternative would not be met. SED 6 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on land under water and on wetlands, but such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 6.6.5.3 and 6.6.8). Under SED 6, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), and stormwater discharges would be controlled through BMPs. However, SED 6 would adversely affect estimated habitat of rare wildlife species, because the vast majority of remediation and supporting activities would occur within such habitat (see Figure S-6); and SED 6 would have substantial adverse impacts on biological conditions in the River. Hence, the prohibition on actions with such effects would not be met. Excavation/dredging activities under SED 6 would be designed to meet the specified dredging performance standards to the extent practical, but would not avoid adverse impacts on the aquatic ecosystem or minimize such impacts relative to other alternatives (e.g., SED 10). The temporary staging areas may not meet the requirements that intermediate facilities cannot have a permanent adverse impact on a state-listed rare species or on an ACEC. Most temporary staging areas under SED 6 would be located in state-mapped Priority Habitat of rare species (see Figure S-6) and in the Upper Housatonic ACEC, and the permanence of their impacts would depend on the uncertain success

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				of restoration. The staging areas would meet the other placement and siting requirements for intermediate facilities.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to SED 6 response actions that take place in waterbodies or in or within 100 feet (buffer zone) of, stream/pond banks or wetlands or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since SED 6 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ As noted above, there are practicable sediment and riverbank remediation alternatives that would be less damaging to resource areas (e.g., SED 10). Thus, the requirement that there be no such practicable alternative would not be met. ▪ SED 6 would include practicable measures to minimize impacts to resource areas, including actions to minimize impact of hydrological changes during construction, control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 6.6.5.3 and 6.6.8), these measures would not prevent substantial adverse impacts of SED 6 on resource areas. As also discussed in the Revised CMS Report (Section 6.6.9.1), SED 6 would not be expected to have a significant effect on flood storage capacity of floodplain or to cause an increase in flood stage or velocities on river. However, the effect of the placement of caps (without removal) on these parameters would be evaluated further during design. ▪ SED 6 would adversely affect estimated habitat of rare wildlife species, because the vast majority of remediation and supporting activities would occur within such habitat (see Figure S-6). Thus, the prohibition on projects with an adverse

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				effect on such habitat would not be met. In addition, if SED 6 was not considered a “limited project,” it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would relate to responsibilities of those dam owners and are not ARARs for SED 6.	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile or surface impoundment may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute state hazardous waste subject to these standards.	In the unlikely event that some excavated bank soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain, given the need for staging areas to be near the

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the hazardous waste.	Further, even if some excavated ***sediments*** did constitute such hazardous waste, these requirements would not apply to temporary staging areas for such ***sediments***, due to exemption from hazardous waste regulations for dredged materials temporarily stored at intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)) (see Table S-6.c). However, if some excavated ***bank soils*** were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	river. In such cases, that requirement should be waived as technically impracticable to attain. The requirement for floodproofing tanks, containers, and similar units used to store hazardous waste (if any) would be met.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which SED 6 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.		
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 6.	Not applicable.

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 6 would involve construction activities in wetlands. Although there may be no practicable alternative (other than MNR) to some construction in wetlands, there are practicable alternatives with much less adverse effect on wetlands (e.g., SED 10). Hence, the requirement that there be no such practicable alternative would not be met. SED 6 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 6.6.5.3 and 6.6.8.

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Table S-6.b: Alternative SED 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 6 would involve construction of access roads and staging areas in the floodplain. Since these facilities must be located near sediment removal areas, they cannot be relocated to avoid any construction in the floodplain. However, there are practicable alternatives with less adverse effects on the floodplain – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 6 would include practicable measures to minimize harm to floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of floodplain. However, restoration measures would not prevent substantial harm to floodplain, as discussed in the Revised CMS Report, Sections 6.6.5.3 and 6.6.8.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing sediments and soils. Options include self-implementing provisions (not applicable to sediments) and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated Housatonic River sediments and bank soils with PCBs ≥ 50 ppm).	It is anticipated that, if SED 6 is selected, these requirements would be met through EPA determination that SED 6 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	Water treatment facilities would be designed to meet this requirement.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L. for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including construction of access roads and temporary staging areas, bank remediation, and temporary staging of excavated materials at staging areas.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that SED 6 would not adversely affect any federally listed T&E species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or bank soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for less than 90 day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some sediments removed in the wet did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such dredged sediments.	In the unlikely event that any sediments removed in the wet were found to constitute RCRA hazardous waste, any tanks used for < 90-day accumulation of such dredged sediments would meet these requirements.
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subparts J, K, and L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in tanks (Subpart J), surface impoundments (Subpart K) and waste piles outside structures (Subpart L). Note: In addition to the requirements for waste piles, the requirements relating to tanks and surface impoundments are identified due to the possibility that such		In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, any waste piles, tanks, or surface impoundments used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While the waste piles and surface impoundments (if any) would meet the single liner/leachate collection requirements of §§ 264.251(a) and 264.221(a), they would not meet

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		types of facilities would be used at the temporary staging areas for holding of liquid sediments removed in the wet.	hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to these types of facilities used for staging of those materials.	the requirements of §§ 264.251(c) and 264.221(c) for a double liner/leachate collection system at "new waste pile units" and "new surface impoundment units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: These were listed as location-specific ARAR in Table S-6.b, but are also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table S-4.b.	Applicable to excavation/removal of sediments, discharge of dredged or fill material to waters and wetlands, and temporary staging areas for excavated sediments.	Same as described for these regulations in Table S-6.b.
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during remediation activities and at temporary staging areas.	SED 6 would include use of stormwater BMPs during construction of access roads and staging areas, bank soil removal and stabilization, and operation of staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible for BMPs for bank remediation or in areas (if any) where there would be no practical alternative to siting the staging areas in or adjacent to wetlands. Stormwater BMPs would not be necessary or

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				practical for sediment excavation/dredging or capping, since those activities would take place within the River. Any applicable stormwater management requirements that could not practically be met should be waived as technically impracticable.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	The vast majority of remediation activities, as well as most access roads and temporary staging areas, in SED 6 would occur within Priority Habitat, as shown on Figure S-6. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 27 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs ≥ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") The state hazardous waste management regulations also exempt dredged material (even if it constitutes non-PCB state hazardous waste) that is temporarily stored at an intermediate facility (pursuant to 314 CMR 9.07(4)) and managed in accordance with a state water quality certification and § 404 requirements under the Clean Water Act (see 310 CMR 30.104(3)(f)).	Applicable to determining whether excavated/ dredged sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
Note: It is not expected that excavated/dredged materials would constitute non-PCB state hazardous waste. However, for ***sediments***, even if some excavated/dredged sediments did constitute such hazardous waste, the following Massachusetts hazardous waste management requirements are considered inapplicable to temporary staging areas for such sediments due to the exemption from the hazardous waste regulations for dredged materials temporarily stored at an intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)). Hence, these requirements have been evaluated based solely on their potential applicability to temporary staging areas that are used for excavated ***bank soils***.				
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute non-PCB state hazardous waste.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply.	
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table S-6.b.)	310 CMR 30.701(6), 30.703(2), 30.702, 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain (given the need for proximity to the river) or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) it is not certain whether some areas could be designed and constructed with a 200-foot buffer zone to

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				fenceline. Any requirements that could not feasibly be met should be waived as technically impracticable.
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while these areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas, or controlling runoff, during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable, could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements because they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during active remediation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
Connecticut Endangered Species Act	Conn. Gen. Stat. 26-303 through 26-316	Requires state agency to: (a) ensure that any action authorized or performed by it does not threaten the continued existence of a listed endangered or threatened species or result in destruction or adverse modification of habitat essential to such species, unless an exemption is granted; and (b) take all reasonable measures to mitigate any adverse impacts of the proposed action on such species or habitat. Prohibits "taking" of endangered or threatened species, except where State determines that a proposed action would not appreciably reduce likelihood of survival or recovery of the species.	This statute is not applicable or relevant and appropriate to SED 6 because implementation of SED 6 is not expected to have any adverse impact on endangered or threatened species or their habitat in Connecticut, or to cause a "taking" of such species.	Not applicable.
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.

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Table S-6.c: Alternative SED 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of SED 6.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated sediments or bank soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table S-7.a: Alternative SED 7 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 7 would not achieve chronic aquatic life criterion in upper portion of Rest of River, with 2 exceedances in 3-year period in Reach 5A using block averaging approach (and 10 exceedances in that reach and 3 exceedances in Reach 5B using rolling average approach). See Revised CMS Report, Section 6.7.4. Hence, this criterion would not be met under SED 7. Model indicates that SED 7 would not achieve human health criterion in any reaches in MA and in 2 of 4 impoundments in CT. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.7.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEPestablishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-7.a: Alternative SED 7 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 7 would achieve chronic aquatic life criterion in CT impoundments. The current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Develop-ment, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-7.a: Alternative SED 7 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 7 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 7 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-7.a: Alternative SED 7 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from "do not eat" to "one meal per week." Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 7 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

<u>**Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs**</u>

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	(a) There are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Hence, the requirement that there be no such alternative would not be met. (b) SED 7 would not meet requirement that discharge not contribute to violation of state water quality standards, since Housatonic River does not currently meet numerical MA water quality criteria for PCBs; hence, that requirement should be waived as technically impracticable to attain. (c) Review of available information indicates that SED 7 would not affect any federally listed T&E species. (d) SED 7 would cause significant adverse effects on aquatic life, aquatic ecosystem, and recreational and aesthetic values, as described in the Revised CMS Report (Sections 6.7.5.3 and 6.7.8). Hence, the prohibition on actions with such effects would not be met. (e) SED 7 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on aquatic ecosystem. Despite such steps, however, SED 7 would have substantial adverse effects on the aquatic ecosystem, as noted above.

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	Where SED 7 would have unavoidable adverse impacts on the aquatic ecosystem, these regulations would require a compensatory mitigation plan would be necessary to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 6.7.5.3 and 6.7.8.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to dredging in, and discharge of dredge and fill material to, navigable waters of the U.S., but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding work in Housatonic River.
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to work in river.	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	In the unlikely event that some excavated materials were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by SED 7 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of SED 7, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody (below high water mark). Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (9.37) and standards for dredging (9.40), including prohibition on dredging in an Area of Critical Environmental Concern (ACEC) except for sole purpose of fisheries or wildlife enhancement. Also requires compliance with other specified environmental regulatory programs (9.33).	Applicable to excavation/removal of sediments from Housatonic River, placement of caps or backfill in river, and placement of structures in river below high water mark to aid in excavation, address erosion, or restore habitat.	SED 7 would not comply with the prohibition on dredging in an ACEC. SED 7 would be designed to meet the other specified standards and requirements of these regulations. (The other relevant environmental regulatory programs referenced in Section 9.33 are discussed separately in these ARARs tables.)

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for SED 3.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: (a) no dredging is allowed if there is practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse effects on land under water; (c) dredging must be conducted to meet performance standards designed to minimize impacts on the aquatic ecosystem and protect human health; and (d) placement of dredged material in an intermediate facility for sediment management (dewatering, processing, etc.) prior to disposal or reuse must meet certain requirements, including requirements governing method of placement/ storage of dredged material and siting criteria.	Applicable to excavation/removal of sediments and bank soils, discharge of dredged or fill material to waters or wetlands, and dredged material management at temporary staging areas.	As noted above, there are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Thus, the requirement that there be no such alternative would not be met. SED 7 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on land under water and on wetlands, but such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 6.7.5.3 and 6.7.8). Under SED 7, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), and stormwater discharges would be controlled through BMPs. However, SED 7 would adversely affect estimated habitat of rare wildlife species, because the vast majority of remediation and supporting activities would occur within such habitat (see Figure S-7); and SED 7 would have substantial adverse impacts on biological conditions in the River. Hence, the prohibition on actions with such effects would not be met. Excavation/dredging activities under SED 7 would be designed to meet the specified dredging performance standards to the extent practical, but would not avoid adverse impacts on the aquatic ecosystem or minimize such impacts relative to other alternatives (e.g., SED 10). The temporary staging areas may not meet the requirements that intermediate facilities cannot have a permanent adverse impact on a state-listed rare species or on an ACEC. Most temporary staging areas under SED 7 would be located in state-mapped Priority Habitat of rare species (see Figure S-7) and in the Upper Housatonic ACEC, and the permanence of their impacts would depend on the uncertain success

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				of restoration. The staging areas would meet the other placement and siting requirements for intermediate facilities.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to SED 7 response actions that take place in waterbodies or in, or within 100 feet (buffer zone) of, stream/pond banks or wetlands or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since SED 7 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ As noted above, there are practicable sediment and riverbank remediation alternatives that would be less damaging to resource areas (e.g., SED 10). Thus, the requirement that there be no such practicable alternative would not be met. ▪ SED 7 would include practicable measures to minimize impacts to resource areas, including actions to minimize impact of hydrological changes during construction, control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 6.7.5.3 and 6.7.8), these measures would not prevent substantial adverse impacts of SED 7 on resource areas. As discussed in the Revised CMS Report (Section 6.7.9.1), SED 7 would not be expected to affect flood storage capacity of floodplain or to cause an increase in flood stage or velocities on river. However, the effect of the placement of caps (without removal) on these parameters would be evaluated further during design. ▪ SED 7 would adversely affect estimated habitat of rare wildlife species, because the vast majority of remediation and supporting activities would occur within such habitat (see Figure S-7). Thus, the prohibition on projects with an adverse

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				effect on such habitat would not be met. In addition, if SED 7 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would relate to responsibilities of those dam owners and are not ARARs for SED 7.	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile or surface impoundment may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute state hazardous waste subject to these standards.	In the unlikely event that some excavated bank soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain, given the need for staging areas to be near the

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the hazardous waste.	Further, even if some excavated ***sediments*** did constitute such hazardous waste, these requirements would not apply to temporary staging areas for such ***sediments***, due to exemption from hazardous waste regulations for dredged materials temporarily stored at intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)) (see Table S-7.c). However, if some excavated ***bank soils*** were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	river. In such cases, that requirement should be waived as technically impracticable to attain. The requirement for floodproofing tanks, containers, and similar units used to store hazardous waste (if any) would be met.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which SED 7 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.		
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 7.	Not applicable.

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 7 would involve some construction activities in wetlands. Although there may be no practicable alternative (other than MNR) to some construction in wetlands, there are practicable alternatives with much less adverse effect on wetlands (e.g., SED 10). Hence, the requirement that there be no such practicable alternative would not be met. SED 7 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 6.7.5.3 and 6.7.8.

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Table S-7.b: Alternative SED 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 7 would involve construction of access roads and staging areas in the floodplain. Since these facilities must be located near sediment removal areas, they cannot be relocated to avoid any construction in the floodplain. However, there are practicable alternatives with less adverse effects on the floodplain – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 7 would include practicable measures to minimize harm to floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of floodplain. However, restoration measures would not prevent substantial harm to floodplain, as discussed in the Revised CMS Report, Sections 6.7.5.3 and 6.7.8.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing sediments and soils. Options include self-implementing provisions (not applicable to sediments) and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated Housatonic River sediments and bank soils with PCBs ≥ 50 ppm).	It is anticipated that, if SED 7 is selected, these requirements would be met through EPA determination that SED 7 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	Water treatment facilities would be designed to meet this requirement.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L. for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including construction of access roads and temporary staging areas, bank remediation, and temporary staging of excavated materials at staging areas.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that SED 7 would not adversely affect any federally listed T&E species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated/dredged sediments or bank soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated/dredged materials do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for less than 90 day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some sediments removed in the wet did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such dredged sediments.	In the unlikely event that any sediments removed in the wet were found to constitute RCRA hazardous waste, any tanks used for < 90-day accumulation of such dredged sediments would meet these requirements.
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subparts J, K, and L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in tanks (Subpart J), surface impoundments (Subpart K) and waste piles outside structures (Subpart L). Note: In addition to the requirements for waste piles, the requirements relating to tanks and surface impoundments are identified due to the possibility that such types of facilities would be used at the		In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, any waste piles, tanks, or surface impoundments used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While the waste piles and surface impoundments (if any) would meet the single liner/leachate collection requirements of §§ 264.251(a) and 264.221(a), they would not meet the requirements of §§ 264.251(c) and 264.221(c)

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		temporary staging areas for holding of liquid sediments removed in the wet.	hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to these types of facilities used for staging of those materials.	for a double liner/leachate collection system at "new waste pile units" and "new surface impoundment units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: These were listed as location-specific ARAR in Table S-7.b, but are also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table S-7.b.	Applicable to excavation/removal of sediments, discharge of dredged or fill material to waters and wetlands, and temporary staging areas for excavated sediments.	Same as described for these regulations in Table S-7.b.
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during remediation activities and at temporary staging areas.	SED 7 would include use of stormwater BMPs during construction of access roads and staging areas, bank soil removal and stabilization, and operation of staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible for BMPs for bank remediation or in areas (if any) where there would be no practical alternative to siting the staging areas in adjacent to wetlands. Stormwater BMPs would not be necessary or practical for sediment excavation/dredging or capping, since those activities would take place within the River. Any applicable stormwater management requirements that could not practically be met should be waived as technically impracticable.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in a State-designated Priority Habitat in MA or other areas where information indicates the occurrence of a State-listed species.	The vast majority of excavation, dredging, and capping activities, as well as most access roads and temporary staging areas, in SED 7 would occur within Priority Habitat, as shown on Figure S-7. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 27 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") The state hazardous waste management regulations also exempt dredged material (even if it constitutes non-PCB state hazardous waste) that is temporarily stored at an intermediate facility (pursuant to 314 CMR 9.07(4)) and managed in accordance with a state water quality certification and § 404 requirements under the Clean Water Act (see 310 CMR 30.104(3)(f)).	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
Note: It is not expected that excavated materials would constitute non-PCB state hazardous waste. However, for ***sediments***, even if some excavated sediments did constitute such hazardous waste, the following Massachusetts hazardous waste management requirements are considered inapplicable to temporary staging areas for such sediments due to the exemption from the hazardous waste regulations for dredged materials temporarily stored at an intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)). Hence, these requirements have been evaluated based solely on their potential applicability to temporary staging areas that are used for excavated ***bank soils***.				
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			excavated bank soils did constitute such hazardous waste, these requirements would apply.	
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table S-7.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain (given the need for proximity to the river) or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) it is not certain whether some areas could be designed and constructed with a 200-foot buffer zone to fenceline. Any requirements that could not feasibly be met should be waived as technically

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				impracticable.
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while these areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas, or controlling runoff, during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable, could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements because they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during active remediation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
Connecticut Endangered Species Act	Conn. Gen. Stat. 26-303 through 26-316	Requires state agency to: (a) ensure that any action authorized or performed by it does not threaten the continued existence of a listed endangered or threatened species or result in destruction or adverse modification of habitat essential to such species, unless an exemption is granted; and (b) take all reasonable measures to mitigate any adverse impacts of the proposed action on such species or habitat. Prohibits "taking" of endangered or threatened species, except where State determines that a proposed action would not appreciably reduce likelihood of survival or recovery of the species.	This statute is not applicable or relevant and appropriate to SED 7 because implementation of SED 7 is not expected to have any adverse impact on endangered or threatened species or their habitat in Connecticut, or to cause a "taking" of such species.	Not applicable.
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.

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Table S-7.c: Alternative SED 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of SED 7.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated sediments or bank soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table S-8.a: Alternative SED 8 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 8 would achieve chronic aquatic life criterion in all reaches using block averaging approach (and would achieve that criterion using rolling average approach in all reaches except for 3 extra exceedances in Reach 5A). See Revised CMS Report, Section 6.8.4. Model indicates that SED 8 would not achieve human health criterion in any reaches in MA and in 1 of 4 impoundments in CT. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.8.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-8.a: Alternative SED 8 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 8 would achieve chronic aquatic life criterion in CT impoundments. The current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Develop-ment, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-8.a: Alternative SED 8 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 8 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 8 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-8.a: Alternative SED 8 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from "do not eat" to "one meal per week." Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 8 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters).	(a) There are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Hence, the requirement that there be no such alternative would not be met. (b) SED 8 would not meet requirement that discharge not contribute to violation of state water quality standards, since Housatonic River does not currently meet numerical MA water quality criteria for PCBs; hence, that requirement should be waived as technically impracticable to attain. (c) Review of available information indicates that SED 8 would not affect any federally listed T&E species. (d) SED 8 would cause significant adverse effects on aquatic life, aquatic ecosystem, and recreational and aesthetic values, as described in the Revised CMS Report (Sections 6.8.5.3 and 6.8.8). Hence, the prohibition on actions with such effects would not be met. (e) SED 8 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on aquatic ecosystem. Despite such steps, however, SED 8 would have substantial adverse effects on the aquatic ecosystem, as noted above.

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters).	Where SED 8 would have unavoidable adverse impacts on the aquatic ecosystem, these regulations would require a compensatory mitigation plan would be necessary to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 6.8.5.3 and 6.8.8.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to dredging in, and discharge of dredge and fill material to, navigable waters of the U.S., but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding work in Housatonic River.
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to work in river.	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	In the unlikely event that some excavated materials were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by SED 8 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of SED 8, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody (below high water mark). Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (9.37) and standards for dredging (9.40), including prohibition on dredging in an Area of Critical Environmental Concern (ACEC) except for sole purpose of fisheries or wildlife enhancement. Also requires compliance with other specified environmental regulatory programs (9.33).	Applicable to excavation/removal of sediments from Housatonic River, placement of caps or backfill in river, and placement of structures in river below high water mark to aid in excavation, address erosion, or restore habitat.	SED 8 would not comply with the prohibition on dredging in an ACEC. SED 8 would be designed to meet the other specified standards and requirements of these regulations. (The other relevant environmental regulatory programs referenced in Section 9.33 are discussed separately in these ARARs tables.)

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for SED 3.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: (a) no dredging is allowed if there is practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse effects on land under water; (c) dredging must be conducted to meet performance standards designed to minimize impacts on the aquatic ecosystem and protect human health; and (d) placement of dredged material in an intermediate facility for sediment management (dewatering, processing, etc.) prior to disposal or reuse must meet certain requirements, including requirements governing method of placement/ storage of dredged material and siting criteria.	Applicable to excavation/removal of sediments and bank soils, discharge of dredged or fill material to waters or wetlands, and dredged material management at temporary staging areas.	As noted above, there are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Thus, the requirement that there be no such alternative would not be met. SED 8 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on land under water and on wetlands, but such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 6.8.5.3 and 6.8.8). Under SED 8, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), and stormwater discharges would be controlled through BMPs. However, SED 8 would adversely affect estimated habitat of rare wildlife species, because the vast majority of remediation and supporting activities would occur within such habitat (see Figure S-8); and SED 8 would have substantial adverse impacts on biological conditions in the River. Hence, the prohibition on actions with such effects would not be met. Excavation/dredging activities under SED 8 would be designed to meet the specified dredging performance standards to the extent practical, but would not avoid adverse impacts on the aquatic ecosystem or minimize such impacts relative to other alternatives (e.g., SED 10). The temporary staging areas may not meet the requirements that intermediate facilities cannot have a permanent adverse impact on a state-listed rare species or on an ACEC. Most temporary staging areas under SED 8 would be located in state-mapped Priority Habitat of rare species (see Figure S-8) and in the Upper Housatonic ACEC, and the permanence of their impacts would depend on the uncertain success

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				of restoration. The staging areas would meet the other placement and siting requirements for intermediate facilities.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to SED 8 response actions that take place in waterbodies or in, or within 100 feet (buffer zone) of, stream/pond banks or wetlands or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since SED 8 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ As noted above, there are practicable sediment and riverbank remediation alternatives that would be less damaging to resource areas (e.g., SED 10). Thus, the requirement that there be no such practicable alternative would not be met. ▪ SED 8 would include practicable measures to minimize impacts to resource areas, including actions to minimize impact of hydrological changes during construction, control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 6.8.5.3 and 6.8.8), these measures would not prevent substantial adverse impacts of SED 8 on resource areas. As discussed in the Revised CMS Report (Section 6.8.9.1), SED 8 would not be expected to affect flood storage capacity of floodplain or to cause an increase in flood stage or velocities on the river. ▪ SED 8 would adversely affect estimated habitat of rare wildlife species, because the vast majority of remediation and supporting activities would occur within such habitat (see Figure S-8). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if SED 8 was not considered a "limited project," it would not meet some of the

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would relate to responsibilities of those dam owners and are not ARARs for SED 8.	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile or surface impoundment may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute state hazardous waste subject to these standards. Further, even if some excavated ***sediments*** did constitute such hazardous waste, these requirements	In the unlikely event that some excavated bank soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain, given the need for staging areas to be near the river. In such cases, that requirement should be waived as technically impracticable to attain. The requirement for floodproofing tanks, containers, and similar units used to store

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		hazardous waste.	would not apply to temporary staging areas for such ***sediments***, due to exemption from hazardous waste regulations for dredged materials temporarily stored at intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)) (see Table S-8.c). However, if some excavated ***bank soils*** were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	hazardous waste (if any) would be met.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which SED 8 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.		
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA– or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 8.	Not applicable.

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 8 would involve construction activities in wetlands. Although there may be no practicable alternative (other than MNR) to some construction in wetlands, there are practicable alternatives with much less adverse effect on wetlands (e.g., SED 10). Hence, the requirement that there be no such practicable alternative would not be met. SED 8 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 6.8.5.3 and 6.8.8.

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Table S-8.b: Alternative SED 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 8 would involve construction of access roads and staging areas in the floodplain. Since these facilities must be located near sediment removal areas, they cannot be relocated to avoid any construction in the floodplain. However, there are practicable alternatives with less adverse effects on the floodplain – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 8 would include practicable measures to minimize harm to floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of floodplain. However, restoration measures would not prevent substantial harm to floodplain, as discussed in the Revised CMS Report, Sections 6.8.5.3 and 6.8.8.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing sediments and soils. Options include self-implementing provisions (not applicable to sediments) and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated Housatonic River sediments and bank soils with PCBs ≥ 50 ppm).	It is anticipated that, if SED 8 is selected, these requirements would be met through EPA determination that SED 8 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allows for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	Water treatment facilities would be designed to meet this requirement.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L. for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including construction of access roads and temporary staging areas, bank remediation, and temporary staging of excavated materials at staging areas.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that SED 8 would not adversely affect any federally listed T&E species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or bank soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some excavated materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for less than 90 day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some sediments removed in the wet did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such dredged sediments.	In the unlikely event that any sediments removed in the wet were found to constitute RCRA hazardous waste, any tanks used for < 90-day accumulation of such dredged sediments would meet these requirements.
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subparts J, K, and L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in tanks (Subpart J), surface impoundments (Subpart K) and waste piles outside structures (Subpart L). Note: In addition to the requirements for waste piles, the requirements relating to tanks and surface impoundments are identified due to the possibility that such types of facilities would be used at the		In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, any waste piles, tanks, or surface impoundments used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While the waste piles and surface impoundments (if any) would meet the single liner/leachate collection requirements of §§ 264.251(a) and 264.221(a), they would not meet the requirements of §§ 264.251(c) and 264.221(c)

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		temporary staging areas for holding of liquid sediments removed in the wet.	hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to these types of facilities used for staging of those materials.	for a double liner/leachate collection system at "new waste pile units" and "new surface impoundment units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: These were listed as location-specific ARAR in Table S-8.b, but are also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table S-4.b.	Applicable to excavation/removal of sediments, discharge of dredged or fill material to waters and wetlands, and temporary staging areas for excavated sediments.	Same as described for these regulations in Table S-8.b.
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during remediation activities and at temporary staging areas.	SED 8 would include use of stormwater BMPs during construction of access roads and staging areas, bank soil removal and stabilization, and operation of staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible for BMPs for bank remediation or in areas (if any) where there would be no practical alternative to siting the staging areas in or adjacent to wetlands. Stormwater BMPs would not be necessary or practical for sediment excavation/dredging or capping, since those activities would take place within the River. Any applicable stormwater management requirements that could not practically be met should be waived as technically impracticable.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	The vast majority of remediation activities, as well as most access roads and temporary staging areas, in SED 8 would occur within Priority Habitat, as shown on Figure S-8. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 27 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.")	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		The state hazardous waste management regulations also exempt dredged material (even if it constitutes non-PCB state hazardous waste) that is temporarily stored at an intermediate facility (pursuant to 314 CMR 9.07(4)) and managed in accordance with a state water quality certification and § 404 requirements under the Clean Water Act (see 310 CMR 30.104(3)(f)).		
Note: It is not expected that excavated materials would constitute non-PCB state hazardous waste. However, for ***sediments***, even if some excavated sediments did constitute such hazardous waste, the following Massachusetts hazardous waste management requirements are considered inapplicable to temporary staging areas for such sediments due to the exemption from the hazardous waste regulations for dredged materials temporarily stored at an intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)). Hence, these requirements have been evaluated based solely on their potential applicability to temporary staging areas that are used for excavated ***bank soils***.				
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			excavated bank soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table S-8.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain (given the need for proximity to the river) or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) it is not certain whether some areas could be designed and constructed with a 200-foot buffer zone to fenceline. Any requirements that could not feasibly be met should be waived as technically impracticable.
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while these areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				have such systems capable of preventing flow onto those areas, or controlling runoff, during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable, could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements because they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during active remediation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
Connecticut Endangered Species Act	Conn. Gen. Stat. 26-303 through 26-316	Requires state agency to: (a) ensure that any action authorized or performed by it does not threaten the continued existence of a listed endangered or threatened species or result in destruction or adverse modification of habitat essential to such species, unless an exemption is granted; and (b) take all reasonable measures to mitigate any	This statute is not applicable or relevant and appropriate to SED 8 because implementation of SED 8 is not expected to have any adverse impact on endangered or threatened species or	Not applicable.

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Table S-8.c: Alternative SED 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		adverse impacts of the proposed action on such species or habitat. Prohibits "taking" of endangered or threatened species, except where State determines that a proposed action would not appreciably reduce likelihood of survival or recovery of the species.	their habitat in Connecticut, or to cause a "taking" of such species.	
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of SED 8.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated sediments or bank soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table S-9.a: Alternative SED 9 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 9 would achieve chronic aquatic life criterion in all reaches using block averaging approach (and would achieve that criterion using rolling average approach in all reaches except for 1 extra exceedance in Reach 5A). See Revised CMS Report, Section 6.9.4. Model indicates that SED 9 would not achieve human health criterion in any reaches in MA and in 1 of 4 impoundments in CT. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.9.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-9.a: Alternative SED 9 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 9 would achieve chronic aquatic life criterion in CT impoundments. The current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assess-ment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-9.a: Alternative SED 9 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 9 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 9 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-9.a: Alternative SED 9 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from “do not eat” to “one meal per week.” Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 9 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

<u>**Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs**</u>

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	(a) There are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Hence, the requirement that there be no such alternative would not be met. (b) SED 9 would not meet requirement that discharge not contribute to violation of state water quality standards, since Housatonic River does not currently meet numerical MA water quality criteria for PCBs; hence, that requirement should be waived as technically impracticable to attain. (c) Review of available information indicates that SED 9 would not affect any federally listed T&E species. (d) SED 9 would cause significant adverse effects on aquatic life, aquatic ecosystem, and recreational and aesthetic values, as described in the Revised CMS Report (Sections 6.9.5.3 and 6.9.8). Hence, the prohibition on actions with such effects would not be met. (e) SED 9 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on aquatic ecosystem. Despite such steps, however, SED 9 would have substantial adverse effects on the aquatic ecosystem, as noted above.

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	Where SED 9 would have unavoidable adverse impacts on the aquatic ecosystem, these regulations would require a compensatory mitigation plan would be necessary to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 6.9.5.3 and 6.9.8.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to dredging in, and discharge of dredge and fill material to, navigable waters of the U.S., but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding work in Housatonic River.
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to work in river.	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	In the unlikely event that some excavated materials were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by SED 9 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of SED 9, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody (below high water mark). Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (9.37) and standards for dredging (9.40), including prohibition on dredging in an Area of Critical Environmental Concern (ACEC) except for sole purpose of fisheries or wildlife enhancement. Also requires compliance with other specified environmental regulatory programs (9.33).	Applicable to excavation/removal of sediments from Housatonic River, placement of caps or backfill in river, and placement of structures in river below high water mark to aid in excavation, address erosion, or restore habitat.	SED 9 would not comply with the prohibition on dredging in an ACEC. SED 9 would be designed to meet the other specified standards and requirements of these regulations. (The other relevant environmental regulatory programs referenced in Section 9.33 are discussed separately in these ARARs tables.)

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for SED 3.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: (a) no dredging is allowed if there is practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse effects on land under water; (c) dredging must be conducted to meet performance standards designed to minimize impacts on the aquatic ecosystem and protect human health; and (d) placement of dredged material in an intermediate facility for sediment management (dewatering, processing, etc.) prior to disposal or reuse must meet certain requirements, including requirements governing method of placement/ storage of dredged material and siting criteria.	Applicable to excavation/removal of sediments and bank soils, discharge of dredged or fill material to waters or wetlands, and dredged material management at temporary staging areas.	As noted above, there are practicable sediment and riverbank remediation alternatives with less adverse impact on aquatic ecosystem – e.g., SED 10. Thus, the requirement that there be no such alternative would not be met. SED 9 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on land under water and on wetlands, but such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 6.9.5.3 and 6.9.8). Under SED 9, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), and stormwater discharges would be controlled through BMPs. However, SED 9 would adversely affect estimated habitat of rare wildlife species, because most remediation and supporting activities would occur within such habitat (see Figure S-9); and SED 9 would have substantial adverse impacts on biological conditions in the River. Hence, the prohibition on actions with such effects would not be met. Excavation/dredging activities under SED 9 would be designed to meet the specified dredging performance standards to the extent practical, but would not avoid adverse impacts on the aquatic ecosystem or minimize such impacts relative to other alternatives (e.g., SED 10). The temporary staging areas may not meet the requirements that intermediate facilities cannot have a permanent adverse impact on a state-listed rare species or on an ACEC. Most temporary staging areas under SED 9 would be located in state-mapped Priority Habitat of rare species (see Figure S-9) and in the Upper Housatonic ACEC, and the permanence of their impacts would depend on the uncertain success

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				of restoration. The staging areas would meet the other placement and siting requirements for intermediate facilities.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to SED 9 response actions that take place in waterbodies or in, or within 100 feet (buffer zone) of, stream/pond banks or wetlands or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since SED 9 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ As noted above, there are practicable sediment and riverbank remediation alternatives that would be less damaging to resource areas (e.g., SED 10). Thus, the requirement that there be no such practicable alternative would not be met. ▪ SED 9 would include practicable measures to minimize impacts to resource areas, including actions to minimize impact of hydrological changes during construction, control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 6.9.5.3 and 6.9.8), these measures would not prevent substantial adverse impacts of SED 9 on resource areas. As discussed in the Revised CMS Report (Section 6.9.9.1), SED 9 would not be expected to affect flood storage capacity of floodplain or to cause an increase in flood stage or velocities on river. However, the effect of the placement of caps (without removal) on these parameters would be evaluated further during design. ▪ SED 9 would adversely affect estimated habitat of rare wildlife species, because most remediation and supporting activities would occur within such habitat (see Figure S-9). Thus, the prohibition on projects with an adverse effect on

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				such habitat would not be met. In addition, if SED 9 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would relate to responsibilities of those dam owners and are not ARARs for SED 9.	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile or surface impoundment may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute state hazardous waste subject to these standards.	In the unlikely event that some excavated bank soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain, given the need for staging areas to be near the

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the hazardous waste.	Further, even if some excavated ***sediments*** did constitute such hazardous waste, these requirements would not apply to temporary staging areas for such ***sediments***, due to exemption from hazardous waste regulations for dredged materials temporarily stored at intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)) (see Table S-9.c). However, if some excavated ***bank soils*** were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	river. In such cases, that requirement should be waived as technically impracticable to attain. The requirement for floodproofing tanks, containers, and similar units used to store hazardous waste (if any) would be met.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which SED 9 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.		
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 9.	Not applicable.

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 9 would involve some construction activities in wetlands. Although there may be no practicable alternative (other than MNR) to some construction in wetlands, there are practicable alternatives with much less adverse effect on wetlands (e.g., SED 10). Hence, the requirement that there be no such practicable alternative would not be met. SED 9 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 6.9.5.3 and 6.9.8.

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Table S-9.b: Alternative SED 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 9 would involve construction of some access roads and staging areas in the floodplain. Since these facilities must be located near sediment removal areas, they cannot be relocated to avoid any construction in the floodplain. However, there are practicable alternatives with less adverse effects on the floodplain – e.g., SED 10. Hence, the requirement that there be no such practicable alternative would not be met. SED 9 would include practicable measures to minimize harm to floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of floodplain. However, restoration measures would not prevent harm to floodplain, as discussed in the Revised CMS Report, Sections 6.9.5.3 and 6.9.8.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing sediments and soils. Options include self-implementing provisions (not applicable to sediments) and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated Housatonic River sediments and bank soils with PCBs ≥ 50 ppm).	It is anticipated that, if SED 9 is selected, these requirements would be met through EPA determination that SED 9 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	Water treatment facilities would be designed to meet this requirement.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L. for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including construction of access roads and temporary staging areas, bank remediation, and temporary staging of excavated materials at staging areas.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that SED 9 would not adversely affect any federally listed T&E species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated/dredged sediments or bank soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated/dredged materials do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for less than 90 day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some sediments removed in the wet did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such dredged sediments.	In the unlikely event that any sediments removed in the wet were found to constitute RCRA hazardous waste, any tanks used for < 90-day accumulation of such dredged sediments would meet these requirements.
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subparts J, K, and L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in tanks (Subpart J), surface impoundments (Subpart K) and waste piles outside structures (Subpart L). Note: In addition to the requirements for waste piles, the requirements relating to tanks and surface impoundments are identified due to the possibility that such types of facilities would be used at the		In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, any waste piles, tanks, or surface impoundments used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While the waste piles and surface impoundments (if any) would meet the single liner/leachate collection requirements of §§ 264.251(a) and 264.221(a), they would not meet the requirements of §§ 264.251(c) and 264.221(c)

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		temporary staging areas for holding of liquid sediments removed in the wet.	hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to these types of facilities used for staging of those materials.	for a double liner/leachate collection system at "new waste pile units" and "new surface impoundment units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: These were listed as location-specific ARAR in Table S-9.b, but are also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table S-9.b.	Applicable to excavation/removal of sediments, discharge of dredged or fill material to waters and wetlands, and temporary staging areas for excavated sediments.	Same as described for these regulations in Table S-9.b.
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during remediation activities and at temporary staging areas.	SED 9 would include use of stormwater BMPs during construction of access roads and staging areas, bank soil removal and stabilization, and operation of staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible for BMPs for bank remediation or in areas (if any) where there would be no practical alternative to siting the staging areas in adjacent to wetlands. Stormwater BMPs would not be necessary or practical for sediment excavation/dredging or capping, since those activities would take place within the River. Any applicable stormwater management requirements that could not practically be met should be waived as technically impracticable.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in a State-designated Priority Habitat in MA or other areas where information indicates the occurrence of a State-listed species.	The vast majority of remediation activities, as well as most access roads and temporary staging areas, in SED 9 would occur within Priority Habitat, as shown on Figure S-9. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 26 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs ≥ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") The state hazardous waste management regulations also exempt dredged material (even if it constitutes non-PCB state hazardous waste) that is temporarily stored at an intermediate facility (pursuant to 314 CMR 9.07(4)) and managed in accordance with a state water quality certification and § 404 requirements under the Clean Water Act (see 310 CMR 30.104(3)(f)).	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
Note: It is not expected that excavated materials would constitute non-PCB state hazardous waste. However, for ***sediments***, even if some excavated sediments did constitute such hazardous waste, the following Massachusetts hazardous waste management requirements are considered inapplicable to temporary staging areas for such sediments due to the exemption from the hazardous waste regulations for dredged materials temporarily stored at an intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)). Hence, these requirements have been evaluated based solely on their potential applicability to temporary staging areas that are used for excavated ***bank soils***.				
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			excavated bank soils did constitute such hazardous waste, these requirements would apply.	
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table S-9.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain (given the need for proximity to the river) or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) it is not certain whether some areas could be designed and constructed with a 200-foot buffer zone to fence-line. Any requirements that could not feasibly be met should be waived as technically impracticable.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while these areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas, or controlling runoff, during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable, could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements because they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during active remediation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
Connecticut Endangered Species Act	Conn. Gen. Stat. 26-303 through 26-316	Requires state agency to: (a) ensure that any action authorized or performed by it does not threaten the continued existence of a listed endangered or threatened species or result in destruction or adverse modification of habitat essential to such species, unless an exemption is granted; and (b) take all reasonable measures to mitigate any adverse impacts of the proposed action on such species or habitat. Prohibits “taking” of endangered or threatened species, except where State determines that a proposed action would not appreciably reduce likelihood of survival or recovery of the species.	This statute is not applicable or relevant and appropriate to SED 9 because implementation of SED 9 is not expected to have any adverse impact on endangered or threatened species or their habitat in Connecticut, or to cause a “taking” of such species.	Not applicable.
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.

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Table S-9.c: Alternative SED 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of SED 9.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated sediments or bank soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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<u>**Table S-10.a: Alternative SED 10 – Potential Chemical-Specific ARARs**</u>

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, National Ambient Water Quality Criteria for PCBs	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L (4-day average not to be exceeded more than once every 3 years). Human health criterion based on human consumption of water and organisms: 0.000064 µg/L (evaluated on annual average basis).	Relevant and appropriate to surface water in Rest of River.	Model indicates that SED 10 would not achieve chronic aquatic life criterion in MA, but would in CT. Where not achieved, this criterion should be waived under CERCLA and NCP on ground that actions necessary to achieve it would result in greater risk to the environment than SED 10 (CERCLA § 121(d)(4)(B); 40 CFR § 300.430(f)(1)(ii)(C)*(2)*). See Revised CMS Report, Section 6.10.4. Model also indicates that SED 10 would not achieve human health criterion in any reaches. That criterion should be waived under CERCLA and NCP as technically impracticable to attain (CERCLA § 121(d)(4)(C); 40 CFR § 300.430(f)(1)(ii)(C)*(3)*) because it is below current ability to measure and would not achieved by any sediment alternative. See Revised CMS Report, Sections 6.1.4 and 6.10.4.
State ARARs				
Numeric Massachusetts water quality criteria for PCBs	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless MDEP establishes site-specific criterion or determines that naturally occurring background concentrations are higher). Note: Housatonic River in Masachusetts is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and pathogens.	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal water quality criteria.

Table S-10.a: Alternative SED 10 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Numeric Connecticut water quality criteria for PCBs	*Connecticut Water Quality Standards* (effective Dec. 17, 2002), Appendix D	Freshwater chronic aquatic life criterion: 0.014 µg/L (same as federal criterion). Human health criterion, based on human consumption of organisms only or water and organisms: 0.00017 µg/L. (This criterion is not an ARAR as noted in next column. CT DEP has proposed to revise this criterion to 0.00000056 µg/L, but that revision has not been adopted.) Note: Housatonic River in Connecticut is listed on Impaired Waters List under § 303(d) of Clean Water Act due to PCBs and, in some stretches, e-coli.	Chronic aquatic life criterion is applicable to surface water of Housatonic River in Connecticut. Current CT human health criterion is not an ARAR since it is less stringent (and less up-to-date) than comparable federal criterion (see 40 CFR 300.5).	CT 1-D Analysis indicates that SED 10 would achieve chronic aquatic life criterion in CT impoundments. The current CT human health criterion is not an ARAR.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Develop-ment, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting remedy for Rest of River.

Table S-10.a: Alternative SED 10 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting remedy for Rest of River.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting remedy for Rest of River.
Massachusetts fish consumption advisory	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any fish from the Housatonic River from Dalton to Sheffield due to PCBs; also includes frogs and turtles. Note: MDPH has also issued a state-wide fish consumption advisory for certain sensitive groups based on mercury in fish.	To be considered.	SED 10 includes continuation and maintenance of this advisory, including appropriate steps to inform anglers about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	SED 10 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table S-10.a: Alternative SED 10 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Connecticut fish consumption advisory	Connecticut Department of Public Health (CDPH), 2006 Advisory for Eating Fish from Connecticut Waterbodies	Establishes advisories on consuming fish from the Housatonic R. in Connecticut (above Derby Dam), including Lakes Lillinonah, Zoar, and Housatonic, due to PCBs in fish. Advisories vary by species, location, and group of consumers (i.e., high-risk vs. low-risk group), ranging from "do not eat" to "one meal per week." Note: CDPH has also issued a state-wide advisory of one meal per month (for high-risk group) or one meal per week (for low-risk group) due to mercury in fish.	To be considered.	SED 10 includes continuation and maintenance of these advisories, including appropriate steps to inform anglers about the advisories, for as long as considered necessary by the CDPH.

Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	(a) There are no sediment/riverbank remediation alternatives (apart from MNR) with less adverse impact on aquatic ecosystem than SED 10. (b) SED 10 would not meet requirement that discharge not contribute to violation of state water quality standards, since Housatonic River does not currently meet numerical MA water quality criteria for PCBs; hence, that requirement should be waived as technically impracticable to attain. (c) Review of available information indicates that SED 10 would not affect any federally listed T&E species. (d) While SED 10 would cause adverse effects on aquatic life, aquatic ecosystem, and recreational and aesthetic values, those effects would be less than those of all other sediment/riverbank alternatives involvimg removal. See Revised CMS Report, Sections 6.10.5.3 and 6.10.8. (e) SED 10 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on aquatic ecosystem. Despite such steps, SED 10 would have adverse effects on the aquatic ecosystem, as noted above. However, those adverse impacts would be less than those of all other sediment/riverbank alternatives involving removal.

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to waters of the U.S. (including wetlands that constitute such waters)	Where SED 10 would have unavoidable adverse impacts on the aquatic ecosystem, these regulations would require a compensatory mitigation plan to address those impacts. Even if such a plan were implemented, adverse effects would occur. See Revised CMS Report, Sections 6.10.5.3 and 6.10.8. However, those adverse effects would be less than those of all other sediment/riverbank alternatives involving removal.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to dredging in, and discharge of dredge and fill material to, navigable waters of the U.S., but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding work in Housatonic River.
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to work in river.	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some excavated materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	In the unlikely event that some excavated materials were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA; URS Corporation, March 13, 2008).

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by SED 10 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of SED 10, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody (below high water mark). Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (9.37) and standards for dredging (9.40), including prohibition on dredging in an Area of Critical Environmental Concern (ACEC) except for sole purpose of fisheries or wildlife enhancement. Also requires compliance with other specified environmental regulatory programs (9.33).	Applicable to excavation/removal of sediments from Housatonic River, placement of caps in river, and placement of structures in river below high water mark to aid in excavation, address erosion, or restore habitat.	SED 10 would not comply with the prohibition on dredging in an ACEC. SED 4 would be designed to meet the other specified standards and requirements of these regulations. (The other relevant environmental regulatory programs referenced in Section 9.33 are discussed separately in these ARARs tables.)

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for SED 10.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: (a) no dredging is allowed if there is practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse effects on land under water; (c) dredging must be conducted to meet performance standards designed to minimize impacts on the aquatic ecosystem and protect human health; and (d) placement of dredged material in an intermediate facility for sediment management (dewatering, processing, etc.) prior to disposal or reuse must meet certain requirements, including requirements governing method of placement/storage of dredged material and siting criteria.	Applicable to excavation/removal of sediments and bank soils, discharge of dredged or fill material to waters or wetlands, and dredged material management at temporary staging areas.	As noted above, there are no sediment/riverbank remediation alternatives (apart from MNR) with less adverse impact on wetlands than SED 10. SED 10 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on land under water and on wetlands. Further, under SED 10, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), stormwater discharges would be controlled through BMPs, and it is unlikely that there would be substantial adverse impacts to the integrity of surface waters. However, SED 10 would adversely affect estimated habitat of rare wildlife species, because all excavation and supporting activities would occur within such habitat (see Figure S-10). Hence, the prohibition on actions with such effects would not be met. Excavation activities under SED 10 would be designed to meet the specified dredging performance standards to the extent practical, but would not avoid some adverse impacts on the aquatic ecosystem. The temporary staging areas may not meet the requirements that intermediate facilities cannot have a permanent adverse impact on a state-listed rare species or on an ACEC. All temporary staging areas under SED 10 would be located in state-mapped Priority Habitat of rare species (see Figure S-10) and in the Upper Housatonic ACEC, and the permanence of their impacts would depend on the uncertain success of restoration. The staging areas would meet the other placement and siting requirements for intermediate facilities.

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to SED 10 response actions that take place in waterbodies or in or within 100 feet (buffer zone) of stream/pond banks or wetlands or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since SED 10 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ There are no sediment/riverbank remediation alternatives (apart from MNR) with less adverse impact on wetlands than SED 10. ▪ SED 10 would include practicable measures to minimize impacts to resource areas, including actions to minimize impact of hydrological changes during construction, control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. In addition, SED 10 is not anticipated to produce any significant loss of flood storage capacity of floodplain or to cause an increase in flood stage or velocities on river. ▪ SED 10 would adversely affect estimated habitat of rare wildlife species, because all excavation and supporting activities would occur within such habitat (see Figure S-10). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. However, SED 10 would have less adverse impact on such habitat than the other sediment/riverbank alternatives involving removal. In addition, if SED 10 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts Dam Safety Standards	302 CMR 10.00	Regulations establish design and construction criteria for new and existing dams (302 CMR 10.14) and requirements for periodic inspections of dams (302 CMR 10.07). These regulations exclude dams subject to regulation by the Federal Energy Regulatory Commission (FERC) (302 CMR 10.04).	Applicable to existing GE-owned dams on River in Massachusetts. Not applicable to other existing dams in Rest of River in Massachusetts, because those dams are subject to regulation by FERC, which preempts application of these state dam safety standards. In any case, even if these standards were relevant to non-GE-owned dams, they would relate to responsibilities of those dam owners and are not ARARs for SED 10.	GE will meet these requirements at dams that it owns (Woods Pond Dam and Rising Pond Dam). Not applicable to other dams in Rest of River in Massachusetts.
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile or surface impoundment may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the hazardous waste.	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute state hazardous waste subject to these standards. Further, even if some excavated ***sediments*** did constitute such hazardous waste, these requirements would not apply to temporary staging areas for such ***sediments***, due to exemption from hazardous waste regulations for dredged materials temporarily stored at	In the unlikely event that some excavated bank soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain, given the need for staging areas to be near the river. In such cases, that requirement should be waived as technically impracticable to attain. The requirement for floodproofing tanks, containers, and similar units used to store hazardous waste (if any) would be met.

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)) (see Table S-10.c). However, if some excavated ***bank soils*** were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which SED 10 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
Connecticut Dam Safety Requirements	Conn. Gen. Stat. 22a-401 to 22a-411 Conn. Agencies Regs. Sec. 22a-409-2	Requirements for registration of certain types of dams; periodic inspections of dams; maintenance activities; construction, repair, replacement, or removal of dams; and notifications to CT DEP of sudden or unpredicted floods or major changes in condition of dams.	Not applicable to existing dams on River in Connecticut, because all such dams are subject to FERC regulation, which preempts application of these state dam requirements. In any case, even if these requirements were relevant, they would relate to responsibilities of the dam owners and are not ARARs for SED 10.	Not applicable.
Connecticut Inland Wetlands and Watercourses Act and regulations	Conn. Gen. Stat. 22a-36 *et seq*. Conn. Agencies Regs. Sec. 22a-39-4	Permit required from local (municipal) wetland agency for activities that remove material from inland wetlands or watercourses; CT DEP allowed to issue general permit for minor activities with minimal environmental impacts, defined to include monitoring and sampling (Conn. Gen. Stat. 22a-45a). No substantive standards provided.	Relevant and appropriate to sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on sampling in Connecticut portion of river.

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Table S-10.b: Alternative SED 10 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	There is no sediment/riverbank remediation alternative (apart from MNR) that would avoid construction in wetlands. However, SED 10 would have less adverse impact on wetlands than all other sediment/riverbank alternatives involving removal. SED 10 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands.
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	SED 10 would involve construction of access roads and staging areas in the floodplain. Since these facilities must be located near sediment removal areas, they cannot be relocated to avoid any construction in the floodplain. However, there are no sediment/riverbank remediation alternatives (apart from MNR) with less adverse impact on the floodplain than SED 10. SED 10 would include practicable measures to minimize harm to the floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of the floodplain.

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing sediments and soils. Options include self-implementing provisions (not applicable to sediments) and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated Housatonic River sediments and bank soils with PCBs ≥ 50 ppm).	It is anticipated that, if SED 10 is selected, these requirements would be met through EPA determination that SED 10 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	Water treatment facilities would be designed to meet this requirement.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table S-10.b.

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L. for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including construction of access roads and temporary staging areas, bank remediation, and temporary staging of excavated materials at staging areas.

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** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that SED 10 would not adversely affect any federally listed T&E species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or bank soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some excavated materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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<u>Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs</u> *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for less than 90 day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, excavated materials do not constitute RCRA hazardous waste. However, if some sediments removed in the wet did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such dredged sediments.	In the unlikely event that any sediments removed in the wet were found to constitute RCRA hazardous waste, any tanks used for < 90-day accumulation of such dredged sediments would meet these requirements.
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated materials do not constitute RCRA hazardous waste. Further, even if some materials did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subparts J, K, and L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in tanks (Subpart J), surface impoundments (Subpart K) and waste piles outside structures (Subpart L). Note: In addition to the requirements for waste piles, the requirements relating to tanks and surface impoundments are identified due to the possibility that such types of facilities would be used at the		In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles, tanks, or surface impoundments used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While the waste piles and surface inpoundments (if any) would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		temporary staging areas for holding of liquid sediments removed from Woods Pond in the wet.	staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to these types of facilities used for staging of those materials.	collection system at "new waste pile units" and "new surface impoundment units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated materials were found to constitute RCRA hazardous waste, and if such materials were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: Listed as location-specific ARAR in Table S-10.b, but also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table S-10.b.	Applicable to excavation/removal of sediments, discharge of dredged or fill material to waters and wetlands, and temporary staging areas for excavated sediments.	Same as described for these regulations in Table S-10.b.
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	SED 10 would include use of stormwater BMPs during construction of access roads and staging areas, bank soil removal and stabilization, and operation of staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards and would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible for BMPs for bank remediation and in areas (if any) where there is no practical alternative to siting the staging areas in or adjacent to wetlands. Stormwater BMPs would not be necessary or practical for sediment excavation or thin-layer capping, since those activities would take place within the River. Any applicable stormwater management requirements that could not practicably be met should be waived as technically impracticable.

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All excavation and supporting activities in SED 10 would occur within Priority Habitat, as shown on Figure S-10. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 17 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.")	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated sediments or bank soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils subject to removal would be conducted during design to confirm that result.

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		The state hazardous waste management regulations also exempt dredged material (even if it constitutes non-PCB state hazardous waste) that is temporarily stored at an intermediate facility (pursuant to 314 CMR 9.07(4)) and managed in accordance with a state water quality certification and § 404 requirements under the Clean Water Act (see 310 CMR 30.104(3)(f)).		
Note: It is not expected that the excavated materials would constitute non-PCB state hazardous waste. However, for ***sediments***, even if some excavated sediments did constitute such hazardous waste, the following Massachusetts hazardous waste management requirements are considered inapplicable to temporary staging areas for such sediments due to the exemption from the hazardous waste regulations for dredged materials temporarily stored at an intermediate facility and managed under state water quality certification and § 404 of Clean Water Act (310 CMR 30.104(3)(f)). Hence, these requirements have been evaluated based solely on their potential applicability to temporary staging areas that are used for excavated ***bank soils***.				
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			excavated bank soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table S-10.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated materials do not constitute non-PCB state hazardous waste. However, if some excavated bank soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain (given the need for proximity to the river) or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (d) it is not certain whether some areas could be designed and constructed with a 200-foot buffer zone to fenceline. Any such requirements that could not feasibly be met should be waived as technically impracticable to attain.
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while these areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				have such systems capable of preventing flow onto those areas, or controlling runoff, during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable, could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable to attain.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated bank soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements because they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
Connecticut Endangered Species Act	Conn. Gen. Stat. 26-303 through 26-316	Requires state agency to: (a) ensure that any action authorized or performed by it does not threaten the continued existence of a listed endangered or threatened species or result in destruction or adverse modification of habitat essential to such species, unless an exemption is granted; and (b) take all reasonable measures to mitigate any	This statute is not applicable or relevant and appropriate to SED 10 because implementation of SED 10 is not expected to have any adverse impact on endangered or	Not applicable.

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Table S-10.c: Alternative SED 10 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		adverse impacts of the proposed action on such species or habitat. Prohibits "taking" of endangered or threatened species, except where State determines that a proposed action would not appreciably reduce likelihood of survival or recovery of the species.	threatened species or their habitat in Connecticut, or to cause a "taking" of such species.	
Connecticut fisheries and game laws	Conn. Gen. Stat. 26-60	Authorizes CT DEP to issue permits to properly accredited persons for sampling of fish, crustaceans, and wildlife for educational and scientific purposes, with CT DEP to determine number, species, area, and method of collection.	Relevant and appropriate to biota sampling in Connecticut portion of Housatonic River, but no permit required.	Would be attained through coordination with CT DEP on biota sampling in Connecticut portion of river.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of SED 10.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an area of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated sediments or bank soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Floodplain Alternative Tables

Table F-1.a: Alternative FP 1 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

Table F-1.a: Alternative FP 1 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles)	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	Would be considered in FP 1 through continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	Would be considered in FP 1 through continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-1.b: Alternative FP 1 – Potential Location-Specific ARARs

Statute/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
None				

Table F-1.c: Alternative FP 1 – Potential Action-Specific ARARs

Statute/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
None				

Table F-2.a: Alternative FP 2 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

<u>**Table F-2.a: Alternative FP 2 – Potential Chemical-Specific ARARs**</u>

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles)	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	FP 2 includes continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	FP 2 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-2.b: Alternative FP 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem (including wetlands), or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	(a) There are no floodplain remediation alternatives (apart from no action) with less adverse impact on aquatic ecosystem (including wetlands) than FP 2 and FP 9 (which would have comparable impacts). (b) FP 2 would not be expected to cause or contribute to violation of state water quality or toxic effluent standards. (c) Review of available information indicates that FP 2 would not affect any federally listed T&E species. (d) While FP 2 would cause adverse impacts on wetlands (as part of aquatic ecosystem), those effects would be less than the effects of the other floodplain removal alternatives due to relatively small amount of wetlands affected (~ 1.5% of forested wetlands and < 1% of other wetlands in PSA; see Revised CMS Report, Section 7.2.5.3). (e) FP 2 would include appropriate and practicable steps to minimize or mitigate potential adverse effects on wetlands. Despite such steps, FP 2 would have some adverse effects on wetlands, as noted above. However, those adverse impacts would be less than those of the other floodplain removal alternatives (except FP 9, which would have comparable effects).

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Table F-2.b: Alternative FP 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	Where FP 2 would have unavoidable adverse impacts on wetlands (as part of aquatic ecosystem) after all practical steps have been taken to avoid or minimize such impacts, these regulations would require a compensatory mitigation plan to address those impacts. Even if such a plan were implemented, adverse effects would occur. See Revised CMS Report, Sections 7.2.5.3 and 7.2.8. However, those adverse effects would be less than those of all other floodplain alternatives involving removal (except FP 9, which would have comparable effects).
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some excavated soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside	In the unlikely event that some excavated soils were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.

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Table F-2.b: Alternative FP 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by FP 2 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of FP 2, it is anticipated that EPA would notify DOI as required.

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Table F-2.b: Alternative FP 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for FP 2.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	There are no floodplain remediation alternatives (apart from no action) with less adverse impact on wetlands (as part of aquatic ecosystem) than FP 2 and FP 9 (which would have comparable impacts). FP 2 would include appropriate and practicable steps to avoid, minimize, or mitigate potential adverse effects on wetlands. Further, under FP 2, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), stormwater discharges would be controlled through BMPs, and there would be no substantial adverse impacts to the integrity of surface waters. However, FP 2 would adversely affect estimated habitat of rare wildlife species because all excavation and most supporting activities would occur within such habitat (see Figure F-2). Hence, the prohibition on actions with such effects would not be met.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only	Applicable to FP 2 response actions that take place in or within 100 feet (buffer zone) of stream/pond banks or wetlands (buffer zone) or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since FP 2 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ There are no floodplain remediation alternatives (apart from no action) with less impact on resource areas than FP 2 and FP 9 (which would have comparable effects). ▪ FP 2 would include practicable measures to avoid or minimize impacts to resource areas, including control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. In addition, FP 2 is not anticipated to have any significant effect on

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Table F-2.b: Alternative FP 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.		flood storage capacity of floodplain. ▪ FP 2 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-2). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. However, FP 2 would have less adverse impact on such habitat than the other floodplain removal alternatives (except FP 9, which would have comparable effects). In addition, if FP 2 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or that impairs such wetlands within an Area of Critical Environmental Concern (ACEC) (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including the requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute state hazardous waste subject to these standards (see Table F-2.c). However, if some excavated soils were found to constitute such hazardous waste, these requirements would apply to temporary	In the unlikely event that some excavated soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain.

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Table F-2.b: Alternative FP 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			staging areas for such waste.	
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which FP 2 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.

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Table F-2.b: Alternative FP 2 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	There is no floodplain remediation alternative (apart from no action) that would avoid some construction in wetlands. However, FP 2 would have less adverse impact on wetlands than all other floodplain removal alternatives (except FP 9, which would have comparable effects). FP 2 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands.
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 2 would involve excavation of soils and construction of access roads and staging areas in the floodplain. However, apart from no action, there is no floodplain alternative that would avoid adverse effects on floodplain, and FP 2 would have less adverse impact on wetlands than all other floodplain removal alternatives (except FP 9, which would have comparable effects). FP 2 would include practicable measures to minimize harm to floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of floodplain.

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<u>Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs</u> *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing soils. Options include self-implementing provisions and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated floodplain soils with PCBs ≥ 50 ppm).	It is anticipated that, if FP 2 is selected, these requirements would be met through an EPA determination that FP 2 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for a few of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	If floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Water treatment facilities would be designed to meet this requirement.

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Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	If excavated floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including soil excavation, construction of access roads and temporary staging areas, and temporary staging of excavated soils at those areas.

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<u>Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs</u> *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that FP 2 would not adversely affect any federally listed T&E species or their habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute RCRA hazardous waste. However, if some excavated soils did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's AOC policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subpart L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.		In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for a few of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.

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Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: These were listed as location-specific ARAR in Table F-2.b, but are also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table F-2.b.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	Same as described for these regulations in Table F-2.b.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-2.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	FP 2 would include use of stormwater BMPs during construction of access roads and staging areas and at the excavation areas and temporary staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands to the extent practical.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in a state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All excavation activities, as well as most access roads and temporary staging areas, in FP 2 would occur within Priority Habitat, as shown on Figure F-2. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 18 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.

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<u>Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs</u> *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs ≥ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.")	Applicable to determining whether excavated floodplain soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated floodplain soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table F-2.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) while an effort would be made to design and construct the areas with a 200-foot buffer zone to the fenceline, it is not certain that this would be feasible in all cases. Any such requirements that could not feasibly be met should be waived as technically impracticable.

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Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while the staging areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable. could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table F-2.c: Alternative FP 2 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of FP 2.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table F-3.a: Alternative FP 3 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

Table F-3.a: Alternative FP 3 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles)	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	FP 3 includes continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	FP 3 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-3.b: Alternative FP 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem, including wetlands; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem (including wetlands), or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	(a) There are practicable floodplain remediation alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. (b) FP 3 would not be expected to cause or contribute to violation of state water quality or toxic effluent standards. (c) Review of available information indicates that FP 3 would not affect any federally listed T&E species. (d) FP 3 would cause significant adverse effects on wetlands, as described in the Revised CMS Report (Sections 7.3.5.3 and 7.3.8). Hence, the prohibition on actions with such effects would not be met. (e) FP 3 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on wetlands. Despite such steps, however, FP 3 would have substantial adverse effects on wetlands, as noted above.

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Table F-3.b: Alternative FP 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	Where FP 3 would have unavoidable adverse impacts on wetlands (as part of aquatic ecosystem), these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 7.3.5.3 and 7.3.8.
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some excavated soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside	In the unlikely event that some excavated soils were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.

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Table F-3.b: Alternative FP 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by FP 3 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of FP 3, it is anticipated that EPA would notify DOI as required.

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Table F-3.b: Alternative FP 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for FP 3	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	(a) As noted above, there are practicable floodplain remediation alternatives with less adverse impact on wetlands (e.g., FP 2 and FP 9). Hence, the requirement that there be no such alternative would not be met. (b) FP 3 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on wetlands, but such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 7.3.5.3 and 7.3.8). (c) FP 3 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-3). In addition, FP 3 would involve discharges of dredged or fill material to a number of certified vernal pools in the PSA, which constitute Outstanding Resource Waters. Thus, the prohibition on actions that would affect these types of areas would not be met. (d) Stormwater discharges would be controlled through BMPs. (e) FP 3 would cause substantial long-term adverse impacts to the integrity of surface waters – e.g., through its impacts on vernal pools. Thus, the prohibition on actions with such impacts would not be met.

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Table F-3.b: Alternative FP 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to FP 3 response actions that take place in or within 100 feet (buffer zone) of stream/pond banks or wetlands (buffer zone) or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since FP 3 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ Since there are practicable floodplain remediation alternatives that would be less damaging to resource areas (e.g., FP 2 and FP 9), the requirement that there be no such practicable alternative would not be met. ▪ FP 3 would include practicable measures to minimize impacts to resource areas, including control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 7.3.5.3 and 7.3.8), these measures would not prevent adverse impacts on resource areas. FP 3 is not anticipated to have any significant effect on flood storage capacity of floodplain. ▪ FP 3 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-3). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if FP 3 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or that impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).

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Table F-3.b: Alternative FP 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including the requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute state hazardous waste subject to these standards (see Table F-3.c). However, if some excavated soils were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	In the unlikely event that some excavated soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which FP 3 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table F-3.b: Alternative FP 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 3 would involve construction in wetlands. While there may be no practicable alternative (other than no action) to some work in wetlands, there are practicable alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. FP 3 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 7.3.5.3 and 7.3.8.

* ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table F-3.b: Alternative FP 3 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 3 would involve excavation of soils and construction of access roads and staging areas in the floodplain. While there may be no practicable alternative (other than no action) that would avoid any effect on the floodplain, there are practicable alternatives with fewer adverse effects on the floodplain – e.g., FP 2 and FP 9. Hence, the requirement that there be no such practicable alternative would not be met. FP 3 would include practicable measures to minimize harm to the floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of the floodplain, and maintenance of existing flood storage capacity of the floodplain. However, restoration measures would not prevent substantial harm to the floodplain, as discussed in the Revised CMS Report, Sections 7.3.5.3 and 7.3.8.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing soils. Options include self-implementing provisions and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated floodplain soils with PCBs ≥ 50 ppm).	It is anticipated that, if FP 3 is selected, these requirements would be met through an EPA determination that FP 3 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	If floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Water treatment facilities would be designed to meet this requirement.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	If excavated floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including soil excavation, construction of access roads and temporary staging areas, and temporary staging of excavated soils at those areas.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that FP 3 would not adversely affect any federally listed T&E species or their habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute RCRA hazardous waste. However, if some excavated soils did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's AOC policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subpart L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.		In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: Listed as location-specific ARAR in Table F-3.b, but also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table F-3.b.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	Same as described for these regulations in Table F-3.b.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	FP 3 would include use of stormwater BMPs during construction of access roads and staging areas and at the excavation areas and temporary staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible in areas where the soil removal would take place within or adjacent to wetlands or in areas (if any) where there is no practical alternative to siting the staging areas in or adjacent to wetlands. In such cases, the setback requirement should be waived as technically impracticable to meet.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All excavations and most access roads and temporary staging areas in FP 3 would occur within Priority Habitat, as shown on Figure F-3. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 26 state-listed species. Thus, the prohibition on a "take" would not be met.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs ≧ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.)	Applicable to determining whether excavated floodplain soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated floodplain soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table F-3.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) while an effort would be made to design and construct the areas with a 200-foot buffer zone to the fenceline, it is not certain that this would be feasible in all cases. Any such requirements that could not feasibly be met should be waived as technically impracticable.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while the staging areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable. could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-3.b.

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Table F-3.c: Alternative FP 3 – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of FP 3.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table F-4.a: Alternative FP 4 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

Table F-4.a: Alternative FP 4 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles)	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	FP 4 includes continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	FP 4 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-4.b: Alternative FP 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem, including wetlands; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem (including wetlands), or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	(a) There are practicable floodplain remediation alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. (b) FP 4 would not be expected to cause or contribute to violation of state water quality or toxic effluent standards. (c) Review of available information indicates that FP 4 would not affect any federally listed T&E species. (d) FP 4 would cause significant adverse effects on wetlands, as described in the Revised CMS Report (Sections 7.4.5.3 and 7.4.8). Hence, the prohibition on actions with such effects would not be met. (e) FP 4 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on wetlands. Despite such steps, however, FP 4 would have substantial adverse effects on wetlands, as noted above.

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Table F-4.b: Alternative FP 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	Where FP 4 would have unavoidable adverse impacts on wetlands (as part of aquatic ecosystem), these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 7.4.5.3 and 7.4.8.
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some excavated soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside	In the unlikely event that some excavated soils were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.

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Table F-4.b: Alternative FP 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by FP 4 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of FP 4, it is anticipated that EPA would notify DOI as required.

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Table F-4.b: Alternative FP 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for FP 3	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	(a) As noted above, there are practicable floodplain remediation alternatives with less adverse impact on wetlands (e.g., FP 2 and FP 9). Hence, the requirement that there be no such alternative would not be met. (b) FP 4 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on wetlands, but such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 7.4.5.3 and 7.4.8). (c) FP 4 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-4). In addition, FP 4 would involve discharges of dredged or fill material to a number of certified vernal pools in the PSA, which constitute Outstanding Resource Waters. Thus, the prohibition on actions that would affect these types of areas would not be met. (d) Stormwater discharges would be controlled through BMPs. (e) FP 4 would cause substantial long-term adverse impacts to the integrity of surface waters – e.g., through its impacts on vernal pools. Thus, the prohibition on actions with such impacts would not be met.

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Table F-4.b: Alternative FP 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to FP 4 response actions that take place in or within 100 feet (buffer zone) of stream/pond banks or wetlands (buffer zone) or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since FP 4 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ Since there are practicable floodplain remediation alternatives that would be less damaging to resource areas (e.g., FP 2 and FP 9), the requirement that there be no such practicable alternative would not be met. ▪ FP 4 would include practicable measures to minimize impacts to resource areas, including control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 7.4.5.3 and 7.4.8), these measures would not prevent adverse impacts on resource areas. FP 4 is not anticipated to have any significant effect on flood storage capacity of floodplain. ▪ FP 4 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-4). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if FP 4 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or that impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).

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Table F-4.b: Alternative FP 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including the requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute state hazardous waste subject to these standards (see Table F-4.c). However, if some excavated soils were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	In the unlikely event that some excavated soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which FP 4 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.

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Table F-4.b: Alternative FP 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 4 would involve construction in wetlands. While there may be no practicable alternative (other than no action) to some work in wetlands, there are practicable alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. FP 4 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 7.4.5.3 and 7.4.8.

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Table F-4.b: Alternative FP 4 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 4 would involve excavation of soils and construction of access roads and staging areas in the floodplain. While there may be no practicable alternative (other than no action) that would avoid any effect on the floodplain, there are practicable alternatives with fewer adverse effects on the floodplain – e.g., FP 2 and FP 9. Hence, the requirement that there be no such practicable alternative would not be met. FP 4 would include practicable measures to minimize harm to the floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of the floodplain, and maintenance of existing flood storage capacity of the floodplain. However, restoration measures would not prevent substantial harm to the floodplain, as discussed in the Revised CMS Report, Sections 7.4.5.3 and 7.4.8.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing soils. Options include self-implementing provisions and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated floodplain soils with PCBs ≥ 50 ppm).	It is anticipated that, if FP 4 is selected, these requirements would be met through an EPA determination that FP 4 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allows for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	If floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Water treatment facilities would be designed to meet this requirement.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	If excavated floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including soil excavation, construction of access roads and temporary staging areas, and temporary staging of excavated soils at those areas.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that FP 4 would not adversely affect any federally listed T&E species or their habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute RCRA hazardous waste. However, if some excavated soils did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's AOC policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subpart L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.		In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: Listed as location-specific ARAR in Table F-4.b, but also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table F-4.b.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	Same as described for these regulations in Table F-4.b.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	FP 4 would include use of stormwater BMPs during construction of access roads and staging areas and at the excavation areas and temporary staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25-feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible in areas where the soil removal would take place within or adjacent to wetlands or in areas (if any) where there is no practical alternative to siting the staging areas in or adjacent to wetlands. In such cases, the setback requirement should be waived as technically impracticable to meet.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All excavations and most access roads and temporary staging areas in FP 4 would occur within Priority Habitat, as shown on Figure F-4. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 26 state-listed species. Thus, the prohibition on a "take" would not be met.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-4.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.)	Applicable to determining whether excavated floodplain soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated floodplain soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table F-4.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) while an effort would be made to design and construct the areas with a 200-foot buffer zone to the fenceline, it is not certain that this would be feasible in all cases. Any such requirements that could not feasibly be met should be waived as technically impracticable.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while the staging areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable. could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table F-4.c: Alternative FP 4 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of FP 4.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered “placement,” such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated soils should constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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<u>**Table F-5.a: Alternative FP 5 – Potential Chemical-Specific ARARs**</u>

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

Table F-5.a: Alternative FP 5 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	FP 5 includes continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	FP 5 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-5.b: Alternative FP 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem, including wetlands; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem (including wetlands), or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	(a) There are practicable floodplain remediation alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. (b) FP 5 would not be expected to cause or contribute to violation of state water quality or toxic effluent standards. (c) Review of available information indicates that FP 5 would not affect any federally listed T&E species. (d) FP 5 would cause significant adverse effects on wetlands, as described in the Revised CMS Report (Sections 7.5.5.3 and 7.5.8). Hence, the prohibition on actions with such effects would not be met. (e) FP 5 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on wetlands. Despite such steps, however, FP 5 would have substantial adverse effects on wetlands, as noted above.

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Table F-5.b: Alternative FP 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	Where FP 5 would have unavoidable adverse impacts on wetlands (as part of aquatic ecosystem), these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 7.5.5.3 and 7.5.8.
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some excavated soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside	In the unlikely event that some excavated soils were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.

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Table F-5.b: Alternative FP 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by FP 5 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of FP 5, it is anticipated that EPA would notify DOI as required.

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Table F-5.b: Alternative FP 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for FP 3	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	(a) As noted above, there are practicable floodplain remediation alternatives with less adverse impact on wetlands (e.g., FP 2 and FP 9). Hence, the requirement that there be no such alternative would not be met. (b) FP 5 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on wetlands, but such steps would not avoid substantial harm to these resource areas (see Revised CMS Report, Sections 7.5.5.3 and 7.5.8). (c) FP 5 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-5). In addition, FP 5 would involve discharge of dredged or fill material to at least one certified vernal pool in the PSA, which constitutes an Outstanding Resource Water. Thus, the prohibition on actions that would affect these types of areas would not be met. (d) Stormwater discharges would be controlled through BMPs. (e) FP 5 would cause substantial long-term adverse impacts to the integrity of surface waters – e.g., through its impacts on vernal pools. Thus, the prohibition on actions with such impacts would not be met.

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Table F-5.b: Alternative FP 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.50 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to FP 5 response actions that take place in or within 100 feet (buffer zone) of stream/pond banks or wetlands (buffer zone) or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since FP 5 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ Since there are practicable floodplain remediation alternatives that would be less damaging to resource areas (e.g., FP 2 and FP 9), the requirement that there be no such practicable alternative would not be met. ▪ FP 5 would include practicable measures to minimize impacts to resource areas, including control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 7.5.5.3 and 7.5.8), these measures would not prevent adverse impacts on resource areas. FP 5 is not anticipated to have any significant effect on flood storage capacity of floodplain. ▪ FP 5 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-5). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if FP 5 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or that impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).

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Table F-5.b: Alternative FP 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including the requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute state hazardous waste subject to these standards (see Table F-5.c). However, if some excavated soils were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	In the unlikely event that some excavated soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which FP 5 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met -- through the process identified in Phase IA CRA.

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Table F-5.b: Alternative FP 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 5 would involve construction in wetlands. While there may be no practicable alternative (other than no action) to some work in wetlands, there are practicable alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. FP 5 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 7.5.5.3 and 7.5.8.

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Table F-5.b: Alternative FP 5 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 5 would involve excavation of soils and construction of access roads and staging areas in the floodplain. While there may be no practicable alternative (other than no action) that would avoid any effect on the floodplain, there are practicable alternatives with fewer adverse effects on the floodplain – e.g., FP 2 and FP 9. Hence, the requirement that there be no such practicable alternative would not be met. FP 5 would include practicable measures to minimize harm to the floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of the floodplain, and maintenance of existing flood storage capacity of the floodplain. However, restoration measures would not prevent substantial harm to the floodplain, as discussed in the Revised CMS Report, Sections 7.5.5.3 and 7.5.8.

* ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing soils. Options include self-implementing provisions and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated floodplain soils with PCBs ≥ 50 ppm).	It is anticipated that, if FP 5 is selected, these requirements would be met through an EPA determination that FP 5 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allows for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	If floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Water treatment facilities would be designed to meet this requirement.

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Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	If excavated floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including soil excavation, construction of access roads and temporary staging areas, and temporary staging of excavated soils at those areas.

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<u>**Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs ***</u>

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that FP 5 would not adversely affect any federally listed T&E species or their habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute RCRA hazardous waste. However, if some excavated soils did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's AOC policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subpart L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.		In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.

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Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: Listed as location-specific ARAR in Table F-5.b, but also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table F-5.b.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	Same as described for these regulations in Table F-5.b.

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Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	FP 5 would include use of stormwater BMPs during construction of access roads and staging areas and at the excavation areas and temporary staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible in areas where the soil removal would take place within or adjacent to wetlands or in areas (if any) where there is no practical alternative to siting the staging areas in or adjacent to wetlands. In such cases, the setback requirement should be waived as technically impracticable to meet.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provisions (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR,	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All excavation and most access roads and temporary staging areas in FP 5 would occur within Priority Habitat, as shown on Figure F-5. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 21 state-listed species. Thus, the prohibition on a "take" would not be met.

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Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.)	Applicable to determining whether excavated floodplain soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated floodplain soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table F-5.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) while an effort would be made to design and construct the areas with a 200-foot buffer zone to the fenceline, it is not certain that this would be feasible in all cases. Any such requirements that could not feasibly be met should be waived as technically impracticable.

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Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while the staging areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable. could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-5.b.

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Table F-5.c: Alternative FP 5 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of FP 5.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table F-6.a: Alternative FP 6 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

Table F-6.a: Alternative FP 6 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles)	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	FP 6 includes continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	FP 6 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-6.b: Alternative FP 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem, including wetlands; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem (including wetlands), or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	(a) There are practicable floodplain remediation alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. (b) FP 6 would not be expected to cause or contribute to violation of state water quality or toxic effluent standards. (c) Review of available information indicates that FP 6 would not affect any federally listed T&E species. (d) FP 6 would cause significant adverse effects on wetlands, as described in the Revised CMS Report (Sections 7.6.5.3 and 7.6.8). Hence, the prohibition on actions with such effects would not be met. (e) While FP 6 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on wetlands, it would be impossible to prevent substantial adverse effects on wetlands, as noted above.

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Table F-6.b: Alternative FP 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	Where FP 6 would have unavoidable adverse impacts on wetlands (as part of aquatic ecosystem), these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 7.6.5.3 and 7.6.8.
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some excavated soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside	In the unlikely event that some excavated soils were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.

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Table F-6.b: Alternative FP 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by FP 6 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of FP 6, it is anticipated that EPA would notify DOI as required.

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Table F-6.b: Alternative FP 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for FP 3	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated “Outstanding Resource Waters,” including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	(a) As noted above, there are practicable floodplain remediation alternatives with less adverse impact on wetlands (e.g., FP 2 and FP 9). Hence, the requirement that there be no such alternative would not be met. (b) While FP 6 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on wetlands, such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 7.6.5.3 and 7.6.8). (c) FP 6 would adversely affect estimated rare wildlife species habitat, because virtually all excavation and most supporting activities would occur within such habitat (see Figure F-6). In addition, FP 6 would involve discharge of dredged or fill material to at least one certified vernal pool in the PSA, which constitutes an Outstanding Resource Water. Thus, the prohibition on actions that would affect these types of areas would not be met. (d) Stormwater discharges would be controlled through BMPs. (e) FP 6 would cause substantial long-term adverse impacts to the integrity of surface waters – e.g., through its impacts on venal pools. Thus, the prohibition on actions with such impacts would not be met.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q)	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a “limited project” if they: (a) have no practicable alternative, consistent with the MCP, that would be less	Applicable to FP 6 response actions that take place in or within 100 feet (buffer zone) of stream/pond banks or	Since FP 6 involves response actions, the requirements for “limited projects” would appear to apply. Under those requirements: ▪ Since there are practicable floodplain

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Table F-6.b: Alternative FP 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	wetlands (buffer zone) or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	remediation alternatives that would be less damaging to resource areas (e.g., FP 2 and FP 9), the requirement that there be no such practicable alternative would not be met. ▪ FP 6 would include practicable measures to minimize impacts to resource areas, including control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 7.6.5.3 and 7.6.8), these measures would not prevent adverse impacts on resource areas. FP 6 is not anticipated to have any significant effect on flood storage capacity of floodplain. ▪ FP 6 would adversely affect estimated rare wildlife species habitat, because virtually all excavation and most supporting activities would occur within such habitat (see Figure F-6). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if FP 6 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or that impairs such wetlands within an ACEC (10.55(4)) and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).

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Table F-6.b: Alternative FP 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including the requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute state hazardous waste subject to these standards (see Table F-6.c). However, if some excavated soils were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	In the unlikely event that some excavated soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which FP 6 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met -- through the process identified in Phase IA CRA.

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Table F-6.b: Alternative FP 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 6 would involve construction in wetlands. While there may be no practicable alternative (other than no action) to some work in wetlands, there are practicable alternatives with much less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. FP 6 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 7.6.5.3 and 7.6.8.

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Table F-6.b: Alternative FP 6 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 6 would involve excavation of soils and construction of access roads and staging areas in the floodplain. While there may be no practicable alternative (other than no action) that would avoid any effect on the floodplain, there are practicable alternatives with many fewer adverse effects on the floodplain – e.g., FP 2 and FP 9. Hence, the requirement that there be no such practicable alternative would not be met. FP 6 would include practicable measures to minimize harm to the floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of the floodplain, and maintenance of existing flood storage capacity of the floodplain. However, restoration measures would not prevent substantial harm to the floodplain, as discussed in the Revised CMS Report, Sections 7.6.5.3 and 7.6.8.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing soils. Options include self-implementing provisions and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated floodplain soils with PCBs ≥ 50 ppm).	It is anticipated that, if FP 6 is selected, these requirements would be met through an EPA determination that FP 6 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	If floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Water treatment facilities would be designed to meet this requirement.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	If excavated floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including soil excavation, construction of access roads and temporary staging areas, and temporary staging of excavated soils at those areas.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that FP 6 would not adversely affect any federally listed T&E species or their habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute RCRA hazardous waste. However, if some excavated soils did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's AOC policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subpart L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.		In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: Listed as location-specific ARAR in Table F-6.b, but also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table F-6.b.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	Same as described for these regulations in Table F-6.b.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	FP 6 would include use of stormwater BMPs during construction of access roads and staging areas and at the excavation areas and temporary staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible in the many areas where the soil removal would take place within or adjacent to wetlands or in areas (if any) where there is no practical alternative to siting the staging areas in or adjacent to wetlands. In such cases, the setback requirement should be waived as technically impracticable to meet.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	Virtually all of the excavations and most of the access roads and temporary staging areas in FP 6 would occur within Priority Habitat, as shown on Figure F-6. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 24 state-listed species. Thus, the prohibition on a "take" would not be met.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.)	Applicable to determining whether excavated floodplain soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated floodplain soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-6.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table F-6.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) while an effort would be made to design and construct the areas with a 200-foot buffer zone to the fenceline, it is not certain that this would be feasible in all cases. Any such requirements that could not feasibly be met should be waived as technically impracticable.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while the staging areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable. could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table F-6.c: Alternative FP 6 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of FP 6.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered “placement,” such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table F-7.a: Alternative FP 7 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

Table F-7.a: Alternative FP 7 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles)	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	FP 7 includes continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	FP 7 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-7.b: Alternative FP 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem, including wetlands; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem (including wetlands), or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	(a) There are practicable floodplain remediation alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. (b) FP 7 would not be expected to cause or contribute to violation of state water quality or toxic effluent standards. (c) Review of available information indicates that FP 7 would not affect any federally listed T&E species. (d) FP 7 would cause significant adverse effects on wetlands, as described in the Revised CMS Report (Sections 7.7.5.3 and 7.7.8). Hence, the prohibition on actions with such effects would not be met. (e) While FP 7 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on wetlands, it would be impossible to prevent substantial adverse effects on wetlands, as noted above.

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Table F-7.b: Alternative FP 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	Where FP 7 would have unavoidable adverse impacts on wetlands (as part of aquatic ecosystem), these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 7.7.5.3 and 7.7.8.
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some excavated soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside	In the unlikely event that some excavated soils were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.

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Table F-7.b: Alternative FP 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by FP 7 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of FP 7, it is anticipated that EPA would notify DOI as required.

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Table F-7.b: Alternative FP 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for FP 3	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	(a) As noted above, there are practicable floodplain remediation alternatives with less adverse impact on wetlands (e.g., FP 2 and FP 9). Hence, the requirement that there be no such alternative would not be met. (b) While FP 7 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on wetlands, such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 7.7.5.3 and 7.7.8). (c) FP 7 would adversely affect estimated rare wildlife species habitat, because it would involve extensive and widespread excavation and supporting activities within such habitat (see Figure F-7). In addition, FP 7 would involve discharges of dredged or fill material to a number of certified vernal pools in the PSA, which constitute Outstanding Resource Waters. Thus, the prohibition on actions that would affect these types of areas would not be met. (d) Stormwater discharges would be controlled through BMPs. (e) FP 7 would cause substantial long-term adverse impacts to the integrity of surface waters – e.g., through its impacts on vernal pools. Thus, the prohibition on actions with such impacts would not be met.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative,	Applicable to FP 7 response actions that take place in or within 100 feet (buffer zone) of	Since FP 7 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements:

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Table F-7.b: Alternative FP 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	stream/pond banks or wetlands (buffer zone) or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	▪ Since there are practicable floodplain remediation alternatives that would be less damaging to resource areas. (e.g., FP 2 and FP 9), the requirement that there be no such practicable alternative would not be met. ▪ FP 7 would include practicable measures to minimize impacts to resource areas, including control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 7.7.5.3 and 7.7.8), these measures would not prevent adverse impacts on resource areas. FP 7 is not anticipated to have any significant effect on flood storage capacity of floodplain. ▪ FP 7 would adversely affect estimated rare wildlife species habitat, because it would involve extensive and widespread excavation and supporting activities within such habitat (see Figure F-7). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if FP 7 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or that impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).

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Table F-7.b: Alternative FP 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including the requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute state hazardous waste subject to these standards (see Table F-7.c). However, if some excavated soils were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	In the unlikely event that some excavated soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which FP 7 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met -- through the process identified in Phase IA CRA.

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Table F-7.b: Alternative FP 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 7 would involve construction in wetlands. While there may be no practicable alternative (other than no action) to some work in wetlands, there are practicable alternatives with much less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. FP 7 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 7.7.5.3 and 7.7.8.

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Table F-7.b: Alternative FP 7 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 7 would involve excavation of soils and construction of access roads and staging areas in the floodplain. While there may be no practicable alternative (other than no action) that would avoid any effect on the floodplain, there are practicable alternatives with many fewer adverse effects on the floodplain – e.g., FP 2 and FP 9. Hence, the requirement that there be no such practicable alternative would not be met. FP 7 would include practicable measures to minimize harm to the floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of the floodplain, and maintenance of existing flood storage capacity of the floodplain. However, restoration measures would not prevent substantial harm to the floodplain, as discussed in the Revised CMS Report, Sections 7.7.5.3 and 7.7.8.

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<u>**Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs ***</u>

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing soils. Options include self-implementing provisions and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated floodplain soils with PCBs ≥ 50 ppm).	It is anticipated that, if FP 7 is selected, these requirements would be met through an EPA determination that FP 7 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	If floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Water treatment facilities would be designed to meet this requirement.

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	If excavated floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including soil excavation, construction of access roads and temporary staging areas, and temporary staging of excavated soils at those areas.

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that FP 7 would not adversely affect any federally listed T&E species or their habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute RCRA hazardous waste. However, if some excavated soils did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

<table>
<tr><th>Statute/Regulation</th><th>Citation **</th><th>Synopsis of Requirements</th><th>Status (Applicability/ Appropriateness)</th><th>Actions(s) To Be Taken To Achieve ARAR</th></tr>
<tr><td>RCRA regulations for hazardous waste management facilities – general requirements</td><td>40 CFR 264.1(j)</td><td>General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)</td><td rowspan="2">These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's AOC policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.</td><td>In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.</td></tr>
<tr><td>RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste</td><td>40 CFR Part 264, Subpart L</td><td>Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.</td><td>In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.</td></tr>
</table>

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: Listed as location-specific ARAR in Table F-7.b, but also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table F-7.b.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	Same as described for these regulations in Table F-7.b.

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	FP 7 would include use of stormwater BMPs during construction of access roads and staging areas and at the excavation areas and temporary staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible in the many areas where the soil removal would take place within or adjacent to wetlands or in areas (if any) where there is no practical alternative to siting the staging areas in or adjacent to wetlands. In such cases, the setback requirement should be waived as technically impracticable to meet.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	FP 7 would involve extensive excavations, as well as construction of access roads and staging areas, within Priority Habitat, as shown on Figure F-7. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 29 state-listed species. Thus, the prohibition on a "take" would not be met.

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.)	Applicable to determining whether excavated floodplain soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated floodplain soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table F-7.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) while an effort would be made to design and construct the areas with a 200-foot buffer zone to the fenceline, it is not certain that this would be feasible in all cases. Any such requirements that could not feasibly be met should be waived as technically impracticable.

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while the staging areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable. could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table F-7.c: Alternative FP 7 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of FP 7.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Table F-8.a: Alternative FP 8 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

Table F-8.a: Alternative FP 8 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles)	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	FP 8 includes continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	FP 8 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-8.b: Alternative FP 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem, including wetlands; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem (including wetlands), or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	(a) There are practicable floodplain remediation alternatives with less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. (b) FP 8 would not be expected to cause or contribute to violation of state water quality or toxic effluent standards. (c) Review of available information indicates that FP 8 would not affect any federally listed T&E species. (d) FP 8 would cause significant adverse effects on wetlands, as described in the Revised CMS Report (Sections 7.8.5.3 and 7.8.8). Hence, the prohibition on actions with such effects would not be met. (e) While FP 8 would include appropriate and practicable steps in an effort to minimize or mitigate potential adverse effects on wetlands, it would be impossible to prevent substantial adverse effects on wetlands, as noted above.

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Table F-8.b: Alternative FP 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	Where FP 8 would have unavoidable adverse impacts on wetlands (as part of aquatic ecosystem), these regulations would require a compensatory mitigation plan to address those impacts. However, even if such a plan were implemented, substantial adverse impacts would remain. See Revised CMS Report, Sections 7.8.5.3 and 7.8.8.
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some excavated soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside	In the unlikely event that some excavated soils were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.

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Table F-8.b: Alternative FP 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by FP 8 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of FP 8, it is anticipated that EPA would notify DOI as required.

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Table F-8.b: Alternative FP 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for FP 3	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated “Outstanding Resource Waters,” including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	(a) As noted above, there are practicable floodplain remediation alternatives with less adverse impact on wetlands (e.g., FP 2 and FP 9). Hence, the requirement that there be no such alternative would not be met. (b) While FP 8 would include appropriate and practicable steps in an effort to avoid, minimize, or mitigate potential adverse effects on wetlands, such steps would not prevent substantial harm to these resource areas (see Revised CMS Report, Sections 7.8.5.3 and 7.8.8). (c) FP 8 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-8). In addition, FP 8 would involve discharges of dredged or fill material to a number of certified vernal pools in the PSA, which constitute Outstanding Resource Waters. Thus, the prohibition on actions that would affect these types of areas would not be met. (d) Stormwater discharges would be controlled through BMPs. (e) FP 8 would cause substantial long-term adverse impacts to the integrity of surface waters – e.g., through its impacts on venal pools. Thus, the prohibition on actions with such impacts would not be met.

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Table F-8.b: Alternative FP 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are aitjprozed as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.	Applicable to FP 8 response actions that take place in or within 100 feet (buffer zone) of stream/pond banks or wetlands (buffer zone) or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since FP 8 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ Since there are practicable floodplain remediation alternatives that would be less damaging to resource areas (e.g., FP 2 and FP 9), the requirement that there be no such practicable alternative would not be met. ▪ FP 8 would include practicable measures to minimize impacts to resource areas, including control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. However, as discussed in the Revised CMS Report (Sections 7.8.5.3 and 7.8.8), these measures would not prevent massive adverse impacts on resource areas. FP 8 is not anticipated to have any significant effect on flood storage capacity of floodplain. ▪ FP 8 would adversely affect estimated rare wildlife species habitat, because all excavation and most supporting activities would occur within such habitat (see Figure F-8). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if FP 8 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands or that impairs such wetlands within an ACEC (10.55(4)) and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).

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Table F-8.b: Alternative FP 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including the requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute state hazardous waste subject to these standards (see Table F-8.c). However, if some excavated soils were found to constitute such hazardous waste, these requirements would apply to temporary staging areas for such waste.	In the unlikely event that some excavated soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which FP 8 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met -- through the process identified in Phase IA CRA.

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Table F-8.b: Alternative FP 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 8 would involve construction in wetlands. While there may be no practicable alternative (other than no action) to some work in wetlands, there are practicable alternatives with much less adverse impact on wetlands – e.g., FP 2 and FP 9. Hence, the requirement that there be no such alternative would not be met. FP 8 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands. However, restoration measures would not prevent substantial harm to wetlands, as discussed in the Revised CMS Report, Sections 7.8.5.3 and 7.8.8.

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Table F-8.b: Alternative FP 8 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 8 would involve excavation of soils and construction of access roads and staging areas in the floodplain. While there may be no practicable alternative (other than no action) that would avoid any effect on the floodplain, there are practicable alternatives with many fewer adverse effects on the floodplain – e.g., FP 2 and FP 9. Hence, the requirement that there be no such practicable alternative would not be met. FP 8 would include practicable measures to minimize harm to the floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of the floodplain, and maintenance of existing flood storage capacity of the floodplain. However, restoration measures would not prevent substantial harm to the floodplain, as discussed in the Revised CMS Report, Sections 7.8.5.3 and 7.8.8.

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Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing soils. Options include self-implementing provisions and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated floodplain soils with PCBs ≥ 50 ppm).	It is anticipated that, if FP 8 is selected, these requirements would be met through an EPA determination that FP 8 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	If floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Water treatment facilities would be designed to meet this requirement.

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Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	If excavated floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including soil excavation, construction of access roads and temporary staging areas, and temporary staging of excavated soils at those areas.

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Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that FP 8 would not adversely affect any federally listed T&E species or their habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute RCRA hazardous waste. However, if some excavated soils did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's AOC policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subpart L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.		In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for some staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.

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Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: Listed as location-specific ARAR in Table F-8.b, but also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table F-8.b.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	Same as described for these regulations in Table F-8.b.

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Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	FP 8 would include use of stormwater BMPs during construction of access roads and staging areas and at the excavation areas and temporary staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands where practicable, but setbacks would not be feasible in the many areas where the soil removal would take place within or adjacent to wetlands or in areas (if any) where there is no practical alternative to siting the staging areas in or adjacent to wetlands. In such cases, the setback requirement should be waived as technically impracticable to meet.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	All of the excavations and most of the access roads and temporary staging areas in FP 8 would occur within Priority Habitat, as shown on Figure F-8. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 26 state-listed species. Thus, the prohibition on a "take" would not be met.

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Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.)	Applicable to determining whether excavated floodplain soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated floodplain soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-8.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table F-8.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g) without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain or outside wetlands; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) while an effort would be made to design and construct the areas with a 200-foot buffer zone to the fenceline, it is not certain that this would be feasible in all cases. Any such requirements that could not feasibly be met should be waived as technically impracticable.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-8.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while the staging areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable. could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-8.b.

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Table F-8.c: Alternative FP 8 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of FP 8.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table F-8.b.

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Table F-9.a: Alternative FP 9 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	Used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing the Cancer Slope Factors used in EPA's Human Health Risk Assessment and in developing the human health IMPGs used in CMS. May be considered by EPA in selecting floodplain remedy for Rest of River.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	Draft of these guidelines was considered in EPA's Human Health Risk Assessment. EPA may consider final guidelines in selecting floodplain remedy for Rest of River.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	Draft of this guidance was considered in EPA's Human Health Risk Assessment. EPA may consider final guidance in selecting floodplain remedy for Rest of River.

Table F-9.a: Alternative FP 9 – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting floodplain remedy for Rest of River.
Massachusetts fish consumption advisory (also covers frogs and turtles)	Massachusetts Department of Public Health (MDPH), Center for Environmental Health, Freshwater Fish Consumption Advisory List (2007)	Advises that the public should not consume any frogs and turtles from the Housatonic River from Dalton to Sheffield due to PCBs.	To be considered.	FP 9 includes continuation and maintenance of this advisory, including appropriate steps to inform the public about the advisory, for as long as considered necessary by the MDPH.
Massachusetts waterfowl consumption advisory	Massachusetts Department of Public Health, Center for Environmental Health, Provisional Waterfowl Consumption Advisory (1999)	Advises that the public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments from Pittsfield south to Rising Pond.	To be considered.	FP 9 includes continuation and maintenance of this advisory, including appropriate steps to inform waterfowl hunters about the advisory, for as long as considered necessary by the MDPH.

Table F-9.b: Alternative FP 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem (including wetlands), or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	(a) There are no floodplain remediation alternatives (apart from no action) with less adverse impact on aquatic ecosystem (including wetlands) than FP 2 and FP 9 (which would have comparable impacts). (b) FP 9 would not be expected to cause or contribute to violation of state water quality or toxic effluent standards. (c) Review of available information indicates that FP 9 would not affect any federally listed T&E species. (d) While FP 9 would cause adverse impacts on wetlands (as part of aquatic ecosystem), those effects would be less than the effects of all other floodplain removal alternatives (except FP 2, which would have comparable effects) due to relatively small amount of wetlands affected (~ 1.7% of forested wetlands and < 1% of other wetlands in PSA; see Revised CMS Report, Section 7.9.5.3). (e) FP 9 would include appropriate and practicable steps to minimize or mitigate potential adverse effects on wetlands. Despite such steps, FP 9 would have some adverse effects on wetlands, as noted above. However, those adverse impacts would be less than those of all other floodplain alternatives involving removal (except FP 2, which would have comparable effects).

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Table F-9.b: Alternative FP 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S.	Where FP 9 would have unavoidable adverse impacts on wetlands (as part of aquatic ecosystem) after all practical steps have been taken to avoid or minimize such impacts, these regulations would require a compensatory mitigation plan to address those impacts. Even if such a plan were implemented, adverse effects would occur. See Revised CMS Report, Sections 7.9.5.3 and 7.9.8. However, those adverse effects would be less than those of all other floodplain alternatives involving removal (except FP 2, which would have comparable effects).
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some excavated soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's Area of Contamination (AOC) policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside	In the unlikely event that some excavated soils were found to constitute RCRA hazardous waste, these requirements would be met at any staging areas for such materials within 100-year floodplain but outside Rest of River boundary and not subject to AOC policy. For any such staging areas, procedures would be instituted to remove any hazardous waste safely before flood waters can reach those areas.

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Table F-9.b: Alternative FP 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			lateral boundary of Rest of River to which AOC policy would not apply, these requirements would be relevant and appropriate to such staging areas in 100-year floodplain.	
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.		Would be attained through process described in Section 6 of GE's *Initial Phase IA Cultural Resources Assessment for the Housatonic River – Rest of River Project* (Phase IA CRA: URS Corporation, March 13, 2008).
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	Identification of archaeological or historic data potentially affected by FP 9 would be made through process identified in Phase IA CRA. If such data are identified that could be irrevocably lost or destroyed by implementation of FP 9, it is anticipated that EPA would notify DOI as required.

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Table F-9.b: Alternative FP 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act) Note: These regulations are also listed as action-specific ARARs for FP 9.	314 CMR 9.01 - 9.08	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on bordering or isolated vegetated wetlands, including 1:1 restoration or replication of such wetlands (unless waived); (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under the Wetlands Protection Act or would be to certain designated "Outstanding Resource Waters," including certified vernal pools, unless a variance is obtained; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	There are no floodplain remediation alternatives (apart from no action) with less adverse impact on wetlands (as part of aquatic ecosystem) than FP 2 and FP 9 (which would have comparable impacts). FP 9 would include appropriate and practicable steps to avoid, minimize, or mitigate potential adverse effects on wetlands. Further, under FP 9, there would be no discharge to Outstanding Resource Waters (including certified vernal pools), stormwater discharges would be controlled through BMPs, and there would be no substantial adverse impacts to the integrity of surface waters. However, FP 9 would adversely affect estimated habitat of rare wildlife species because the great majority of excavation and supporting activities would occur within such habitat (see Figure F-9). Hence, the prohibition on actions with such effects would not be met.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 – 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only	Applicable to FP 9 response actions that take place in or within 100 feet (buffer zone) of stream/pond banks or wetlands (buffer zone) or are within floodplains or Riverfront Areas (extending 200 feet from river's edge) and that will alter any such resource areas.	Since FP 9 involves response actions, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ There are no floodplain remediation alternatives (apart from no action) with less impact on resource areas than FP 2 and FP 9 (which would have comparable effects). ▪ FP 9 would include practicable measures to avoid or minimize impacts to resource areas, including control of stormwater discharges during construction through BMPs, implementation of mitigation measures where necessary, and restoration of disturbed vegetation as required. In addition, FP 9 is not anticipated to have any significant effect on

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Table F-9.b: Alternative FP 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 – 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species. For areas within 100 feet of stream/pond banks or wetlands (buffer zone) or within 200 feet from river's edge (Riverfront Areas), minor activities such as sampling and monitoring are exempt from these requirements. See 310 CMR 10.02(2)(b)1.g.		flood storage capacity of floodplain. ▪ FP 9 would adversely affect estimated rare wildlife species habitat, because the great majority of excavation and supporting activities would occur within such habitat (see Figure F-9). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. However, FP 9 would have less adverse impact on such habitat than the other floodplain removal alternatives (except FP 2, which would have comparable effects). In addition, if FP 9 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on work that results in loss of > 5000 square feet of bordering vegetated wetlands (10.55(4)) or that impairs such wetlands within an ACEC (10.55(4)), and potentially the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including the requirement that no active portion of a waste pile may be constructed within 500-year floodplain.	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute state hazardous waste subject to these standards (see Table F-9.c). However, if some excavated soils were found to constitute such hazardous waste, these requirements would apply to temporary	In the unlikely event that some excavated soils were found to constitute state hazardous waste subject to these regulations, it may not be feasible for some temporary staging areas for such waste to meet the requirement that waste piles be located outside 500-year floodplain.

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Table F-9.b: Alternative FP 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			staging areas for such waste.	
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized work in areas where the work would have an area of potential impact on property(ies) listed in State Register.	Extent to which FP 9 would have potential impact on property(ies) listed in the State Register would be determined – and, if it would, the substantive provisions of these regulations would be met – through the process identified in Phase IA CRA.
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during clearing or excavation activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.

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Table F-9.b: Alternative FP 9 – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	There is no floodplain remediation alternative (apart from no action) that would avoid some construction in wetlands. However, FP 9 would have less adverse impact on wetlands than all other floodplain removal alternatives (except FP 2, which would have comparable effects). FP 9 would include practicable measures to minimize harm to wetlands, including avoiding siting access roads and staging areas in wetlands where practicable, use of erosion and sedimentation control measures, and reasonable restoration measures for affected wetlands.
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	FP 9 would involve excavation of soils and construction of access roads and staging areas in the floodplain. However, apart from no action, there is no floodplain alternative that would avoid any adverse effects on floodplain, and FP 9 would have less adverse impact on wetlands than all other floodplain removal alternatives (except FP 2, which would have comparable effects). FP 9 would include practicable measures to minimize harm to floodplain, including erosion and sedimentation control measures, reasonable restoration measures for affected portions of floodplain, and maintenance of existing flood storage capacity of floodplain.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	General requirements (761.50) and specific options (761.61) for cleanup of PCB Remediation Waste, including PCB-containing soils. Options include self-implementing provisions and risk-based approval by EPA. Risk-based approval is pursuant to 40 CFR 761.61(c) and requires demonstration that cleanup method will not pose an unreasonable risk of injury to health or the environment.	Applicable to cleanup of PCB Remediation Waste (which would include excavated floodplain soils with PCBs $\geq$ 50 ppm).	It is anticipated that, if FP 9 is selected, these requirements would be met through an EPA determination that FP 9 meets requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on storage of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.65 40 CFR 761.61(c)	General and specific requirements for storage of PCB Remediation Waste. Regulations include specific provisions for storage of PCB Remediation waste in piles at the cleanup site or site of generation for up to 180 days (761.65(c)(9)). They also allow for risk-based approval by EPA of alternate storage method (761.61(c)), based on demonstration that it will not pose an unreasonable risk of injury to health or the environment.	Applicable to temporary storage of PCB Remediation Waste.	Temporary staging areas would meet the default conditions in 761.65(c)(9) with the following exception: While these areas would contain run-on control systems capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for a few of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (although they would include appropriate flood control measures). For those temporary staging areas that would not meet this condition, the TSCA requirements could be met through an EPA determination that those staging areas meet requirements for risk-based approval under 40 CFR 761.61(c).
TSCA regulations on discharges of PCB-containing water	40 CFR 761.50(a)(3)	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 µg/L or discharge is in accordance with NPDES discharge limits.	Applicable to discharges of treated water from dewatering/treatment facility to Housatonic River.	If floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Water treatment facilities would be designed to meet this requirement.

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** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in excavation or other handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act and NPDES regulations	33 USC 1342 40 CFR 122, including, but not limited to, 122.3(d) and 122.44(a) & (e) 40 CFR 125.1 - 125.3	Point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards, except that discharges in compliance with instructions of On-Scene Coordinator (OSC) acting pursuant to NCP are exempt from these requirements.	Applicable to point source discharges of treated water from dewatering/treatment facility to Housatonic River.	If excavated floodplain soils are saturated, they would be dewatered, and resulting water would be treated. Discharges could not feasibly meet MA water quality criteria for PCBs (0.014 and 0.000064 µg/L) in receiving waters, since current water quality conditions in Housatonic River do not meet those criteria. In addition, it is not anticipated that those criteria would be met at the point of discharge. EPA used a standard of 0.5 µg/L for discharges from the treatment facility in the 1½ Mile Reach Removal Action, and the data from discharges in that project were generally in the range of 0.01 to 0.1 µg/L and often > 0.014 µg/L. However, this ARAR could be met through discharges in compliance with instructions from OSC.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction activities, including temporary staging of excavated materials.	Would be attained through use of BMPs to control erosion from stormwater discharges during construction activities, including soil excavation, construction of access roads and temporary staging areas, and temporary staging of excavated soils at those areas.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the key steps include a biological assessment by the authorizing agency; a biological opinion by the resource service; and if the action is likely to adversely affect a listed species or critical habitat, identification of "reasonable and prudent" measures to avoid and/or minimize such effects.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that FP 9 would not adversely affect any federally listed T&E species or their habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated soils would constitute hazardous waste.	Based on prior experience at other portions of this Site, it is not anticipated that excavated soils would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
RCRA regulations for generators of hazardous waste	40 CFR 262.30 - 262.33	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute RCRA hazardous waste. However, if some excavated soils did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to any temporary staging areas if, as expected, excavated soils do not constitute RCRA hazardous waste. Further, even if some soils did constitute such waste, these requirements would not apply to staging areas within Rest of River boundary under EPA's AOC policy, since those staging areas would be located in overall area of dispersed contamination. However, if any RCRA hazardous waste was staged at areas outside the lateral Rest of River boundary to which AOC policy would not apply, these requirements would be relevant and appropriate to waste piles used for staging of those materials.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, these requirements would be met at the temporary staging areas used for such waste.
RCRA regulations for hazardous waste management facilities – technical requirements for storage of hazardous waste	40 CFR Part 264, Subpart L	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in waste piles outside structures.		In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the waste piles used for temporary staging of such waste would meet these requirements with the following exceptions: (a) While these waste piles would meet the single liner/leachate collection requirements of § 264.251(a), they would not meet the requirements of § 264.251(c) for a double liner/leachate collection system at "new waste pile units" (if applicable); and (b) while the waste pile areas would contain a run-on control system capable of preventing flow onto those areas from a 25-year precipitation storm event, it would not be practical for a few of the staging areas in the floodplain to have a run-on control system capable of preventing flow onto those areas from a 25-year flood (see § 264.251(g)). These requirements, which were developed for permanent hazardous waste storage units, are not practical for short-term temporary staging areas and thus, if applicable, should be waived as technically impracticable to attain.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable to attain.
RCRA land disposal restrictions	40 CFR 268.50	Prohibits storage of hazardous wastes that are prohibited from land disposal under Part 268, Subpart C, with a number of exceptions, including that such waste may be stored solely for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal.	Same as above.	In the unlikely event that any excavated soils were found to constitute RCRA hazardous waste, and if such soils were staged at areas outside Rest of River boundary to which AOC policy would not apply, the temporary staging areas for such waste would meet the exception to the storage prohibition for the accumulation of such quantities as are necessary to facilitate treatment or disposal.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (Note: These were listed as location-specific ARAR in Table F-9.b, but are also listed here at EPA's direction.)	314 CMR 9.01 - 9.08	Same as described for these regulations in Table F-9.b.	Applicable to discharges of dredged or fill material to wetlands that constitute waters of the U.S. in MA.	Same as described for these regulations in Table F-9.b.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as to provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction activities and at temporary staging areas.	FP 9 would include use of stormwater BMPs during construction of access roads and staging areas and at the excavation areas and temporary staging areas. These BMPs would be designed to meet the MDEP's specified stormwater management standards. These stormwater systems would include setbacks (~ 25 feet) from receiving waters and wetlands to the extent practical.
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in a state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	The great majority of the excavation activities, as well as access roads and temporary staging areas, in FP 9 would occur within Priority Habitat, as shown on Figure F-9. Based on the evaluations presented in Appendix L to this Revised CMS Report, these activities and facilities would result in a "take" of at least 18 state-listed species. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs ≥ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.")	Applicable to determining whether excavated floodplain soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this Site, it is not anticipated that excavated floodplain soils would constitute non-PCB state hazardous waste. However, representative TCLP testing of soils subject to removal would be conducted during design to confirm that result.
Massachusetts hazardous waste regulations for generators	310 CMR 30.321 - 30.324	Pre-transport requirements for generators of hazardous waste (packaging, labeling, marking, placarding).	These requirements would not apply if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met prior to any off-site transport of such waste.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to staging areas for such waste.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, these requirements would be met at staging areas for such waste.
Massachusetts hazardous waste management regulations – location standards for units used to store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table F-9.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of an existing private drinking water well, or (g without a 200-foot buffer zone to fenceline.	These requirements would not apply to temporary staging areas if, as expected, excavated soils do not constitute non-PCB state hazardous waste. However, if some excavated soils did constitute such hazardous waste, these requirements would apply to waste piles for such waste at temporary staging areas.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these standards except that: (a) it may not be practical in some cases to site such staging areas outside 500-year floodplain; (b) it is unknown whether such sites would overlie a "potential public underground drinking water source" (defined as a groundwater source capable of yielding 100 gpm or more of water and with less than 10,000 mg/L of total dissolved solids); and (c) while an effort would be made to design and construct the areas with a 200-foot buffer zone to the fenceline, it is not certain that this would be feasible in all cases. Any such requirements that could not feasibly be met should be waived as technically impracticable.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for storage of hazardous waste	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would meet these requirements except that: (a) it may not be practical for some staging areas to meet the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.); and (b) while the staging areas would contain run-on and runoff control systems capable of handling a 100-year precipitation storm event, some staging areas in the floodplain would not have such systems capable of preventing flow onto those areas or controlling runoff during a 100-year flood (see 30.641(2 & (3)). To the extent that these requirements, if applicable. could not practicably be met at particular temporary staging areas, they should be waived as technically impracticable.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that any excavated soils were found to constitute non-PCB state hazardous waste, waste piles used for such waste at temporary staging areas would not meet these requirements since they would not have groundwater monitoring systems such as required for regular hazardous waste management facilities. Construction of such systems for short-term temporary staging areas would not be practicable, and thus these requirements, if applicable, should be waived as technically impracticable.

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Table F-9.c: Alternative FP 9 – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control regulations	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to excavation and construction activities generating dust.	Would be attained through use of dust control measures during activities that could generate dust and through particulate and PCB air monitoring during excavation activities and during construction and operation of the staging areas, along with response actions if certain action levels are exceeded. These measures would be specified in design.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 ppm or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during implementation of FP 9.
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, even if excavated soils were to constitute RCRA hazardous waste, the technical RCRA requirements for a hazardous waste storage facility would not apply to temporary staging areas located within the boundary of the Rest of River area, because those areas would be within the overall area of dispersed contamination.

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Treatment/Disposition
Alternative Tables

Table T-1: Alternative TD 1 (Off-Site Disposal) – Potential ARARs

Statute/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
None. ARARs apply only to on-site activities and thus are not relevant to the off-site transport and disposal of sediments and soils. To the extent that ARARs are relevant to the construction of access roads and staging areas, those requirements are addressed in the evaluation of alternatives for sediments and floodplain soils.				

Table T-2.a: Alternative TD 2 (Local In-Water CDF) – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act, Ambient Water Quality Criteria	*National Recommended Water Quality Criteria: 2002*, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	Freshwater chronic aquatic life criterion (based on protection of mink): 0.014 µg/L. Human health criterion based on human consumption of water and organisms: 0.000064 µg/L.	Relevant and appropriate to surface water in Rest of River.	It is not expected that the placement or presence of PCB-containing sediments in the CDF(s) would have an appreciable long-term effect on the water column PCB concentrations in the river and thus on attainment of the water quality criteria, since the CDF(s) would be enclosed by sheetpiles on the river side and berms on the land side and would be built to withstand high-flow events, and since the solids and associated PCBs in the water flowing through the permeable berms would be expected to be filtered out in the berms (and additional filter dams if needed) before that water is redirected into the river. Regarding attainment of these criteria generally, see the chemical-specific tables on the SED alternatives.
State ARARs				
Numeric Massachusetts water quality criteria	*Massachusetts Surface Water Quality Standards*, 314 CMR 4.05(5)(e)	Same as federal water quality criteria (unless Massachusetts Department. of Environmental Protection [MDEP] establishes site-specific criterion or determines that naturally occurring background concentrations are higher).	Applicable to surface water of Housatonic River in Massachusetts.	Same as for federal criteria.
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting disposition option for sediments.

Table T-2.a: Alternative TD 2 (Local In-Water CDF) – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Reference Doses	EPA's IRIS http://www.epa.gov/iris webp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting disposition option for sediments.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing EPA's Cancer Slope Factors. May be considered by EPA in selecting disposition option for sediments.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	May be considered by EPA in selecting disposition option for sediments.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	May be considered by EPA in selecting disposition option for sediments.
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting disposition option for sediments.

Table T-2.b: Alternative TD 2 (Local In-Water CDF) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	Applicable to the discharges of dredge or fill material resulting from construction of Confined Disposal Facility(ies) (CDF(s)) in Woods Pond and/or backwaters and from the disposal of hydraulically dredged sediments in the CDF(s).	(a) The requirement that there be no practicable alternative with less adverse impact on aquatic ecosystem would not be met. (b) It is not expected that placement or presence of PCB-containing sediments in the CDF(s) would have an appreciable long-term effect on attainment of the state water quality criteria, for reasons given in Table T-2.a. (c) Review of available information indicates that there are no federally listed T&E species in the areas that would be affected by CDF(s). Thus, the CDF(s) would not jeopardize the existence of such species. (d) The CDF(s) would not be expected to cause significant degradation of Housatonic River water, since they would be enclosed by sheetpiles on the river side and berms on the land side and would be built to withstand high-flow events, and since the solids and associated PCBs in the water flowing through the permeable berms would be expected to be filtered out in the berms (and additional filter dams if needed) before that water is redirected into the river. (e) To minimize or mitigate adverse effects on aquatic ecosystem, TD 2 would include: (i) implementation of measures (e.g., water column monitoring, visual observations for leaks or breaches) to prevent impacts on the river water during pumping of sediments into CDF(s); (ii) upon completion, placement of soil covers over CDF(s) and planting them with appropriate vegetation; and (iii) if necessary, development of an appropriate wetlands mitigation plan. However, it would not be feasible to provide complete flood storage

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Table T-2.b: Alternative TD 2 (Local In-Water CDF) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				compensation for the loss of flood storage capacity resulting from CDF(s) due to the large volume required and the lack of any suitable places to obtain that volume of compensation at the appropriate elevations/areas without creating other adverse effects on the river or floodplain (i.e., a large hole). Thus, if the required steps were considered to include such a requirement, that requirement would not be met.
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project will have unavoidable adverse impacts after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation – i.e., the restoration, creation, enhancement, or (in some circumstances) preservation of aquatic resources. This requires a mitigation work plan, including detailed specifications and descriptions for compensatory mitigation. The regulations also require objective performance standards, monitoring for at least 5 years, and active long-term management and maintenance where necessary to ensure long-term sustainability.	Applicable to construction of CDF(s) and disposal of sediments in CDF(s)	These regulations would require a compensatory mitigation plan to address the unavoidable adverse impacts of the CFD(s) on the aquatic ecosystem. However, even if such a plan were implemented, considerable adverse impacts would remain. See Revised CMA Report, Sections 9.2.5.3 and 9.2.7.
Rivers and Harbors Act of 1899, Section 10	33 USC 403	Prohibits obstruction, excavation, filling, or altering any navigable water of the United States without authorization from U.S. Army Corps of Engineers.	Relevant and appropriate to construction of CDF(s) and disposal of sediments in CDF(s), but no permit required.	Since no permit is required, this requirement would be addressed through EPA's coordination with U.S. Army Corps of Engineers regarding creation of CDF(s).

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Table T-2.b: Alternative TD 2 (Local In-Water CDF) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Fish and Wildlife Coordination Act requirements	16 USC 662(a) 40 CFR 6.302(g)	A federal agency proposing to undertake or authorize an action that will control or modify any waterbody must consult with federal and state resource agencies to ascertain measures to prevent, mitigate, and compensate for project-related loss of or damage to fish and wildlife resources and to provide for the development and improvement of such resources.	Applicable to EPA; relevant and appropriate to creation of CDF(s).	Would be attained through consultation by EPA with U.S. Fish and Wildlife Service and MA Department of Fish and Game.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic (including archaeological) property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	It is anticipated that these requirements would be met through: consultation by EPA with the State Tribal Historic Preservation Office (and, if applicable, any pertinent Tribal Historic Preservation Office); evaluation of the CDF location(s) to determine the "area of potential effects" of the CDF(s) and the potential for that area to contain properties included or eligible for inclusion in NRHP; determination of whether the CDF(s) would have an adverse impact on such a property; and if so, evaluation – and, as appropriate, implementation – of alternatives to avoid, or measures to minimize or mitigate, the adverse impacts.

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Table T-2.b: Alternative TD 2 (Local In-Water CDF) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	If it is determined that TD 2 could cause the loss or destruction of archaeological or historic data, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Waterways Law and implementing regulations	MGL Ch. 91 310 CMR 9.00	Standards and requirements for any construction, placement, excavation, alteration, or removal of any fill or structures in a waterbody. Includes standards governing engineering and construction of fill and structures to be placed in waterbodies (§ 9.37). Also requires compliance with other specified environmental regulatory programs (§ 9.33).	Applicable to construction of CDF(s) and disposal of sediments in CDF(s).	CDF(s) would be designed and constructed to meet the applicable standards for construction in waterways (§ 9.37). (The other relevant environmental regulatory programs referenced in § 9.33 are discussed separately in these ARARs tables.)
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act)	314 CMR 9.06	For discharge of dredged or fill material: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on wetlands; (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under Wetlands Protection Act; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Applicable to discharge of dredged or fill material resulting from construction of CDF(s) and disposal of sediments in CDF(s).	(a) The requirement that there be no practicable alternative with less adverse impact on aquatic ecosystem would not be met. (b) To minimize adverse effects on land under water and wetlands, TD 2 would include: (i) measures to prevent impacts on the river water during construction of CDF(s) and pumping of sediments into CDF(s); and (ii) upon completion, placement of soil covers over CDF(s) and planting them with appropriate vegetation. (c) The backwater areas identified for potential CDF(s) and a portion of the area of Woods Pond identified for a potential CDF are within, and would adversely affect, the state-mapped estimated habitat of rare wildlife species (as shown on Figure T-2).

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Table T-2.b: Alternative TD 2 (Local In-Water CDF) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				Thus, the prohibition on actions with adverse effects on such habitat would not be met. (d) Stormwater discharges would be controlled with BMPs during construction and filling of CDF(s) and following closure. (e) It is not expected that the CDF(s) would cause substantial long-term effects on Housatonic River water for reasons given above.
	314 CMR 9.07(1)	Prohibits disposal of dredged material if a feasible alternative exists that involves reuse, recycling, or contaminant destruction and/or detoxification. Lists factors to be considered in evaluating feasibility of such an alternative.	Applicable to disposal of dredged material in CDF(s)	This requirement would be met because, based on evaluation of the various TD alternatives, there is no feasible alternative that involves reuse, recycling, or contaminant destruction and/or detoxification, considering the factors listed in this provision.
	314 CMR 9.07(8)	Standards for confined disposal of dredged sediments, including requirements that: (a) there must be no practicable alternative with less impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid, minimize, or mitigate adverse environmental impacts; and (c) a confined disposal facility must meet specified siting criteria and design standards.	Applicable to creation of CDF(s).	The requirement that there be no practicable alternative with less adverse impact on aquatic ecosystem would not be met. Steps to minimize or mitigate adverse environmental effects are discussed above. Based on current information, it appears that the CDF(s) would meet the specified siting criteria except that: (a) the backwater CDF area(s) and a majority of the Woods Pond CDF area are within state-mapped Priority Habitat of rare species (see Figure T-2) and would adversely affect that habitat; (b) a portion of the most northern backwater that might be used for a CDF would be located within, and thus have some adverse effect on, a state Wildlife Management Area; and (c) due to the location of the CDF(s) within the Upper Housatonic Area of Critical Environmental Concern (ACEC), the prohibition on confined disposal facilities within an ACEC would not be met. The CDF(s) would meet the specified design standards except that they would not have an impervious cover or prevent run-on from a 25-year flood, since it is not their purpose to prevent any infiltration of precipitation or run-on water into the CDF(s).

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Table T-2.b: Alternative TD 2 (Local In-Water CDF) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 - 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the Massachusetts Contingency Plan (MCP), that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes to resource areas, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 - 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species.	Applicable to construction of CDF(s) and disposal of sediments in CDF(s).	Since TD 2 would be a response action, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ The requirement that there be no practicable alternative with less adverse impact on resource areas would not be met. ▪ Steps to minimize or mitigate impacts to resource areas are discussed above. Given the impacts of the CDF(s) on river hydrology and the resulting permanent reduction in existing flood storage capacity in Woods Ponds and/or the backwaters, it is uncertain whether TD 2 would meet the requirements to minimize hydrological changes and to provide compensatory flood storage. The applicability of the latter requirement is unclear, since it applies where flood storage capacity is lost as a result of projects within floodplain areas but not specifically within the waterbodies themselves. However, if it is applicable, it would not be feasible to provide complete flood storage compensation due to the large volume required and the lack of any suitable places to obtain that volume of compensation at the appropriate elevations/areas without creating other adverse effects on the river or floodplain, as discussed above. Thus, that requirement, if applicable, would not be met. ▪ The backwater CDF area(s) and a portion of the CDF area in Woods Pond are within, and would adversely affect, state-mapped estimated habitat of rare wildlife species (as shown on Figure T-2). Thus, the prohibition on actions with adverse effects on such habitat would not be met. In addition, if TD 2 was not considered a "limited project," it would not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., prohibition on impairing the water-carrying capacity and the fish and wildlife habitat of land under water and banks (10.56(4), 10.54(4)).

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Table T-2.b: Alternative TD 2 (Local In-Water CDF) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized projects in areas where the work would have an area of potential impact on property(ies) listed in State Register.	An evaluation would be made through consultation with the MHC (and, if applicable, any pertinent Tribal Historic Preservation Office) as to whether the construction or operation of the CDF(s) would adversely affect any property listed in the State Register of Historic Places. If it would, the substantive provisions of these regulations would be met.
	MGL c. 9, § 27C	Any person supervising any survey, excavation, or construction on state or local government lands must report to the state archaeologist any archaeological, paleontological, or historical site or object discovered, and must take all reasonable steps to secure its preservation. Further, any person conducting any activity (including construction activity) who discovers unmarked human remains suspected of being more than 100 years old must cease activity and report the discovery to state archaeologist for evaluation.	Applicable to excavations or construction on state or local government lands in MA – or, in the case of unmarked human remains, any lands in MA.	If, during construction activities, any archaeological, paleontological, or historical site or object is discovered on state or local government lands, or any unmarked human remains potentially over 100 years old are discovered, these requirements for notification and (if applicable) preservation would be met.

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Table T-2.b: Alternative TD 2 (Local In-Water CDF) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA.	The requirement that there be no practicable alternative with less adverse impact on wetlands would not be met. To minimize harm to wetlands, soil cover(s) would be placed over CDF(s) upon completion and planted with appropriate vegetation.

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Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on disposal of PCB Remediation Waste	40 CFR 761.50(d)(4) 40 CFR 761.61(b) & (c) 40 CFR 761.75	Section 761.75(b) establishes standards and requirements for chemical waste landfills used for disposal of PCBs, including siting, design, operation, and monitoring requirements. Any of these requirements may be waived by EPA under § 761.75(c)(4) if EPA finds it not necessary to protect against unreasonable risk of injury to health or the environment. In addition, § 761.61(c) allows for risk based approval of alternate method of disposal of non-liquid PCB Remediation Waste if EPA finds that such method will not pose an unreasonable risk of injury to health or the environment. As another alternative, dredged material with < 50 mg/kg may be disposed of in accordance with permit under § 404 of Clean Water Act or equivalent (§ 761.61(b)(3)).	Applicable to disposal of PCB Remediation Waste in CDF(s).	The CDF(s) would not meet several of the substantive requirements of § 761.75(b) for a PCB chemical waste landfill (which were not developed for an in-water CDF). These include the requirements relating to soil characteristics or a bottom liner, hydrologic conditions, flood protection, and leachate collection. However, the requirements of the TSCA regulations could be met through an EPA determination that the CDF(s) meet(s) the substantive criteria for a waiver of the § 761.75(b) requirements under § 761.75(c)(4) or for a risk-based approval under § 761.61(c).
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act – NPDES regulations (stormwater discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction and filling of CDF.	Stormwater discharges during construction and operation of the CDF(s) would be controlled with BMPs.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-2.b, although some of those requirements (e.g., EPA's regulations under Section 404 of Clean Water Act, Massachusetts water quality certification regulations, including its standards for confined disposal) could also be considered action-specific ARARs for TD 2.

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Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the steps set forth in the regulations must be followed.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because review of available information indicates that there are no federally listed T&E species or their habitat in the areas that would be affected by CFD(s), and thus TD 2 would not adversely affect any such species or their critical habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Note that Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments to be placed in the CDF(s) would constitute hazardous waste.	Based on prior experience at other portions of this site, it is not anticipated that the sediments to be placed in the CDF(s) would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of those sediments/soils would be conducted during design to confirm that result.
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply to the CDF(s) because the sediments are not expected to constitute RCRA hazardous waste and, even if they did, the CDF(s) would be located in overall area of dispersed contamination and thus not subject to these regulations under EPA's Area of Contamination (AOC) policy.	Not applicable assuming these requirements do not apply. In the unlikely event that sediments to be placed in CDF(s) were found to constitute RCRA hazardous waste and the AOC policy were determined not to apply, these requirements would be met, except that they would not prevent wash-out from a 100-year flood during filling, since the berm elevations would not be high enough to keep the water out of the active CDF(s) in such a flood.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-2.b, although some of those requirements (e.g., EPA's regulations under Section 404 of Clean Water Act, Massachusetts water quality certification regulations, including its standards for confined disposal) could also be considered action-specific ARARs for TD 2.

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Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
RCRA requirements for hazardous waste management facilities – technical requirements for surface impoundments and landfills	40 CFR Part 264, Subpart K (surface impoundments) 40 CFR Part 264, Subpart N (landfills) 40 CFR 264.111 40 CFR 264.117	Design, operating, closure, and post-closure requirements for disposal of hazardous waste in surface impoundments and landfills.	Same as above	Not applicable assuming these requirements do not apply. In the unlikely event that sediments to be placed in CDF(s) were found to constitute RCRA hazardous waste and the AOC policy were determined not to apply, the CDF(s) would not meet certain of these RCRA requirements, which were not developed for an in-water CDF. These include the requirements for a double liner/leachate collection system and for run-on and runoff control systems – which would be inconsistent with purpose of CDF(s) to act as filtration systems that allow water to pass through permeable berms.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above	Not applicable assuming these requirements do not apply. In the unlikely event that sediments to be placed in CDF(s) were found to constitute RCRA hazardous waste and the AOC policy were determined not to apply, these requirements could be met at the CDF(s).

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Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
RCRA land disposal restrictions	40 CFR Part 268	Establishes prohibitions and restrictions on, and treatment standards for, land disposal of certain hazardous wastes unless location of disposition is part of Corrective Action Management Unit (CAMU) under § 264.552 (which must be on contiguous property under control of owner where waste originated) or part of AOC under EPA's AOC policy. Includes specific alternate treatment standards for contaminated soil (which includes sediments under the definition of soil in § 268.2(k)); these are set forth in § 268.49. Under these standards, treatment would not be required if concentrations are less than 10 times the Universal Treatment Standards. Otherwise, treatment would be required to achieve 90% reduction in total concentrations for non-metals and in leachate concentrations for metals.	Same as above.	Not applicable assuming these requirements do not apply. In the unlikely event that sediments to be placed in CDF(s) were found to constitute RCRA hazardous waste and the AOC policy were determined not to apply, and to the extent (if any) that the sediments would require treatment under the alternate standards for contaminated soil in § 268.49, the placement of such wastes in the CDF(s) would not meet that requirement, because TD 2 would not involve treatment.
State ARARs				
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act or that involve discharge of dredged or fill material must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction and operation of CDF(s).	Stormwater discharges during construction and operation of the CDF(s) would be controlled with BMPs. Those BMPs would meet these stormwater management standards, except that they could not feasibly include a setback from the receiving waters since the CDF(s) would be within the water.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-2.b, although some of those requirements (e.g., EPA's regulations under Section 404 of Clean Water Act, Massachusetts water quality certification regulations, including its standards for confined disposal) could also be considered action-specific ARARs for TD 2.

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Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Endangered Species Act and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity within mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of a state-listed species. Note: The MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in a state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	The backwater areas identified for CDF(s) and the majority of the Woods Pond area identified for a CDF are within mapped Priority Habitat, as shown on Figure T-2. Based on the evaluations presented in Appendix L to this Revised CMS Report, the construction and operation of the CDF(s) in those areas would result in a "take" of state-listed species (with the number dependent on the CDF location(s)). Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting State-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Note that wastes that contain PCBs ≥ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this site, it is not anticipated that excavated sediments to be placed in the CDF(s) would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments would be conducted during design to confirm that result.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-2.b, although some of those requirements (e.g., EPA's regulations under Section 404 of Clean Water Act, Massachusetts water quality certification regulations, including its standards for confined disposal) could also be considered action-specific ARARs for TD 2.

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Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
		constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") The Massachusetts hazardous waste regulations exempt dredged material that is placed in a confined disposal facility under 314 CMR 9.07 and managed in accordance with a state water quality certification and the requirements of a permit under § 404 of Clean Water Act. In addition, under the Massachusetts Contingency Plan (MCP), the on-site disposal of contaminated media constituting hazardous waste as part of a remedial action under the MCP (including its "adequately regulated" provisions) is exempt from the state hazardous waste regulations unless MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).		
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to the CDF(s) if, as expected, the sediments to be placed in the CDF(s) do not constitute non-PCB state hazardous waste. Further, even if some sediments did constitute such hazardous waste , the CDF(s) should be exempt from these requirements under the exemptions described above.	Not applicable assuming these requirements do not apply. In the unlikely event that sediments to be placed in CDF(s) were found to constitute non-PCB state hazardous waste and the above-mentioned exemptions were determined not to apply, these requirements would be met.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-2.b, although some of those requirements (e.g., EPA's regulations under Section 404 of Clean Water Act, Massachusetts water quality certification regulations, including its standards for confined disposal) could also be considered action-specific ARARs for TD 2.

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Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – location standards for hazardous waste surface impoundments and landfills	310 CMR 30.701(6), 30.702, 30.703(2)-(4), 30.704, 30.705(1), (3) & (6), 30.706	Location standards for hazardous waste surface impoundments and landfills, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) in any waterbody, (e) within ½ mile or a delineated Zone 2 of a public water supply well, (f) on land overlying an actual, planned, or potential public underground drinking water source, (g) within 1000 feet of a private drinking water well, (h) without a 200-foot buffer zone to fenceline, or (i) for landfills, within flow path of groundwater that constitutes an actual or potential public or private drinking water source. Potential public drinking water source is defined as groundwater capable of yielding ≥ 100 gallons per minute (gpm) and having < 10,000 mg/L of total dissolved solids (TDS); potential private drinking water source is defined as groundwater capable of yielding 2 to 100 gpm and having < 10,000 mg/L of TDS.	Same as above.	Not applicable assuming these requirements do not apply. In the unlikely event that sediments to be placed in CDF(s) were found to constitute non-PCB state hazardous waste and the above-mentioned exemptions were determined not to apply, the CDF(s) would not meet some of these standards (i.e., the prohibition on hazardous waste surface impoundments and landfills within 500-year floodplain or in wetlands or waterbodies) and potentially others (e.g., the prohibitions on location within 1000 feet of private drinking water well or over or in the flow path of a potential public drinking water source or in the flow path of an actual or potential private drinking water source), which would be investigated in design.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-2.b, although some of those requirements (e.g., EPA's regulations under Section 404 of Clean Water Act, Massachusetts water quality certification regulations, including its standards for confined disposal) could also be considered action-specific ARARs for TD 2.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – technical requirements for hazardous waste surface impoundments and landfills	310 CMR 30.602 310 CMR 30.610 (surface impoundments) 310 CMR 30.620 (landfills) 310 CMR 30.580 310 CMR 30.590	Requirements for design, operation, closure and post-closure care of landfills used for disposal of hazardous waste.	Same as above.	Not applicable assuming these requirements do not apply. In the unlikely event that sediments to be placed in CDF(s) were found to constitute non-PCB state hazardous waste and the above-mentioned exemption were determined not to apply, the CDF(s) would not meet certain of these requirements (which were not developed for an in-water CDF). These include the requirements that the facility have a double liner, a bottom liner at least 4 feet above probable high groundwater table, a leak detection system, a run-on diversion/control system, and a runoff management system. These requirements would either be infeasible for an in-water CDF or inconsistent with purpose of CDF(s) to act as filtration systems that allow water to pass through permeable berms.
	310 CMR 30.660	Groundwater protection requirements for hazardous waste landfills, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	Not applicable assuming these requirements do not apply. In the unlikely event that sediments to be placed in CDF(s) were found to constitute non-PCB state hazardous waste and the above-mentioned exemption were determined not to apply, these requirements could be met at the CDF(s).

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-2.b, although some of those requirements (e.g., EPA's regulations under Section 404 of Clean Water Act, Massachusetts water quality certification regulations, including its standards for confined disposal) could also be considered action-specific ARARs for TD 2.

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<u>**Table T-2.c: Alternative TD 2 (Local In-Water CDF) – Potential Action-Specific ARARs**</u> *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control requirements	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to activities generating dust during construction of CDF(s).	Would be attained through use of dust control measures and particulate and PCB monitoring during construction activities that could generate dust, along with response actions if certain action levels are exceeded.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 mg/kg or greater.	To be considered.	Would be considered in the event of any new PCB spill that occurs during the construction or operation of the CDF(s).
Use of Area of Contamination (AOC) Concept During RCRA Cleanups (EPA, 1995)	Memorandum from EPA Office of Solid Waste and Emergency Response, March 13, 1995	Describes EPA policy on use of Area of Contamination (AOC) approach under RCRA. Explains that an overall area that includes discrete areas of generally dispersed contamination may be considered an AOC, within which the movement of waste is not considered "placement," such that the RCRA land disposal restrictions and other RCRA requirements, including minimum technology requirements, would not be triggered.	To be considered.	Under this policy, the technical RCRA design and operating requirements for a hazardous waste landfill and the RCRA land disposal restrictions for hazardous waste would not apply to the CDF(s), even if sediments placed there were to constitute RCRA hazardous waste, because CDF(s) would be within the overall area of dispersed contamination.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-2.b, although some of those requirements (e.g., EPA's regulations under Section 404 of Clean Water Act, Massachusetts water quality certification regulations, including its standards for confined disposal) could also be considered action-specific ARARs for TD 2.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table T-3.a: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing EPA's Cancer Slope Factors. May be considered by EPA in selecting disposition option for removed sediments and soils.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.

Table T-3.a: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting disposition option for removed sediments and soils.

Table T-3.b: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material to waters of the United States: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	The Massachusetts GIS wetlands mapping shows a small (0.4-acre) shrub swamp that would be within the maximum (but not minimum) operational footprint of an Upland Disposal Facility at the Woods Pond Site. It is unknown whether this wetland would constitute a water of the United States subject to these regulations (an issue that would be investigated during design). If it would, and if the facility operational footprint is large enough to impact this wetland, these regulations would be applicable to the filling of this wetland as part of TD 3.	If the operational footprint of an Upland Disposal Facility is large enough to affect the shrub swamp described in the prior column, and if that swamp is subject to these regulations: (a) EPA would need to find that there is no practicable alternative with less adverse impact on wetlands, or waive that requirement. (b) The facility would not cause or contribute to a violation of a state water quality standard or toxic effluent standard. (c) Review of available information indicates that there are no federal T&E species in the area of this site. Thus, the facility would not jeopardize the existence of any such species. (d) The use of this site would not cause significant degradation of waters of the U.S. apart from the filling of the small shrub swamp. If that is considered a significant adverse effect, the prohibition on actions with such effects would not be met. (e) Appropriate and practicable steps would be taken during construction and use of the Upland Disposal Facility to minimize or mitigate potential adverse ecological effects, but could not avoid impacting the shrub swamp.

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Table T-3.b: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project involving discharge of dredge or fill material to waters of the United States will have unavoidable adverse impacts on the aquatic ecosystem after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation (as described in Table T-2.b).	Uncertain. If the operational footprint of an Upland Disposal Facility at this site is large enough to impact the small shrub swamp described above, and if that swamp is considered to constitute a water of the United States, these regulations would be applicable to the filling of all or part of this wetland as part of TD 3.	If the operational footprint of an Upland Disposal Facility is large enough to affect the shrub swamp described in the prior column, and if that swamp is subject to these regulations, an assessment would be made as to whether the impact on this wetland is significant enough to trigger the requirement for compensatory mitigation. If so, a compensatory mitigation plan would be necessary to address the unavoidable adverse impact of the Upland Disposal Facility on that wetland.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic (including archaeological) property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	The majority of the Woods Pond Site has previously been disturbed such that it would not be expected to contain properties eligible for inclusion in the NRHP. However, this site would be evaluated through: consultation by EPA with the State and Historic Preservation Office (and, if applicable, any pertinent Tribal Historic Preservation Office); determination of the "area of potential effects" of the Upland Disposal Facility and the potential for that area to contain properties included or eligible for inclusion in NRHP; determination of whether the facility would have an adverse impact on such a property; and if so, evaluation – and, as appropriate, implementation – of alternatives to avoid, or measures to minimize or mitigate, the adverse impacts.

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Table T-3.b: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	While this site is unlikely to contain archaeological or historic data, if it is determined that construction of the Upland Disposal Facility at this site could cause the loss or destruction of such data, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act)	314 CMR 9.06	For discharge of dredged or fill material to waters of the U.S. in Massachusetts: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on wetlands; (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under Wetlands Protection Act; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Uncertain. If the operational footprint of an Upland Disposal Facility at this site is large enough to impact the small shrub swamp mapped within the maximum operational footprint (as described above), and if that swamp is considered to constitute a water of the United States, these regulations would be applicable to the filling of this wetland as part of TD 3.	If the operational footprint of an Upland Disposal Facility is large enough to affect the shrub swamp described in the prior column, and if that swamp constitutes a water of the U.S.: (a) EPA would need to find that there is no practicable alternative with less adverse impact on wetlands, or waive that requirement. (b) Appropriate and practicable steps would be taken during construction and use of the Upland Disposal Facility to minimize or mitigate potential adverse ecological effects, but could not avoid impacting the shrub swamp. (c) The facility would not adversely affect estimated habitat of rare wildlife species because the Woods Pond Site is not within the state-mapped estimated habitat of any state-listed wildlife species. (d) Stormwater discharges would be controlled with BMPs during construction and use of the Upland Disposal Facility and following closure.

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Table T-3.b: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				(e) It is not expected that the facility would cause substantial long-term adverse impacts to the integrity of surface water.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 - 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions in resource areas responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the Massachusetts Contingency Plan (MCP), that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes to resource areas, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 -10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species.	Uncertain. If the operational footprint of an Upland Disposal Facility at this site is large enough to impact the small shrub swamp described above, and if that swamp would constitute a resource area under this statute and regulations, these requirements would be applicable to the portion of the facility impacting this wetland.	If the operational footprint of an Upland Disposal Facility is large enough to affect the shrub swamp described in the prior column, and if that swamp constitutes a resource area under these regulations, then: (a) EPA would need to find that there is no practicable alternative with less adverse impact on resource areas, or waive the requirement that there be no such alternative. (b) Appropriate and practicable steps would be taken during construction and use of the Upland Disposal Facility to minimize or mitigate potential adverse effects on the resource area, but could not avoid impacting the shrub swamp. (c) The facility would not adversely affect estimated habitat of rare wildlife species because the Woods Pond Site is not within the state-mapped estimated habitat of any state-listed wildlife species. (d) If the implementation of TD 3 at the Woods Pond Site were not considered a "limited project," it appears that it would meet or could be designed to meet the requirements of 310 CMR 10.54 – 10.58 and 10.60.

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Table T-3.b: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on such a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized projects in areas where the work would have an area of potential impact on property(ies) listed in State Register.	An evaluation would be made through consultation with the MHC (and, if applicable, any pertinent Tribal Historic Preservation Office) as to whether the construction or operation of the Upland Disposal Facility at the Lane Site would adversely affect any property listed in the State Register of Historic Places. If it would, the substantive provisions of these regulations would be met.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA. Thus, if the operational footprint of an Upland Disposal Facility at this site is large enough to impact the small	If the operational footprint of an Upland Disposal Facility is large enough to affect the shrub swamp described above, and if that swamp is subject to this Executive Order, EPA would need to find that there is no practicable alternative with less adverse impact on wetlands and that the project includes all practicable measures to minimize harm to wetlands, or else waive those requirements.

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Table T-3.b: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			shrub swamp described above, and if that swamp is found to meet the definition of a wetland under this Order, this Order would be applicable to EPA..	

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Table T-3.c: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on disposal of PCB Remediation Waste in landfill	40 CFR 761.50(d)(4) 40 CFR 761.61(b) & (c) 40 CFR 761.75	Section 761.75(b) establishes standards and requirements for chemical waste landfills used for disposal of PCBs, including siting, design, operation, and monitoring requirements. Any of these requirements may be waived by EPA under § 761.75(c)(4) if EPA finds that that requirement is not necessary to protect against unreasonable risk of injury to health or the environment. In addition, § 761.61(c) allows for risk-based approval of alternate method of disposal of non-liquid PCB Remediation Waste if EPA finds that such method will not pose an unreasonable risk of injury to health or the environment. As another alternative, dredged material with < 50 mg/kg may be disposed of in accordance with permit under § 404 of Clean Water Act or equivalent (§ 761.61(b)(3)).	Applicable to disposal of PCB Remediation Waste in local Upland Disposal Facility.	Construction and operation of local Upland Disposal Facility at Woods Pond Site would meet the siting, design, and operation requirements of § 761.75, with the following qualifications: (a) While the site would not meet the location requirements of § 761.75(b)(1) relating to the permeability and characteristics of the existing soil, the facility would include a liner with equivalent impermeability, as allowed (with EPA approval) under § 761.75(b)(2). (b) The site may not meet certain of the hydrologic requirements of § 761.75(b)(3) relating to the depth of the groundwater table or its connection to surface water, which would be investigated during design. However, the facility would have a double liner and leachate collection system to prevent impacts to groundwater. Even if any of these specific requirements could not be met, construction and operation of the facility could still meet the TSCA regulations through an EPA determination that the facility meets the substantive criteria for a waiver of that requirement under § 761.75(c)(4) or for a risk-based approval of the facility location and design under § 761.61(c).
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.

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Table T-3.c: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Clean Water Act – NPDES regulations (storm water discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction and operation of Upland Disposal Facility.	Would be attained through use of BMPs, including stormwater diversion berms, stormwater detention basins, and drainage swales, to control erosion from stormwater discharges during construction and operation of Upland Disposal Facility and following closure of that facility.
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the steps set forth in the regulations must be followed.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because the area of the Woods Pond Site identified for potential use for Upland Disposal Facility does not contain any federally listed T&E species or their critical habitat, and thus construction of facility would not adversely affect such species or habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Note that Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or soils to be placed in Upland Disposal Facility would constitute a hazardous waste.	Based on prior experience at other portions of this site, it is not anticipated that the excavated sediments and soils to be placed in the Upland Disposal Facility would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of those sediments/soils would be conducted during design to confirm that result.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-3.b.

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Table T-3.c: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not be expected to apply to Upland Disposal Facility if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to disposal facility.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, these requirements would be met.
RCRA requirements for hazardous waste management facilities – technical requirements for landfills	40 CFR Part 264, Subpart N 40 CFR 264.111 40 CFR 264.117	Design, operating, closure, and post-closure requirements for disposal of hazardous waste in landfills.	Same as above.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, the Upland Disposal Facility would meet these requirements, including requirements for double liner/leachate collection system.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, the Upland Disposal Facility would have groundwater monitoring system and program consistent with these requirements.

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Table T-3.c: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA requirements for hazardous waste management facilities – technical requirements for tanks	40 CFR 264, Subpart J	Design, operating, closure, and post-closure requirements for storage or disposal of hazardous waste in tanks.	Relevant and appropriate to storage of leachate that constitutes RCRA hazardous waste (if any) in tanks.	If these requirements apply and if leachate stored in tanks at the Upland Disposal Facility should constitute RCRA hazardous waste, these requirements would be met.
RCRA land disposal restrictions	40 CFR Part 268	Establishes prohibitions and restrictions on, and treatment standards for, land disposal of certain hazardous wastes unless location of disposition is part of Corrective Action Management Unit (CAMU) under § 264.552 or part of Area of Contamination (AOC) under EPA's AOC policy. Includes specific alternate treatment standards for contaminated soil (which includes sediments under the definition of soil in § 268.2(k)); these are set forth in § 268.49. Under these standards, treatment would not be required if concentrations are less than 10 times the Universal Treatment Standards. Otherwise, treatment would be required to achieve 90% reduction in total concentrations for non-metals and in leachate concentrations for metals.	These restrictions would not be expected to apply if, as expected, the excavated materials to be placed in the Upland Disposal Facility do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these restrictions would be applicable to disposal of such materials. Note: CAMU concept unlikely to apply since Woods Pond Site is not on contiguous property under control of owner where waste originated (see § 264.552). AOC policy unlikely to apply to Woods Pond Site since it is not within overall area of dispersed contamination.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, <u>and</u> if they would require treatment under the alternate standards for contaminated soil in § 268.49, placement of such waste in that facility would not meet these restrictions, because TD 3 would not involve treatment. In that case, either the treatment requirement should be waived as technically impracticable for TD 3 or the materials could not be placed in the Upland Disposal Facility.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-3.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table T-3.c: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Endangered Species Act and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in a designated Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: While the MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" under certain conditions, that provision is not an ARAR, as discussed in the Revised CMS Report (Section 5.4).	Applicable to activities in a State-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species.	Would be attained because the area of the Woods Pond Site identified for potential use for Upland Disposal Facility does not include any state-mapped Priority Habitat, as shown on Figure T-3, and GE is not aware of any other information indicating the presence of a state-listed species within this area.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Note that wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") Note also that, under the Massachusetts Contingency Plan (MCP), the on-site disposal of contaminated media constituting hazardous waste as part of a remedial action under the MCP (including its "adequately regulated" provisions) is exempt from the state hazardous waste	Applicable to determining whether excavated sediments or soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this site, it is not anticipated that excavated sediments or soils to be placed in the Upland Disposal Facility would constitute non-PCB state hazardous waste. However, representative TCLP testing of those sediments/soils would be conducted during design to confirm that result.

* This table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-3.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table T-3.c: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		regulations unless MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).		
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to Upland Disposal Facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under the MCP unless MDEP determines otherwise. However, if some materials did constitute such hazardous waste and the facility was not exempt under the MCP, these requirements would be applicable to the disposal facility.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, these requirements would be met.
Massachusetts hazardous waste management regulations – location standards for hazardous waste landfills	310 CMR 30.701(6), 30.702, 30.703(2)-(4), 30.704, 30.705(1), (3) & (6), 30.706	Location standards for hazardous waste landfills, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) in any waterbody, (e) within ½ mile or a delineated Zone 2 of a public water supply well, (f) on land overlying or in flow path of an actual, planned, or potential public underground drinking water source,	Same as above.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility at Woods Pond Site would meet these standards, except that: (a) it would be within ½ mile of an existing public drinking water well in an adjacent campground; and (b) it could potentially be located within 1000 feet of a private drinking water well or over or within flow path of a potential public

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Table T-3.c: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		(g) within 1000 feet or in flow path of private drinking water well, (h) in flow path of potential private underground drinking water source, or (i) without a 200-foot buffer zone to fenceline. Potential public drinking water source is defined as groundwater capable of yielding ≥ 100 gpm and having < 10,000 mg/L of TDS; potential private drinking water source is defined as groundwater capable of yielding 2 to 100 gpm and having < 10,000 mg/L of TDS.		drinking water source or within flow path of an existing private drinking water well or a potential private drinking water source – all of which would be investigated during design.
Massachusetts hazardous waste management regulations – technical requirements for hazardous waste landfills	310 CMR 30.602 310 CMR 30.620 310 CMR 30.580 310 CMR 30.590	Requirements for design, operation, closure and post-closure care of landfills used for disposal of hazardous waste.	Same as above.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility would meet these requirements, including double liner/leachate collection system requirement.
	310 CMR 30.660	Groundwater protection requirements for hazardous waste landfills, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.		In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility would have groundwater monitoring system and program consistent with these requirements.
Massachusetts air pollution control requirements	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to activities generating dust.	Would be attained through use of dust control measures during construction and operation of the facility and through monthly air monitoring for PCBs and daily air monitoring for particulate matter during facility operations, along with response actions if certain action levels are exceeded.

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Table T-3.c: Alternative TD 3 (Local Upland Disposal) at Woods Pond Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 mg/kg or greater.	To be considered for any new PCB spills that occur during the work.	Would be considered in the event of any new PCB spill that occurs during the construction or operation of the Upland Disposal Facility.

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Table T-3.d: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing EPA's Cancer Slope Factors. May be considered by EPA in selecting disposition option for removed sediments and soils.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.

Table T-3.d: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting disposition option for removed sediments and soils.

Table T-3.e: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material to waters of the United States: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem; (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	The maximum operational footprint for an Upland Disposal Facility at the Forest Street Site would require building a new crossing of small stream (Goose Pond Brook) in the southern portion of the site for an access road, and doing so may involve discharge of dredge or fill material to that stream. If so, these regulations would be applicable to that discharge.	If the construction of an Upland Disposal Facility at the Forest Street Site would require discharge of dredge or fill material to a stream in the course of building a new stream crossing: (a) EPA would need to find that there is no practicable alternative with less adverse impact on the aquatic ecosystem, or waive that requirement. (b) This activity would not be expected to cause or contribute to a violation of a state water quality standard or toxic effluent standard. (c) Review of available information indicates that there are no federal T&E species in the area of this site. Thus, the facility would not jeopardize the existence of any such species. (d) The construction and use of this stream crossing would not be expected to cause significant degradation of waters of the U.S. (e) Appropriate and practicable steps would be taken during construction of the stream crossing, including use of erosion and sedimentation control measures, to minimize or mitigate potential adverse effects on the aquatic ecosystem.

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Table T-3.e: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project involving discharge of dredge or fill material to waters of the United States will have unavoidable adverse impacts on the aquatic ecosystem after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation (as described in Table T-2.b).	If construction of an Upland Disposal Facility at this site would require building a new stream crossing that would involve a discharge of dredge or fill material to that stream, these regulations would be applicable to that discharge.	If these regulations are applicable, they would be met, because the building of a stream crossing would not be expected to cause any unavoidable loss of or long-term adverse impacts to the aquatic ecosystem, and thus no compensatory mitigation would be necessary.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic (including archaeological) property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Forest Street Site would be evaluated through: consultation by EPA with the State and Historic Preservation Office (and, if applicable, any pertinent Tribal Historic Preservation Office); determination of the "area of potential effects" of the Upland Disposal Facility and the potential for that area to contain properties included or eligible for inclusion in NRHP; determination of whether the facility would have an adverse impact on such a property; and if so, evaluation – and, as appropriate, implementation – of alternatives to avoid, or measures to minimize or mitigate, the adverse impacts.

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Table T-3.e: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	If it is determined that construction of the Upland Disposal Facility at this site could cause the loss or destruction of archaeological or historic data, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act)	314 CMR 9.06	For discharge of dredged or fill material to waters of the U.S. in Massachusetts: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on wetlands; (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under Wetlands Protection Act; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	If construction of an Upland Disposal Facility at the Forest Street Site would require building a new stream crossing that would involve a discharge of dredge or fill material to that stream, these regulations would be applicable to that discharge.	If the construction of an Upland Disposal Facility at the Forest Street Site would require discharge of dredge or fill material to a stream in the course of building a stream crossing: (a) EPA would need to find that there is no practicable alternative with less adverse impact on the aquatic ecosystem, or waive that requirement. (b) Appropriate and practicable steps would be taken during construction of the stream crossing, including use of erosion and sedimentation control measures, to minimize or mitigate potential adverse effects on the aquatic ecosystem. (c) This activity would not adversely affect estimated habitat of rare wildlife species because the stream crossing location is not within the state-mapped estimated habitat of any state-listed wildlife species. (d) Stormwater discharges would be controlled with BMPs during construction and use of the stream crossing.

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Table T-3.e: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				(e) It is not expected that the stream crossing would cause substantial long-term adverse impacts to the integrity of surface water.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 - 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions in resource areas responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes to resource areas, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 - 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species.	The maximum operational footprint for an Upland Disposal Facility at the Forest Street Site would require building a new stream crossing of Goose Pond Brook and would be within the 100-foot buffer of that stream. In addition, portions of both the minimum and maximum operational footprints for the facility would be within the 200-foot Riverfront Area of Goose Pond Brook (which is a resource area under this Act). Thus, the requirements of this Act and regulations would be applicable to the construction activities within these resource areas.	(a) EPA would need to find that there is no practicable alternative with less adverse impact on resource areas, or waive the requirement that there be no such alternative. (b) Appropriate and practicable steps would be taken during construction, including use of erosion and sedimentation control measures, to minimize or mitigate potential adverse effects on the resource area(s). (c) Construction activities would not adversely affect estimated habitat of rare wildlife species because they would not occur within or affect the state-mapped estimated habitat of any state-listed wildlife species. (d) If the construction activities in resource areas were not considered a "limited project," they might not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the requirement to maintain a 100-foot wide area of undisturbed vegetation along the stream in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).

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Table T-3.e: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on such a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized projects in areas where the work would have an area of potential impact on property(ies) listed in State Register.	An evaluation would be made through consultation with the MHC (and, if applicable, any pertinent Tribal Historic Preservation Office) as to whether the construction or operation of the Upland Disposal Facility at the Forest Street Site would adversely affect any property listed in the State Register of Historic Places. If it would, the substantive provisions of these regulations would be met.
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA. Thus, if construction of an Upland Disposal Facility at this site would require building a new stream crossing, this Order would be applicable to EPA.	If this Order is applicable, EPA would need to find that there is no practicable alternative with less adverse impact on wetlands or else to waive that requirement. The construction of a stream crossing would implement all practicable measures, including erosion and sedimentation controls, to minimize harm to wetlands.

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Table T-3.f: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
TSCA regulations on disposal of PCB Remediation Waste in landfill	40 CFR 761.50(d)(4) 40 CFR 761.61(b) & (c) 40 CFR 761.75	Section 761.75(b) establishes standards and requirements for chemical waste landfills used for disposal of PCBs, including siting, design, operation, and monitoring requirements. Any of these requirements may be waived by EPA under § 761.75(c)(4) if EPA finds that that requirement is not necessary to protect against unreasonable risk of injury to health or the environment. In addition, § 761.61(c) allows for risk-based approval of alternate method of disposal of non-liquid PCB Remediation Waste if EPA finds that such method will not pose an unreasonable risk of injury to health or the environment. As another alternative, dredged material with < 50 mg/kg may be disposed of in accordance with permit under § 404 of Clean Water Act or equivalent (§ 761.61(b)(3)).	Applicable to disposal of PCB Remediation Waste in local Upland Disposal Facility.	Construction and operation of local Upland Disposal Facility at Forest Street Site would meet the siting, design, and operation requirements of § 761.75, with the following qualifications: (a) While the site would not meet the location requirements of § 761.75(b)(1) relating to the permeability and characteristics of the existing soil, the facility would include a liner with equivalent impermeability, as allowed (with EPA approval) under § 761.75(b)(2). (b) The site may not meet certain of the hydrologic requirements of § 761.75(b)(3) relating to the depth of the groundwater table or its connection to surface water (which would be investigated during design); however, the facility would have a double liner and leachate collection system to prevent impacts to groundwater. (c) The site would not meet the topography requirement of § 761.75(b)(5) that a TSCA landfill be located in an area of low to moderate relief to minimize erosion, landslides, and slumping; however, controls would be implemented to minimize such occurrences. To the extent that any of these specific requirements could not be met, construction and operation of the facility could still meet the TSCA regulations through an EPA determination that the facility meets the substantive criteria for a waiver of that requirement under § 761.75(c)(4) or for a risk-based approval of the facility location and design under § 761.61(c).
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.

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Table T-3.f: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Clean Water Act – NPDES regulations (storm water discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges during construction and operation of Upland Disposal Facility.	Would be attained through use of BMPs, including stormwater diversion berms, stormwater detention basins, and drainage swales, to control erosion from stormwater discharges during construction and operation of Upland Disposal Facility and following closure of that facility.
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the steps set forth in the regulations must be followed.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because the area of the Forest Street Site identified for potential use for Upland Disposal Facility does not contain any federally listed T&E species or their critical habitat, and thus construction of facility would not adversely affect such species or habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Note that Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or soils to be placed in Upland Disposal Facility would constitute hazardous waste.	Based on prior experience at other portions of this site, it is not anticipated that the excavated sediments and soils to be placed in the Upland Disposal Facility would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of those sediments/soils would be conducted during design to confirm that result.

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Table T-3.f: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not be expected to apply to Upland Disposal Facility if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to disposal facility.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, these requirements would be met.
RCRA requirements for hazardous waste management facilities – technical requirements for landfills	40 CFR Part 264, Subpart N 40 CFR 264.111 40 CFR 264.117	Design, operating, closure, and post-closure requirements for disposal of hazardous waste in landfills.	Same as above.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, the Upland Disposal Facility would meet these requirements, including requirements for double liner/leachate collection system.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, the Upland Disposal Facility would have groundwater monitoring system and program consistent with these requirements.

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Table T-3.f: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA requirements for hazardous waste management facilities – technical requirements for tanks	40 CFR 264, Subpart J	Design, operating, closure, and post-closure requirements for storage or disposal of hazardous waste in tanks.	Relevant and appropriate to storage of leachate that constitutes RCRA hazardous waste (if any) in tanks.	If these requirements apply and if leachate stored in tanks at the Upland Disposal Facility should constitute RCRA hazardous waste, these requirements would be met.
RCRA land disposal restrictions	40 CFR Part 268	Establishes prohibitions and restrictions on, and treatment standards for, land disposal of certain hazardous wastes unless location of disposition is part of Corrective Action Management Unit (CAMU) under § 264.552 or part of Area of Contamination (AOC) under EPA's AOC policy. Includes specific alternate treatment standards for contaminated soil (which includes sediments under the definition of soil in § 268.2(k)); these are set forth in § 268.49. Under these standards, treatment would not be required if concentrations are less than 10 times the Universal Treatment Standards. Otherwise, treatment would be required to achieve 90% reduction in total concentrations for non-metals and in leachate concentrations for metals.	These restrictions would not be expected to apply if, as expected, the excavated materials to be placed in the Upland Disposal Facility do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these restrictions would be applicable to disposal of such materials. Note: CAMU concept unlikely to apply since Forest Street Site is not on contiguous property under control of owner where waste originated (see § 264.552). AOC policy unlikely to apply to Forest Street Site since it is not within overall area of dispersed contamination.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, and if they would require treatment under the alternate standards for contaminated soil in § 268.49, placement of such waste in that facility would not meet these restrictions, because TD 3 would not involve treatment. In that case, either the treatment requirement should be waived as technically impracticable for TD 3 or the materials could not be placed in the Upland Disposal Facility.

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Table T-3.f: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Endangered Species Act and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity in a designated Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of such a species. Note: While the MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" under certain conditions, that provision is not an ARAR, as discussed in the Revised CMS Report (Section 5.4).	Applicable to activities in a State-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species.	Would be attained because the area of the Forest Street Site identified for potential use for Upland Disposal Facility does not include any state-mapped Priority Habitat, as shown on Figure T-3, and GE is not aware of any other information indicating the presence of a state-listed species within this area.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Note that wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") Note also that, under the Massachusetts Contingency Plan (MCP), the on-site disposal of contaminated media constituting hazardous waste as part of a remedial action under the MCP (including its "adequately regulated" provisions) is exempt from the state hazardous waste regulations unless MDEP determines that	Applicable to determining whether excavated sediments or soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this site, it is not anticipated that excavated sediments or soils to be placed in the Upland Disposal Facility would constitute non-PCB state hazardous waste. However, representative TCLP testing of those sediments/soils would be conducted during design to confirm that result.

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Table T-3.f: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		compliance with those regulations is required (310 CMR 40.0033(5)).		
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to the Upland Disposal Facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under the MCP unless MDEP determines otherwise. However, if some materials did constitute such hazardous waste and the facility was not exempt under the MCP, these requirements would be applicable to the disposal facility.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, these requirements would be met.
Massachusetts hazardous waste management regulations – location standards for hazardous waste landfills	310 CMR 30.701(6), 30.702, 30.703(2)-(4), 30.704, 30.705(1), (3) & (6), 30.706	Location standards for hazardous waste landfills, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) in any waterbody, (e) within ½ mile or a delineated Zone 2 of a public water supply well, (f) on land overlying or in flow path of an actual, planned, or potential public underground drinking water source, (g) within 1000 feet or in flow path of private drinking water well, (h) in flow path	Same as above.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility at Forest Street Site would meet these standards, except that it could potentially be located within 1000 feet of a private drinking water well or over or within flow path of a potential public drinking water source or within flow path of an existing private drinking water well or a potential private drinking water source – all of which are matters that would be investigated during design.

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Table T-3.f: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		of potential private underground drinking water source, or (i) without a 200-foot buffer zone to fenceline. Potential public drinking water source is defined as groundwater capable of yielding ≥ 100 gpm and having < 10,000 mg/L of TDS; potential private drinking water source is defined as groundwater capable of yielding 2 to 100 gpm and having < 10,000 mg/L of TDS.		
Massachusetts hazardous waste management regulations – technical requirements for hazardous waste landfills	310 CMR 30.602 310 CMR 30.620 310 CMR 30.580 310 CMR 30.590	Requirements for design, operation, closure and post-closure care of landfills used for disposal of hazardous waste.	Same as above.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility would meet these requirements, including double liner/leachate collection system requirement.
	310 CMR 30.660	Groundwater protection requirements for hazardous waste landfills, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.		In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility would have groundwater monitoring system and program consistent with these requirements.
Massachusetts air pollution control requirements	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to activities generating dust.	Would be attained through use of dust control measures during construction and operation of the facility and through monthly air monitoring for PCBs and daily air monitoring for particulate matter during facility operations, along with response actions if certain action levels are exceeded.

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Table T-3.f: Alternative TD 3 (Local Upland Disposal) at Forest Street Site – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 mg/kg or greater.	To be considered for any new PCB spills that occur during the work.	Would be considered in the event of any new PCB spill that occurs during the construction or operation of the Upland Disposal Facility.

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Table T-3.g: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing EPA's Cancer Slope Factors. May be considered by EPA in selecting disposition option for removed sediments and soils.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	May be considered by EPA in selecting disposition option for removed sediments and soils.

Table T-3.g: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting disposition option for removed sediments and soils.

Table T-3.h: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material to waters of the United States: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	The maximum (but not minimum) operational footprint for an Upland Disposal Facility at the Rising Pond Site would impact a small (0.5-acre) forested wetland. It is unknown whether this wetland would constitute a water of the United States subject to these regulations (an issue that would be investigated during design). If it would, these regulations would be applicable to any filling of this wetland as part of TD 3.	If the operational footprint of the Upland Disposal Facility is large enough to impact the small wetland described in the prior column, and if that wetland constitutes a water of the U.S.: (a) EPA would need to find that there is no practicable alternative with less adverse impact on wetlands, or waive that requirement. (b) The facility would not cause or contribute to a violation of a state water quality standard or toxic effluent standard. (c) Review of available information indicates that there are no federal T&E species in the area of this site. Thus, the facility would not jeopardize the existence of any such species. (d) The use of this site would not cause significant degradation of waters of the U.S. apart from the filling of the wetland. If that is considered a significant adverse effect, the prohibition on actions with such effects would not be met. (e) Appropriate and practicable steps would be taken during construction and use of the Upland Disposal Facility to minimize or mitigate potential adverse ecological effects, but could not avoid impacting the wetland described above.

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Table T-3.h: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project involving discharge of dredge or fill material to waters of the United States will have unavoidable adverse impacts on the aquatic ecosystem after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation (as described in Table T-2.b).	Uncertain. If the operational footprint of the Upland Disposal Facility at this site is large enough to impact the small wetland described above, and if that wetland is considered to constitute a water of the United States, these regulations would be applicable to the filling of this wetland as part of TD 3.	If the operational footprint of the Upland Disposal Facility is large enough to impact the small wetland described above, and if that wetland is subject to these regulations, an assessment would be made as to whether the impact on this wetland is significant enough to trigger the requirement for compensatory mitigation. If so, a compensatory mitigation plan would be necessary to address the unavoidable adverse impact of the Upland Disposal Facility on that wetland.
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic (including archaeological) property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	Rising Pond Site would be evaluated through: consultation by EPA with the State Historic Preservation Office (and, if applicable, any pertinent Tribal Historic Preservation Office); determination of whether the "area of potential effects" of the Upland Disposal Facility would include the Rising Paper Mill (which is listed in NRHP) or other properties included or eligible for inclusion in NRHP; determination of whether the facility would have an adverse impact on such a property; and if so, evaluation – and, as appropriate, implementation – of alternatives to avoid, or measures to minimize or mitigate, the adverse impacts.

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Table T-3.h: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	If it is determined that construction of the Upland Disposal Facility at the Rising Pond Site could cause the loss or destruction of archaeological or historic data, it is anticipated that EPA would notify DOI as required.
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act)	314 CMR 9.06	For discharge of dredged or fill material to waters of the U.S. in Massachusetts: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on wetlands; (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under Wetlands Protection Act; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Uncertain. If the operational footprint of the Upland Disposal Facility at this site is large enough to impact the small wetland described above, and if that wetland is considered to constitute a water of the United States, these regulations would be applicable to the filling of this wetland as part of TD 3.	If the operational footprint of the Upland Disposal Facility is large enough to impact the small wetland described in the prior column, and if that wetland constitutes a water of the U.S.: (a) EPA would need to find that there is no practicable alternative with less adverse impact on wetlands, or waive that requirement. (b) Appropriate and practicable steps would be taken during construction and use of the Upland Disposal Facility to minimize or mitigate potential adverse ecological effects, but could not avoid impacting the wetland described above. (c) The operational footprint of the facility may adversely affect estimated habitat of rare wildlife species given that the maximum operational footprint is within the state-mapped estimated habitat of a state-listed wildlife species (wood turtle). If it does, the prohibition on projects with an adverse effect on such habitat would not be met.

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Table T-3.h: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				(d) Stormwater discharges would be controlled with BMPs during construction and use of the Upland Disposal Facility and following closure. (e) It is not expected that the facility would cause substantial long-term adverse impacts to the integrity of surface water.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 - 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions in resource areas responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the MCP, that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes to resource areas, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 - 10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species.	The maximum (but not minimum) operational footprint for an Upland Disposal Facility at this site would impact the small forested wetland described above and, if the adjacent section of Rising Pond is determined to constitute a river under this Act, would impact a portion of the 200-foot Riverfront Area (a resource area under this Act). Under that footprint, these regulations would be applicable to construction activities in those areas.	If the operational footprint of the Upland Disposal Facility is large enough to impact the small wetland and Riverfront Area described in the prior column, then: (a) EPA would need to find that there is no practicable alternative with less adverse impact on resource areas, or waive the requirement that there be no such alternative. (b) Appropriate and practicable steps would be taken during construction and use of the Upland Disposal Facility to minimize or mitigate potential adverse effects on the resource area(s), but could not avoid impacting the small wetland. (c) The operational footprint of the facility may adversely affect estimated habitat of rare wildlife species given that the maximum operational footprint is within the state-mapped estimated habitat of a state-listed wildlife species (wood turtle). If it does, the prohibition on projects with an adverse effect on such habitat would not be met. (d) In addition, if the implementation of TD 3 at the Rising Pond Site were not considered a "limited project," it might not meet some of the requirements of 310 CMR 10.54 – 10.58 and 10.60 – e.g., the prohibition on loss of > 5000

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Table T-3.h: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				square feet of bordering vegetated wetlands (10.55(4)(a)&(b)), the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.) – depending on the size of the operational footprint and the types and size of resource areas affected.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.	Applicable to State; relevant and appropriate to State-authorized projects in areas where the work would have an area of potential impact on property(ies) listed in State Register.	An evaluation would be made through consultation with the MHC (and, if applicable, any pertinent Tribal Historic Preservation Office) as to whether the construction or operation of the Upland Disposal Facility at the Rising Pond Site would adversely affect the Rising Paper Mill, which is listed in the State Register of Historic Places, or any other properties listed in that Register. If it would, the substantive provisions of these regulations would be met.

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Table T-3.h: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA. Thus, if the operational footprint of the Upland Disposal Facility at this site is large enough to impact the small wetland described above, and if that wetland is found to meet the definition of a wetland under this Order, this Order would be applicable to EPA.	If the operational footprint of the Upland Disposal Facility is large enough to impact the small wetland described above, and if that wetland is subject to this Executive Order, EPA would need to find that there is no practicable alternative with less adverse impact on wetlands and that the project includes all practicable measures to minimize harm to wetlands, or else waive those requirements.

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Table T-3.i: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
TSCA regulations on disposal of PCB Remediation Waste in landfill	40 CFR 761.50(d)(4) 40 CFR 761.61(b) & (c) 40 CFR 761.75	Section 761.75(b) establishes standards and requirements for chemical waste landfills used for disposal of PCBs, including siting, design, operation, and monitoring requirements. Any of these requirements may be waived by EPA under § 761.75(c)(4) if EPA finds that that requirement is not necessary to protect against unreasonable risk of injury to health or the environment. In addition, § 761.61(c) allows for risk-based approval of alternate method of disposal of non-liquid PCB Remediation Waste if EPA finds that such method will not pose an unreasonable risk of injury to health or the environment. As another alternative, dredged material with < 50 mg/kg may be disposed of in accordance with permit under § 404 of Clean Water Act or equivalent (§ 761.61(b)(3)).	Applicable to disposal of PCB Remediation Waste in local Upland Disposal Facility.	Construction and operation of local Upland Disposal Facility at Rising Pond Site would meet the siting, design, and operation requirements of § 761.75 with the following qualifications: (a) While the site would not meet the location requirements of § 761.75(b)(1) relating to the permeability and characteristics of the existing soil, the facility would include a liner with equivalent impermeability, as allowed (with EPA approval) under § 761.75(b)(2). (b) The site may not meet certain of the hydrologic requirements of § 761.75(b)(3) relating to the depth of the groundwater table or its connection to surface water, which would be investigated during design. However, the facility would have a double liner and leachate collection system to prevent impacts to groundwater. Even if any of these specific requirements could not be met, construction and operation of the facility could still meet the TSCA regulations through an EPA determination that the facility meets the substantive criteria for a waiver of that requirement under § 761.75(c)(4) or for a risk-based approval of the facility location and design under § 761.61(c).
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.

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Table T-3.i: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Clean Water Act – NPDES regulations (storm water discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction and operation of Upland Disposal Facility.	Would be attained through use of BMPs, including stormwater diversion berms, stormwater detention basins, and drainage swales, to control erosion from stormwater discharges during construction and operation of Upland Disposal Facility and following closure of that facility.
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the steps set forth in the regulations must be followed.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize the continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because the area of Rising Pond Site identified for potential use for Upland Disposal Facility does not contain any federally listed T&E species or their critical habitat, and thus construction of facility would not adversely affect such species or habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Note that Sec. 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments or soils to be placed in Upland Disposal Facility would constitute hazardous waste.	Based on prior experience at other portions of this site, it is not anticipated that the excavated sediments and soils to be placed in the Upland Disposal Facility would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of those sediments/soils would be conducted during design to confirm that result.

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Table T-3.i: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not be expected to apply to the Upland Disposal Facility if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to the disposal facility.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, these requirements would be met.
RCRA requirements for hazardous waste management facilities – technical requirements for landfills	40 CFR Part 264, Subpart N 40 CFR 264.111 40 CFR 264.117	Design, operating, closure, and post-closure requirements for disposal of hazardous waste in landfills.	Same as above.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, the Upland Disposal Facility would meet these requirements, including requirements for double liner/leachate collection system.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, the Upland Disposal Facility would have groundwater monitoring system and program consistent with these requirements.

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Table T-3.i: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA requirements for hazardous waste management facilities – technical requirements for tanks	40 CFR 264, Subpart J	Design, operating, closure, and post-closure requirements for storage or disposal of hazardous waste in tanks.	Relevant and appropriate to storage of leachate that constitutes RCRA hazardous waste (if any) in tanks.	If these requirements apply and if leachate stored in tanks at Upland Disposal Facility should constitute RCRA hazardous waste, these requirements would be met.
RCRA land disposal restrictions	40 CFR Part 268	Establishes prohibitions and restrictions on, and treatment standards for, land disposal of certain hazardous wastes unless location of disposition is part of Corrective Action Management Unit (CAMU) under § 264.552 or part of AOC under EPA's AOC policy. Includes specific alternate treatment standards for contaminated soil (which includes sediments under the definition of soil in § 268.2(k)); these are set forth in § 268.49. Under these standards, treatment would not be required if concentrations are less than 10 times the Universal Treatment Standards. Otherwise, treatment would be required to achieve 90% reduction in total concentrations for non-metals and in leachate concentrations for metals	These restrictions would not be expected to apply if, as expected, the excavated materials to be placed in the Upland Disposal Facility do not constitute RCRA hazardous waste. However, if some such materials did constitute RCRA hazardous waste, these restrictions would be applicable to disposal of such materials. Note: CAMU concept unlikely to apply since Rising Pond Site is not on contiguous property under control of owner where waste originated (see § 264.552). AOC policy unlikely to apply to Rising Pond Site since it is not within overall area of dispersed contamination.	In the unlikely event that some materials to be placed in the Upland Disposal Facility were found to constitute RCRA hazardous waste, <u>and</u> if they would require treatment under the alternate standards for contaminated soil in § 268.49, placement of such waste in that facility would not meet these restrictions, because TD 3 would not involve treatment. In that case, either the treatment requirement should be waived as technically impracticable for TD 3 or the materials could not be placed in the Upland Disposal Facility.

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Table T-3.i: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Endangered Species Act and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity within mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of a state-listed species. The MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in a state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	The maximum (but not minimum) operational footprint for an Upland Disposal Facility at this site includes a portion of mapped Priority Habitat for the state-listed wood turtle (see Figure T-3) and would adversely impact that habitat and species. Thus, depending on the size of the operational footprint, implementation of TD 3 at this site could result in a "take" of that state-listed species. In that event, the prohibition on a "take" would not be met
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Note that wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") Note also that, under the Massachusetts Contingency Plan (MCP), the on-site	Applicable to determining whether excavated sediments or soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this site, it is not anticipated that excavated sediments or soils to be placed in the Upland Disposal Facility would constitute non-PCB state hazardous waste. However, representative TCLP testing of those sediments/soils would be conducted during design to confirm that result.

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Table T-3.i: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		disposal of contaminated media constituting hazardous waste as part of a remedial action under the MCP (including its "adequately regulated" provisions) is exempt from the state hazardous waste regulations unless MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).		
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to Upland Disposal Facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under the MCP unless MDEP determines otherwise. However, if some materials did constitute such hazardous waste and the facility was not exempt under the MCP, these requirements would be applicable to the disposal facility.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, these requirements would be met.

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Table T-3.i: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – location standards for hazardous waste landfills	310 CMR 30.701(6), 30.702, 30.703(2)-(4), 30.704, 30.705(1), (3) & (6), 30.706	Location standards for hazardous waste landfills, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) in any waterbody, (e) within ½ mile or a delineated Zone 2 of a public water supply well, (f) on land overlying or in flow path of an actual, planned, or potential public underground drinking water source, (g) within 1000 feet or in flow path of private drinking water well, (h) in flow path of potential private underground drinking water source, or (i) without a 200-foot buffer zone to fenceline. Potential public drinking water source is defined as groundwater capable of yielding ≥ 100 gpm and having < 10,000 mg/L of TDS; potential private drinking water source is defined as groundwater capable of yielding 2 to 100 gpm and having < 10,000 mg/L of TDS.	Same as above.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility at the Rising Pond Site would meet these standards, except that it could potentially be located within 1000 feet or in the flow path of a private drinking water well or over or within flow path of a potential public drinking water source or within flow path of a potential private drinking water source – which are matters that would be investigated during design. If any of these standards were found to apply and could not be met at this location, it would be necessary to obtain a waiver of such standard(s) as technically impracticable to attain.
Massachusetts hazardous waste management regulations – technical requirements for hazardous waste landfills	310 CMR 30.602 310 CMR 30.620 310 CMR 30.580 310 CMR 30.590	Requirements for design, operation, closure and post-closure care of landfills used for disposal of hazardous waste.	Same as above.	In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility would meet these requirements, including double liner/leachate collection system requirement.
	310 CMR 30.660	Groundwater protection requirements for hazardous waste landfills, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.		In the unlikely event that materials to be placed in the Upland Disposal Facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the facility would have groundwater monitoring system and program consistent with these requirements.

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Table T-3.i: Alternative TD 3 (Local Upland Disposal) at Rising Pond Site – Potential Action-Specific ARARs

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts air pollution control requirements	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to activities generating dust.	Would be attained through use of dust control measures during construction and operation of the facility and through monthly air monitoring for PCBs and daily air monitoring for particulate matter during facility operations, along with response actions if certain action levels are exceeded.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 mg/kg or greater.	To be considered for any new PCB spills that occur during the work.	Would be considered in the event of any new PCB spill that occurs during the construction or operation of the Upland Disposal Facility.

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Table T-4.a: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing EPA's Cancer Slope Factors. May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.

Table T-4.a: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting treatment/disposition option for removed sediments and soils.

Table T-4.b: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material to waters of the United States: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	The Massachusetts GIS wetlands mapping shows a small (0.75-acre) wetland within the footprint of the identified location for a chemical extraction facility on GE-owned property at the DeVos site and another wetland that would be crossed by an access road. It is uncertain whether these wetlands would constitute waters of the United States subject to these regulations (an issue that would be investigated during design). If they would, these regulations would be applicable to the discharge of dredge or fill material to this wetland in connection with construction of the chemical extraction facility and the access road.	If this alternative and location were selected and the small wetlands described in the prior column are subject to these regulations: (a) EPA would need to find that there is no practicable alternative with less adverse impact on wetlands, or to waive that requirement. (b) The facility would not cause or contribute to a violation of a state water quality standard or toxic effluent standard. (c) Review of available information indicates that there are no federal T&E species in the area of this site. Thus, the facility would not jeopardize the existence of any such species. (d) The use of this site would not cause significant degradation of waters of the U.S. apart from the impact on the small wetlands mentioned above. If that is considered a significant adverse effect, the prohibition on actions with such effects would not be met. (e) Appropriate and practicable steps would be taken during construction and operation of the chemical extraction facility and access road to minimize or mitigate potential adverse ecological effects, but the impacts on the small wetlands mentioned above could not be avoided.

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Table T-4.b: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project involving discharge of dredge or fill material to waters of the United States will have unavoidable adverse impacts on the aquatic ecosystem after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation (as described in Table T-2.b).	Uncertain. If the small wetlands described above are considered to constitute waters of the United States, these regulations would be applicable to the discharge of dredge or fill material to these wetlands in connection with construction of the chemical extraction facility and access road.	If this alternative and location were selected and the small wetlands described above are subject to these regulations, an assessment would be made as to whether the impact on these wetlands are significant enough to trigger the requirement for compensatory mitigation. If so, these regulations would require a compensatory mitigation plan to address the unavoidable adverse impact of the chemical extraction facility on those wetlands.
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to treatment facility if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if they did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, these requirements would be met by floodproofing the facility to prevent washout by a 100-year flood.

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Table T-4.b: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic (including archaeological) property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	The location of the chemical treatment facility would be evaluated through: consultation by EPA with the State Historic Preservation Office (and, if applicable, any pertinent Tribal Historic Preservation Office); determination of the "area of potential effects" of the facility and the potential for that area to contain properties included or eligible for inclusion in NRHP; determination of whether the facility would have an adverse impact on such a property; and if so, evaluation – and, as appropriate, implementation – of alternatives to avoid, or measures to minimize or mitigate, the adverse impacts.
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	If it is determined that TD 4 could cause the loss or destruction of archaeological or historic data, it is anticipated that EPA would notify DOI as required.

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Table T-4.b: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act)	314 CMR 9.06	For discharge of dredged or fill material to waters of the U.S. in Massachusetts: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on wetlands; (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under Wetlands Protection Act; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Uncertain. If the small wetlands that would be affected by the treatment facility and access road at this site (as described above) are considered to constitute waters of the United States, these regulations would be applicable to the discharge of dredge or fill material to these wetlands in connection with construction of the chemical extraction facility and access road.	If this alternative and location were selected and the small wetlands described above are subject to these regulations: (a) EPA would need to find that there is no practicable alternative with less adverse impact on wetlands, or to waive that requirement. (b) Appropriate and practicable steps would be taken during construction and operation of the chemical extraction facility and access road to minimize or mitigate potential adverse ecological effects, but the impacts on the small wetlands mentioned above could not be avoided. (c) The treatment facility (including the portion in the wetland area) would be located within, and would adversely affect, estimated habitat of rare wildlife species (see Figure T-4). Thus, the prohibition on discharges with an adverse effect on such habitat would not be met. (d) Stormwater discharges would be controlled with BMPs during construction and operation of the chemical extraction facility and access road. (e) It is not expected that the facility would cause substantial long-term adverse impacts to the integrity of river water.

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Table T-4.b: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 - 10.58 & 10.60 310 CMR 10.59	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the Massachusetts Contingency Plan (MCP), that would be less damaging to resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes to resource areas, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 -10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species.	Applicable to construction and operation of treatment facility, which would be located within 100-year floodplain and, in part, within a Riverfront Area (200 feet from River), which are resource areas under these regulations, and would affect small wetlands (described above), which may also be resource areas under these regulations.	Since TD 4 would be a response action, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ Given the selected location, EPA would need to find that there is no practicable alternative that would be less damaging to resource areas, or to waive the requirement that there be no such practicable alternative. ▪ Practicable measures would be implemented to minimize harm to floodplain, including erosion and sedimentation control measures during construction and operation of the treatment facility and removal of facility structures, staging areas, and access roads and restoration of those areas upon completion of treatment operations. There would be no long-term impact on flood storage capacity of floodplain, but there would be a short-term impact, which would require flood storage compensation. ▪ The treatment facility would be located within, and would adversely affect, estimated rare wildlife species habitat (see Figure T-4). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if TD 4 was not considered a "limited project," it might not meet some of the requirements of 310 CMR 10.54 -10.58 and 10.60 – e.g., the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.).

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Table T-4.b: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the hazardous waste.	These requirements would not apply to treatment facility if, as expected, excavated sediments and soils do not constitute state hazardous waste subject to these standards. Further, even if they did constitute such hazardous waste, the facility may be exempt from these requirements under MCP (as described in Table T-4.c). However, if some materials did constitute such hazardous waste and the facility was not exempt, these requirements would be applicable to the treatment facility.	In the unlikely event that some materials to be treated were found to constitute state hazardous waste and treatment facility is not exempt, waste piles used for staging at treatment facility would not meet the requirement that hazardous waste piles may not be located within 500-year floodplain. Any tanks or similar units used to store such waste at the facility would be floodproofed against a 100-year flood.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an	Applicable to State; relevant and appropriate to state-authorized projects in areas where the work would have an area of potential impact on property(ies) listed in State Register.	An evaluation would be made through consultation with the MHC (and, if applicable, any pertinent Tribal Historic Preservation Office) as to whether the construction or operation of the treatment facility at the DeVos site would adversely affect any property listed in the State Register of Historic Places. If it would, the substantive provisions of these regulations would be met.

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Table T-4.b: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.		
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA. Thus, if the small wetlands described above are found to meet the definition of wetlands under this Order, this Order would be applicable to EPA.	If this alternative and location were selected and the small wetlands described above are subject to this Executive Order, EPA would need to find that there is no practicable alternative, and that the project includes all practicable measures to minimize harm to wetlands, or else would need to waive those requirements.
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA, and would apply here since the identified location for the chemical extraction facility would be	If this alternative and location were selected, EPA would need to find that there is no practicable alternative that would avoid impacts on the floodplain, or to waive the requirement that there be no such practicable alternative. Practicable measures would be implemented to minimize harm to floodplain, including erosion and sedimentation control measures during construction and operation of the treatment facility and removal of facility structures, staging areas, and access roads and restoration of those areas upon completion of treatment operations. There would be no long-term impact on flood storage

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Table T-4.b: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			situated within the 100-year floodplain.	capacity of floodplain. However, there would be a short-term impact while the facility was in place, and so flood storage compensation would be necessary.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Toxic Substances Control Act (TSCA) regulations on cleanup and disposal of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61	Regulations specify methods for disposal of PCB Remediation Waste (e.g., incineration, approved TSCA landfill). Disposal includes actions relating to destroying, degrading, or decontaminating PCB-containing materials. There are no specific provisions for chemical treatment. Regulations allow risk-based approval of cleanup or disposal method (§ 761.61(c)) based on demonstration that such method will not pose an unreasonable risk of injury to health or the environment.	Applicable to treatment of PCB Remediation Waste, since they apply to disposal and disposal includes actions relating to destroying, degrading, or decontaminating materials containing PCBs.	Since there are no specific requirements relating to chemical treatment of PCB-containing wastes, it would be necessary to obtain EPA's determination that the chemical extraction process meets the substantive criteria for a risk-based approval under § 761.61(c).
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act – NPDES regulations (storm water discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction and operation of treatment facility.	Would be attained through use of BMPs, including stormwater diversion berms, stormwater detention basins, and drainage swales, to control erosion from stormwater discharges during construction and operation of treatment facility.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the steps set forth in the regulations must be followed.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because area identified for chemical extraction facility does not contain any federally listed T&E species or their critical habitat, and thus facility would not adversely affect such species or habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Note that § 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments and soils to be treated at treatment facility would constitute hazardous waste.	Based on prior experience at other portions of this site, it is not anticipated that excavated sediments or soils to be treated would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils would be conducted during design to confirm that result.
RCRA regulations for less than 90-day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if some materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such materials.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, any tanks or containment buildings used for < 90-day accumulation of those materials would meet these requirements.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if some materials did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to storage/ treatment facility for such materials (other than < 90-day accumulation units).	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, these requirements would be met.
RCRA regulations for hazardous waste management facilities – technical requirements for storage and treatment of hazardous waste	40 CFR Part 264, Subparts J, L, X, and DD	Design, operating, closure, and (if necessary) post-closure requirements for storage of hazardous waste in tanks (Subpart J), waste piles outside structures (Subpart L), miscellaneous units (Subpart X), and containment buildings (Subpart DD).	Same as above.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, any tanks, waste piles, containment buildings, or miscellaneous units used for treatment of such waste or for temporary staging of such waste before treatment (other than < 90-day accumulation units) would meet these requirements.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, the treatment facility, including the staging areas for such waste before treatment, would have groundwater monitoring system and program consistent with these requirements.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – air emission standards for process vents	40 CFR Part 264, Subpart AA	Air emission standards for process vents, closed vent systems, and control devices at facilities that treat hazardous wastes having total organic concentrations of 10 ppm or greater using distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping.	These requirements would not apply if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if some materials did constitute RCRA hazardous waste, and if treatment facility uses solvent extraction, and if materials to be treated by solvent extraction contain total organic concentrations ≥ 10 mg/kg, these requirements would be relevant and appropriate.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, and if the treatment facility uses solvent extraction, and if the materials to be treated by solvent extraction contain total organic concentrations ≥ 10 ppm, these emission standards for process vents would be met.
State ARARs				
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction and operation of the treatment facility.	Stormwater discharges during construction and operation of the treatment facility would be controlled with BMPs, which would be designed to meet the specified stormwater management standards. These stormwater systems would include setbacks from receiving waters and wetlands.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts Endangered Species Act (MESA) and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity within mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of a state-listed species. The MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.	Applicable to activities in a state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	The area identified for the treatment facility is within state-mapped Priority Habitat, as shown on Figure T-4. The construction of the facility in this location would result in a "take" of at least 3 state-listed species, as shown in Appendix L. Thus, the prohibition on a "take" would not be met.
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting state-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts air pollution control requirements	310 CMR 7.09	Prohibits person engaged in dust-generating activities from creating condition of air pollution, defined as air concentrations that would cause a nuisance, be injurious or potentially injurious to human or animal life, vegetation, or property, or unreasonably interfere with comfortable enjoyment of life and property or conduct of business.	Applicable to activities generating dust.	Would be attained through use of dust control measures during construction and operation of the facility and through monthly air monitoring for PCBs and daily air monitoring for particulate matter during treatment facility operations (if expected to generate dust), along with response actions if certain action levels are exceeded.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") In addition, under the Massachusetts Contingency Plan (MCP), the on-site treatment of contaminated media constituting hazardous waste as part of a remedial action under the MCP (including its "adequately regulated" provisions) is exempt from the state hazardous waste regulations unless MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this site, it is not anticipated that excavated sediments or soils to be treated at the treatment facility would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils would be conducted during design to confirm that result.
Massachusetts hazardous waste management regulations – requirements for less than 90-day accumulation of hazardous waste	310 CMR 30.340 – 30.343	Allows on-site accumulation of hazardous waste for less than 90 days in containers or tanks, provided generator complies with requirements specified or referenced in these regulations.	These requirements would not apply to treatment facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines	In the unlikely event that materials to be treated were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, any tanks used for < 90-day accumulation of such materials would meet these requirements.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			otherwise. However, if some materials did constitute such hazardous waste and the facility was not exempt under MCP, these requirements would be applicable to < 90-day on-site accumulation of such materials.	
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to treatment facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials did constitute such hazardous waste and the facility was not exempt under MCP, these requirements would be applicable to the treatment facility .	In the unlikely event that materials to be treated were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, these requirements would be met.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – location standards for units used to treat or store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table T-4.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of a private drinking water well, or (g) without a 200-foot buffer zone to fenceline. Potential public drinking water source is defined as groundwater capable of yielding ≥ 100 gpm and having < 10,000 mg/L of TDS.	These requirements would not apply to treatment facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials did constitute such hazardous waste and the facility was not exempt under MCP, these requirements would be applicable to the staging piles for such waste at the treatment facility.	In the unlikely event that materials to be treated were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the temporary staging piles used for such waste at a treatment facility located at DeVos site would meet these location standards, except for the following : (a) the prohibition on waste piles within 500-year floodplain; (b) the requirement for a 200-foot buffer zone to the fenceline (since there would not be a 200-foot buffer between the facility and the River); and (c) potentially the prohibition on waste piles on land overlying a potential public drinking water source (an issue to be investigated in design).
	310 CMR 30.701(2)	For treatment or storage facility (other than surface impoundment or waste pile) that does not receive hazardous waste from off-site sources, portion in 100-year floodplain must be floodproofed.	These requirements would not apply if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials did constitute such hazardous waste and the facility was not exempt under MCP, these requirements would be	In the unlikely event that materials to be treated were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, any tanks or miscellaneous units used to treat or store such waste would be floodproofed against a 100-year flood.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			applicable to tanks or miscellaneous units used to store or treat such waste.	
Massachusetts hazardous waste management regulations – technical requirements for treatment and storage of hazardous waste	310 CMR 30.602 310 CMR 30.690 310 CMR 30.580	Requirements for design, operation, and closure of tanks used to store or treat hazardous waste.	Same as above.	In the unlikely event that materials to be treated were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, any tanks used to store or treat such waste at the treatment facility would meet these requirements.
	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	These requirements would not apply if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials did constitute such hazardous waste and the facility was not exempt under MCP, these requirements would be applicable to the staging piles for such waste at the treatment facility.	In the unlikely event that materials to be treated were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the temporary staging piles for such waste at treatment facility would meet these requirements, except potentially for the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.) – an issue that would be investigated during design.

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Table T-4.c: Alternative TD 4 (Chemical Extraction) (Assumed to Take Place at DeVos Site) – Potential Action-Specific ARARs *

Statute/Regulation	Citation **	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	Same as above.	In the unlikely event that materials to be treated were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the staging areas for such waste before treatment would have groundwater monitoring system and program consistent with these requirements.
Massachusetts requirements for storage and handling of flammable liquids	527 CMR 6.05, 6.07	Requirements for installation of liquefied petroleum (LP) gas systems.	Applicable to storage of LP gas (i.e., propane, propylene, butanes, and/or butylenes) if used as extraction fluid in chemical treatment.	Would be met if LP gas used.
	527 CMR 14.03, 14.04, 14.07	Requirements for storage and handling of flammable liquids.	Applicable to storage and handling of flammable liquids if used as extraction fluids in chemical treatment.	Would be met if flammable liquids used.
Massachusetts tank regulations	527 CMR 9.03, 9.04	Requirements for design and operation of above-ground storage tanks of > 10,000 gallons for any liquids other than water (527 CMR 9.03) and for above-ground storage tanks $\leq$ 10,000 gallons for flammable (Class I) liquids (527 CMR 9.04).	Applicable to above-ground storage of any non-water liquids in > 10,000 gallon tanks or storage of flammable liquids in $\leq$ 10,000 gallon tanks.	Would be met for these types of tanks.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 mg/kg or greater.	To be considered for any new PCB spills that occur during the work.	Would be considered in the event of any new PCB spill that occurs during construction of the treatment facility or treatment operations.

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Table T-5.a: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal and State ARARs				
None				
To Be Considered				
Cancer Slope Factors	EPA's Integrated Risk Information System (IRIS) http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate carcinogenic risk purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.
Reference Doses	EPA's IRIS http://www.epa.gov/iriswebp/iris/index.html	Guidance values used to evaluate non-carcinogenic hazards purportedly associated with exposure to PCBs.	To be considered.	May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.
PCBs: Cancer Dose-Response Assessment and Application in Environmental Mixtures (EPA, 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	Guidance describing EPA's reassessment of the purported carcinogenicity of PCBs. It includes revised Cancer Slope Factors for PCBs based on the pathway of exposure.	To be considered.	Considered in establishing EPA's Cancer Slope Factors. May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	To be considered.	May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA, 2005)	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	Guidance on issues relating to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	To be considered.	May be considered by EPA in selecting treatment/disposition option for removed sediments and soils.

Table T-5.a: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Chemical-Specific ARARs

Authority/Regulation	Citation	Synopsis of Criteria	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment (National Research Council, 2006)	Report available from National Academies Press	Evaluation by National Academy of Sciences' National Research Council of EPA's reassessment of exposures to and purported risks of dioxin and dioxin-like congeners (including PCBs), including use of linear, no threshold extrapolation procedure.	To be considered.	Should be considered by EPA in selecting treatment/disposition option for removed sediments and soils.

Table T-5.b: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
Clean Water Act – Section 404 and implementing regulations issued by U.S. Army Corps of Engineers (ACOE) and by EPA	33 USC 1344 33 CFR Parts 320-323 (ACOE) 40 CFR Part 230 (EPA)	For discharge of dredge or fill material to waters of the United States: (a) there must be no practicable alternative with less adverse impact on aquatic ecosystem (including wetlands); (b) discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard; (c) discharge cannot jeopardize the existence of any threatened or endangered (T&E) species; (d) discharge cannot cause or contribute to significant degradation of waters of the U.S., including significant adverse effects on human health or welfare, aquatic life, aquatic ecosystem, or recreational, aesthetic, and economic values; and (e) discharger must take appropriate and practicable steps to minimize or mitigate potential adverse effects on aquatic ecosystem.	The Massachusetts GIS wetlands mapping shows a small (0.75-acre) wetland within the footprint of the identified location for a thermal desorption facility on GE-owned property at the DeVos site and another wetland that would be crossed by an access road. It is uncertain whether these wetlands would constitute waters of the United States subject to these regulations (an issue that would be investigated during design). If they would, these regulations would be applicable to the discharge of dredge or fill material to this wetland in connection with construction of the facility and the access road.	If this alternative and location were selected and the small wetlands described in the prior column are subject to these regulations: (a) EPA would need to find that there is no practicable alternative with less adverse impact on wetlands, or to waive that requirement. (b) The facility would not cause or contribute to a violation of a state water quality standard or toxic effluent standard. (c) Review of available information indicates that there are no federal T&E species in the area of this site. Thus, the facility would not jeopardize the existence of any such species. (d) The use of this site would not cause significant degradation of waters of the U.S. apart from the impact on the small wetlands mentioned above. If that is considered a significant adverse effect, the prohibition on actions with such effects would not be met. (e) Appropriate and practicable steps would be taken during construction and operation of the thermal desorption facility and access road to minimize or mitigate potential adverse ecological effects, but the impacts on the small wetlands mentioned above could not be avoided.

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Table T-5.b: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	33 CFR Part 332 (ACOE) 40 CFR Part 203, Subpart J (EPA)	Compensatory mitigation regulations: If project involving discharge of dredge or fill material to waters of the United States will have unavoidable adverse impacts on the aquatic ecosystem after all appropriate and practicable steps have been taken to avoid or minimize the impacts, responsible party must implement compensatory mitigation (as described in Table T-2.b).	Uncertain. If the small wetlands described above are considered to constitute waters of the United States, these regulations would be applicable to the discharge of dredge or fill material to these wetlands in connection with construction of the thermal desorption facility and access road.	If this alternative and location were selected and the small wetlands described above are subject to these regulations, an assessment would be made as to whether the impact on these wetlands is significant enough to trigger the requirement for compensatory mitigation. If so, these regulations would require a compensatory mitigation plan to address the unavoidable adverse impact of the thermal desorption facility on those wetlands.
Resource Conservation and Recovery Act (RCRA) requirements for hazardous waste facilities in floodplains	40 CFR 264.1(j)(7) 40 CFR 264.18(b)	A hazardous waste treatment, storage, or disposal facility used for remediation waste and located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of such waste by a 100-year flood unless owner/operator shows that procedures are in effect to remove waste safely before flood waters can reach facility.	These requirements would not apply to treatment facility if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if they did constitute RCRA hazardous waste, these requirements would be relevant and appropriate.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, these requirements would be met by floodproofing the facility to prevent washout by a 100-year flood.

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Table T-5.b: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
National Historic Preservation Act and regulations	16 USC 470f 36 CFR Part 800	A federal agency proposing to fund or authorize a project must take into account the project's effect on properties (including a site, building, structure, or object) included or eligible for inclusion in the National Register of Historic Places (NRHP). This requires: (a) consultation with the State and/or Tribal Historic Preservation Offices; (b) identification of the project's "area of potential effects"; (c) identification of any listed or eligible historic (including archaeological) property within that area that could be affected by the project; (d) if there is such property, determination of whether the project would have an adverse impact on the property; (e) if so, evaluation of alternatives to avoid, minimize, or mitigate the adverse impacts; and (f) agreement on such measures or, failing agreement, implementation of such measures identified by the authorizing agency.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where property(ies) listed or eligible for inclusion on NRHP may be present.	The location of the thermal desorption facility would be evaluated through: consultation by EPA with the State Historic Preservation Office (and, if applicable, any pertinent Tribal Historic Preservation Office); determination of the "area of potential effects" of the facility and the potential for that area to contain properties included or eligible for inclusion in NRHP; determination of whether the facility would have an adverse impact on such a property; and if so, evaluation – and, as appropriate, implementation – of alternatives to avoid, or measures to minimize or mitigate, the adverse impacts.
Archaeological and Historic Preservation Act	16 USC 469	When a federal agency finds or is notified that a federal or federally authorized project may cause the loss or destruction of archaeological or historic data, it must notify Department of Interior (DOI). If DOI determines that the data are significant and may be irrevocably lost or destroyed, it is to conduct a survey and other investigation of the affected area and recover and preserve such data as necessary in the public interest.	Applicable to EPA; relevant and appropriate to federally authorized work in areas where archaeological or historic data may be present.	If it is determined that TD 5 could cause the loss or destruction of archaeological or historic data, it is anticipated that EPA would notify DOI as required.

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Table T-5.b: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts Clean Water Act – water quality certification regulations (under § 401 of federal Clean Water Act)	314 CMR 9.06	For discharge of dredged or fill material to waters of the U.S. in Massachusetts: (a) no such discharge is allowed if there is a practicable alternative with less adverse impact on aquatic ecosystem; (b) appropriate and practicable steps must be taken to avoid and minimize adverse effects on land under water and on wetlands; (c) there must be no discharge that would adversely affect estimated habitat of rare wildlife species under Wetlands Protection Act; (d) stormwater discharges must be controlled with best management practices (BMPs); and (e) there must be no substantial adverse impacts to physical, chemical, or biological integrity of surface waters.	Uncertain. If the small wetlands that would be affected by the treatment facility and access road at this site (as described above) are considered to constitute waters of the United States, these regulations would be applicable to the discharge of dredge or fill material to these wetlands in connection with construction of the thermal desorption facility and access road.	If this alternative and location were selected and the small wetlands described above are subject to these regulations: (a) EPA would need to find that there is no practicable alternative with less adverse impact on wetlands, or to waive that requirement. (b) Appropriate and practicable steps would be taken during construction and operation of the thermal desorption facility and access road to minimize or mitigate potential adverse ecological effects, but the impacts on the small wetlands mentioned above could not be avoided. (c) The treatment facility (including the portion in the wetland area) would be located within, and would adversely affect, estimated habitat of rare wildlife species (see Figure T-4). Thus, the prohibition on discharges with an adverse effect on such habitat would not be met. (d) Stormwater discharges would be controlled with BMPs during construction and operation of the thermal desorption facility and access road. (e) It is not expected that the facility would cause substantial long-term adverse impacts to the integrity of river water.
Massachusetts Wetlands Protection Act and regulations	MGL c. 131, § 40 310 CMR 10.53(3)(q) 310 CMR 10.54 - 10.58 & 10.60	Under 310 CMR 10.53(3)(q), actions responding to the release or threat of release of hazardous materials are authorized as a "limited project" if they: (a) have no practicable alternative, consistent with the Massachusetts Contingency Plan (MCP), that would be less damaging to	Applicable to construction and operation of thermal desorption facility, which would be located within 100-year floodplain and, in part, within a Riverfront Area (200 feet from River),	Since TD 5 would be a response action, the requirements for "limited projects" would appear to apply. Under those requirements: ▪ Given the selected location, EPA would need to find that there is no practicable alternative that would be less damaging to resource areas, or to

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Table T-5.b: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	310 CMR 10.59	resource areas; and (b) avoid or minimize impacts to resource areas, including, to the maximum extent practicable, minimizing hydrological changes to resource areas, using BMPs during construction (including prevention of erosion/siltation); implementing mitigating measures, providing compensatory storage for lost flood storage capacity, avoiding flow restrictions that would increase flood stage or velocity, substantially restoring disturbed vegetation, and working in resource areas only when the ground is sufficiently stable to support the equipment. For actions that do not qualify as a "limited project," the requirements of 310 CMR 10.54 -10.58 and 10.60 would apply. In either case, under 310 CMR 10.59, the action must have no adverse effect on estimated habitat of rare wildlife species.	which are resource areas under these regulations, and would affect small wetlands (described above), which may also be resource areas under these regulations.	waive the requirement that there be no such practicable alternative. ▪ Practicable measures would be implemented to minimize harm to floodplain, including erosion and sedimentation control measures during construction and operation of the desorption facility and removal of facility structures, staging areas, and access roads and restoration of those areas upon completion of thermal desorption operations. There would be no long-term impact on flood storage capacity of floodplain, but there would be a short-term impact, which would require flood storage compensation. ▪ The thermal desorption facility would be located within, and would adversely affect, estimated rare wildlife species habitat (see Figure T-4). Thus, the prohibition on projects with an adverse effect on such habitat would not be met. In addition, if TD 5 was not considered a "limited project," it may not meet some of the requirements of 310 CMR 10.54 -10.58 and 10.60 – e.g., the requirement to maintain a 100-foot wide area of undisturbed vegetation along the river in a Riverfront Area (with certain exceptions) (10.58(4)(d)1.). In addition, a portion of the treated material from the thermal desorption process would be used as backfill in the floodplain. This activity would meet the requirements of these regulations. The material to be used would be shown, through sampling and comparison to MCP Method 1 standards or other appropriate standards for unrestricted areas, to pose no significant risk to health or the environment. It would also be amended with organic material to support

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Table T-5.b: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
				vegetative growth. Further, since this material would be used as backfill for floodplain excavations, its use would not affect the flood storage capacity of the floodplain.
Massachusetts standards for hazardous waste management facilities in floodplains	310 CMR 30.701	Location standards for hazardous waste management facilities in floodplains, including requirements that: (a) no active portion of a waste pile may be constructed within 500-year floodplain; and (b) tanks, containers, and similar units that are used to store hazardous waste, do not receive waste from off-site sources, and are located within the 100-year floodplain must be floodproofed to prevent floodwaters from contacting the hazardous waste.	These requirements would not apply to treatment facility if, as expected, excavated sediments and soils do not constitute state hazardous waste subject to these standards. Further, even if they did constitute such hazardous waste, the facility may be exempt from these requirements under MCP (as described in Table T-5.c). However, if some materials did constitute such hazardous waste and the facility was not exempt, these requirements would be applicable to the treatment facility.	In the unlikely event that some materials to be treated were found to constitute state hazardous waste and treatment facility is not exempt, waste piles used for staging at treatment facility would not meet the requirement that hazardous waste piles may not be located within 500-year floodplain. Any tanks or similar units used to store such waste at the facility would be floodproofed against a 100-year flood.
Massachusetts Historical Commission Act and regulations	MGL c. 9, § 27C 950 CMR 71.07	A state body proposing to fund or authorize a project must notify the Massachusetts Historical Commission (MHC) (or the project proponent may notify MHC) if the project has an area of potential impact that could cause a change in the historical, architectural, archaeological, or cultural qualities possessed by a property listed in the State Register of Historic Places. If MHC determines that the project will have an adverse impact on a property listed in	Applicable to State; relevant and appropriate to state-authorized projects in areas where the work would have an area of potential impact on property(ies) listed in State Register.	An evaluation would be made through consultation with the MHC (and, if applicable, any pertinent Tribal Historic Preservation Office) as to whether the construction or operation of the thermal desorption facility at the DeVos site would adversely affect any property listed in the State Register of Historic Places. If it would, the substantive provisions of these regulations would be met.

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Table T-5.b: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		the State Register, the state body, project proponent, and MHC must consider "prudent and feasible alternatives" that could eliminate, minimize, or mitigate the adverse effects. If there are, such alternatives will be specified in an agreement among those parties; and if there is no agreement, project cannot proceed until state body or project proponent responds to the MHC.		
To Be Considered				
Executive Order for Wetlands Protection	Exec. Order 11990 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(a) and 40 CFR Part 6, App. A	A federal agency must avoid undertaking or providing assistance for construction in wetlands unless: (a) there is no practicable alternative; and (b) the proposed action includes all practicable measures to minimize harm to wetlands.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA. Thus, if the small wetlands described above are found to meet the definition of wetlands under this Order, this Order would be applicable to EPA.	If this alternative and location were selected and the small wetlands described above are subject to this Executive Order, EPA would need to find that there is no practicable alternative with less adverse impact on wetlands and that the project includes all practicable measures to minimize harm to wetlands, or else would need to waive those requirements.

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Table T-5.b: Alternative TD 5 (Thermal Desorption [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Location-Specific ARARs

Statute/Regulation	Citation *	Synopsis of Requirements	Status (Applicability/ Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Executive Order for Floodplain Management	Exec. Order 11988 (1977) Procedures for implementing this Order are set forth in 40 CFR 6.302(b) and 40 CFR Part 6, App. A	A federal agency proposing action in a floodplain must consider alternatives to avoid adverse effects on the floodplain, and if there is no practicable alternative, must design or modify the action to minimize harm to or within the floodplain.	Since this Executive Order was not formally promulgated after notice-and-comment rulemaking, it is to be considered (TBC), rather than an ARAR. However, as an order of the President, it is applicable to and binding on EPA, and would apply here since the identified location for the thermal desorption facility would be situated within the 100-year floodplain.	If this alternative and location were selected, EPA would need to find that there is no practicable alternative that would avoid any impact on the floodplain, or to waive the requirement that there be no such practicable alternative. Practicable measures would be implemented to minimize harm to floodplain, including erosion and sedimentation control measures during construction and operation of the treatment facility and removal of facility structures, staging areas, and access roads and restoration of those areas upon completion of treatment operations. There would be no long-term impact on flood storage capacity of floodplain. However, there would be a short-term impact while the facility was in place, and so flood storage compensation would be necessary. In addition, a portion of treated material from the thermal desorption process would be used as backfill in the floodplain. This material would be sampled for PCBs, as well as amended with organic material, to ensure that it would not cause harm within the floodplain.

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Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Federal ARARs				
TSCA regulations on cleanup and disposal of PCB Remediation Waste	40 CFR 761.50 40 CFR 761.61(b) & (c)	Regulations specify methods for disposal of non-liquid PCBs (which includes actions to destroy or degrade PCBs). They include disposal in incinerator meeting requirements of § 761.70 (or equivalent disposal method approved under § 761.60(e)) and disposal in chemical waste landfill meeting requirements of § 761.75. In addition, § 761.61(c) allows for risk-based approval of alternate disposal method if EPA finds that such method will not pose an unreasonable risk of injury to health or the environment.	Applicable to disposal of PCB Remediation Waste (which includes actions to destroy or degrade PCBs) in thermal desorption facility.	Thermal desorption facility would not meet regulations' definition of incinerator (i.e., engineered device using controlled flame combustion to thermally degrade PCBs), and on-site reuse is not explicitly authorized. It is anticipated that, if TD 5 were selected, these TSCA requirements would be met through EPA's determination that the thermal desorption process and facility meet the substantive criteria for a risk-based approval under § 761.61(c).
TSCA regulations on decontamination	40 CFR 761.79	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and various types of surfaces.	Applicable to decontamination of equipment used in handling of PCB-containing materials.	Would be attained through use of proper decontamination procedures.
Clean Water Act – NPDES regulations (storm water discharges)	40 CFR 122.26(c)(1)(ii)(C) 40 CFR 122.44(k)	Best management practices (BMPs) must be employed to control pollutants in stormwater discharges during construction activities.	Applicable to stormwater discharges to river during construction and operation of treatment facility.	Would be attained through use of BMPs, including stormwater diversion berms, stormwater detention basins, and drainage swales, to control erosion from stormwater discharges during construction and operation of treatment facility.

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Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Endangered Species Act and regulations	16 USC 1536(a)-(d) 40 CFR 6.302(h) 50 CFR Part 402, Subparts A & B	A federal agency must ensure that any action authorized, funded, or carried out by it is not likely to jeopardize the continued existence of a listed threatened or endangered (T&E) species or result in destruction or adverse modification of critical habitat, unless an exemption is granted. If a listed species or critical habitat may be present in the action area, the steps set forth in the regulations must be followed.	Applicable to EPA; relevant and appropriate to federally authorized actions (if any) that are likely to jeopardize continued existence of a federally listed T&E species or result in destruction or adverse modification of critical habitat.	Would be attained because area identified for thermal desorption facility does not contain any federally listed T&E species or their critical habitat, and thus facility would not adversely affect such species or habitat.
Resource Conservation and Recovery Act (RCRA) regulations on identification of hazardous waste	40 CFR Part 261	Establishes criteria and lists for determining whether a waste is a hazardous waste under RCRA. Note that § 261.24 identifies concentrations of contaminants which make waste a hazardous waste due to toxicity, as determined through the Toxicity Characteristic Leaching Procedure (TCLP).	Relevant and appropriate to determining whether excavated sediments and soils at thermal desorption facility would constitute hazardous waste.	Based on prior experience at other portions of this site, it is not anticipated that excavated sediments or soils to be treated at thermal desorption facility would constitute RCRA characteristic hazardous waste. However, representative TCLP testing of sediments/soils would be conducted during design to confirm that result.
RCRA regulations for less than 90-day accumulation of hazardous waste	40 CFR 262.34	Allows on-site accumulation of hazardous waste for less than 90 days in containers, tanks, or containment buildings, provided generator complies with specified requirements, including referenced requirements of 40 CFR Part 265.	These requirements would not apply if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if some materials to be treated did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to < 90-day on-site accumulation of such materials.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, any tanks or containment buildings used for < 90-day accumulation of those materials would meet these requirements.

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Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
RCRA regulations for hazardous waste management facilities – general requirements	40 CFR 264.1(j)	General requirements for facilities used to manage remediation wastes that constitute hazardous waste (e.g., requirements for waste analysis, security, precautions to prevent accidental ignition or reaction of wastes, preventing washout of units in floodplain by 100-year flood). (These requirements are in lieu of Part 264, Subparts B, C, and D.)	These requirements would not apply if, as expected, the excavated sediments and soils do not constitute RCRA hazardous waste. However, if some materials to be treated did constitute RCRA hazardous waste, these requirements would be relevant and appropriate to storage/ treatment facility for such materials (other than < 90-day accumulation units).	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, these requirements would be met.
RCRA regulations for hazardous waste management facilities – technical requirements for storage and treatment of hazardous waste	40 CFR Part 264, Subparts J, L, X, and DD	Design, operating, closure, and (if necessary) post-closure requirements for storage or treatment of hazardous waste in tanks (Subpart J), waste piles outside structures (Subpart L), miscellaneous units (Subpart X), and containment buildings (Subpart DD).	Same as above.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, any tanks, waste piles, containment buildings, or miscellaneous units used for treatment of such waste or for temporary staging of such waste before treatment (other than < 90-day accumulation units) would meet these requirements.
RCRA regulations for hazardous waste management facilities – groundwater protection	40 CFR Part 264, Subpart F	Groundwater protection requirements for hazardous waste contained in solid waste management units. Includes groundwater protection standards (i.e., maximum contaminant levels) for waste piles outside structures; alternate limits allowed under 40 CFR 264.94(b); and requirements for groundwater monitoring systems.	Same as above.	In the unlikely event that some materials to be treated were found to constitute RCRA hazardous waste, the treatment facility, including the staging areas for such waste before treatment, would have groundwater monitoring system and program consistent with these requirements.

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Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
State ARARs				
Massachusetts air pollution control regulations	310 CMR 7.00	Section 7.01(1) prohibits person operating an air contamination source from creating a condition of air pollution. Other provisions establish specific requirements for particular pollutants or types of facilities – e.g., emission limitations and requirements for facility that emits volatile and/or halogenated organic compounds (7.18); reasonably available control technology requirements for source of nitrogen oxides (7.19); emission limitations, fuel requirements, and operational requirements for emergency generators (7.26(42).	Applicable to thermal desorption facility.	Thermal desorption facility would meet general requirement of § 7.01(1) through appropriate air emission controls (to be specified in design) and ambient air monitoring. The facility would be designed to meet any of the specific requirements of these regulations that would apply to design and operation of a thermal desorption facility.
Massachusetts Clean Water Act and Wetlands Protection Act – stormwater management standards	310 CMR 10.05(6)(k) 314 CMR 9.06(6)(a)	Projects subject to regulation under the Wetlands Protection Act must incorporate stormwater BMPs to attenuate pollutants in stormwater discharges, as well as provide a setback from receiving waters and wetlands, in accordance with 10 specified stormwater management standards.	Applicable to stormwater discharges during construction and operation of thermal desorption facility.	Stormwater discharges during construction and operation of the treatment facility would be controlled with BMPs, which would be designed to meet the specified stormwater management standards. These stormwater systems would include setbacks from receiving waters and wetlands.
Massachusetts Endangered Species Act and regulations	MGL c. 131A 321 CMR 10.00, Parts I, II, & V	A proposed activity within mapped Priority Habitat for a state-listed rare species or other area where such a species has occurred may not result in a "take" of a state-listed species. The MESA regulations contain a provision (§ 10.23) authorizing the Mass. DFW to permit a "take" if the applicant has adequately addressed alternatives, an insignificant portion of the local population would be impacted, and the applicant agrees to	Applicable to activities in a state-mapped Priority Habitat in MA or other areas where information indicates the occurrence of a state-listed species (except that § 10.23 does not constitute an ARAR).	The area identified for the thermal desorption facility is within state-mapped Priority Habitat, as shown on Figure T-4. The construction of the facility in this location would result in a "take" of at least 3 state-listed species, as shown in Appendix L. Thus, the prohibition on a "take" would not be met.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-5.b.

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Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
		carry out a conservation and management plan that provides a long-term Net Benefit to the conservation of the species. However, as discussed in the Revised CMS Report (Section 5.4), that provision is not an ARAR.		
	321 CMR 10.00, Part IV	Projects that will alter a designated Significant Habitat must be reviewed to ensure that they will not reduce the viability of the habitat to sustain an endangered or threatened species.	Would be applicable to activities affecting state-designated Significant Habitat in MA. However, no such habitat has been designated.	Not applicable.
Massachusetts hazardous waste regulations on identification of hazardous waste	310 CMR 30.100	Establishes criteria and lists for determining whether a waste is a hazardous waste under state law. Wastes that contain PCBs $\geq$ 50 mg/kg (which are listed wastes) are exempt from the state hazardous waste management regulations so long as they are managed in compliance with EPA's TSCA regulations (40 CFR Part 761) (see 310 CMR 30.501(3)(a)). (Materials that constitute state hazardous wastes on other grounds are referred to in this table as "non-PCB state hazardous waste.") In addition, under the MCP, the on-site treatment of contaminated media constituting hazardous waste as part of a remedial action under the MCP (including its "adequately regulated" provisions) is exempt from the state hazardous waste regulations unless MDEP determines that compliance with those regulations is required (310 CMR 40.0033(5)).	Applicable to determining whether excavated sediments and bank soils would constitute hazardous waste under state law.	Based on prior experience at other portions of this site, it is not anticipated that excavated sediments or soils to be treated at the thermal desorption facility would constitute non-PCB state hazardous waste. However, representative TCLP testing of sediments/soils would be conducted during design to confirm that result.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-5.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
Massachusetts hazardous waste management regulations – requirements for less than 90-day accumulation of hazardous waste	310 CMR 30.340 – 30.343	Allows on-site accumulation of hazardous waste for less than 90 days in containers or tanks, provided generator complies with requirements specified or referenced in these regulations.	These requirements would not apply to thermal desorption facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials to be treated did constitute such hazardous waste and the facility was not exempt under MCP, these requirements would be applicable to < 90-day on-site accumulation of such materials.	In the unlikely event that materials to be treated at thermal desorption facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, any tanks used for < 90-day accumulation of such materials would meet these requirements.
Massachusetts hazardous waste management regulations – general requirements	310 CMR 30.513, 30.514, 30.524, 30.560	General requirements for hazardous waste management facilities (for waste analysis, security, emergency prevention and response, and precautions to prevent accidental ignition or reaction of wastes).	These requirements would not apply to thermal desorption facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials to be treated did constitute such hazardous waste and the facility was not exempt under MCP, these requirements would be	In the unlikely event that materials to be treated at thermal desorption facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, these requirements would be met.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-5.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			applicable to the treatment facility.	
Massachusetts hazardous waste management regulations – location standards for units used to treat or store hazardous waste (Note: Some of these regulations were also listed as location-specific ARAR in Table T-5.b.)	310 CMR 30.701(6), 30.702, 30.703(2), 30.704(3), 30.705(3) & (6)	Location standards for waste piles, including that active portion of such facility may not be constructed (a) in 500-year floodplain, (b) in watershed of Class A surface waters, (c) in wetlands, (d) within ½ mile of public water supply well, (e) on land overlying an actual, planned, or potential public underground drinking water source, (f) within 1000 feet of a private drinking water well, or (g) without a 200-foot buffer zone to fenceline. Potential public drinking water source is defined as groundwater capable of yielding ≥ 100 gpm and having < 10,000 mg/L of TDS.	These requirements would not apply to thermal desorption facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials to be treated did constitute such hazardous waste and the facility was not exempt from these requirements under MCP, these requirements would be applicable to the staging piles for such waste at that facility.	In the unlikely event that materials to be treated at thermal desorption facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the temporary staging piles used for such waste at a thermal desorption facility at the DeVos site would meet these location standards, except for the following : (a) the prohibition on waste piles within 500-year floodplain; (b) the requirement for a 200-foot buffer zone to the fenceline (since there would not be a 200-foot buffer between the facility and the River); and (c) potentially the prohibition on waste piles on land overlying a potential public drinking water source (an issue to be investigated in design).
	310 CMR 30.701(2)	For storage facility (other than surface impoundment or waste pile) that does not receive hazardous waste from off-site sources, portion in 100-year floodplain must be floodproofed.	These requirements would not apply to thermal desorption facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some	In the unlikely event that materials to be treated at thermal desorption facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, any tanks or miscellaneous units used to treat or store such waste would be floodproofed against a 100-year flood.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-5.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			materials to be treated did constitute such hazardous waste and the facility was not exempt from these requirements under MCP, these requirements would be applicable to tanks or miscellaneous units used to store or treat such waste.	
Massachusetts hazardous waste management regulations – technical requirements for storage and treatment of hazardous waste	310 CMR 30.602 310 CMR 30.690 310 CMR 30.580	Requirements for design, operation, and closure of tanks used to treat or store hazardous waste.	Same as above.	In the unlikely event that materials to be treated at desorption facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, any tanks used to store or treat such waste at the facility would meet these requirements.
	310 CMR 30.602 310 CMR 30.606 310 CMR 30.580	Requirements for design, construction, operation, closure, and post-closure care of facilities that treat hazardous waste in miscellaneous units (i.e., units that do not fall within any other category).	These requirements would not apply to thermal desorption facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under the MCP unless MDEP determines otherwise. However, if some materials to be treated did constitute such hazardous waste and the facility was not exempt from these requirements under the MCP, these requirements would be applicable to that facility.	In the unlikely event that materials to be treated at thermal desorption facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, any miscellaneous units used to treat such waste at the facility would meet these requirements.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-5.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
	310 CMR 30.602 310 CMR 30.640 310 CMR 30.580	Requirements for design, operation, and closure of waste piles used to store hazardous waste.	These requirements would not apply to thermal desorption facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials to be treated did constitute such hazardous waste and the facility was not exempt from these requirements under MCP, these requirements would be applicable to the staging piles for such waste at the facility.	In the unlikely event that materials to be treated at thermal desorption facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the temporary staging piles for such waste at treatment facility would meet these requirements, except potentially for the requirement that liner must be a minimum of 4 feet above probable high groundwater table (30.641(1)(a)1.) – an issue that would be investigated during design.
	310 CMR 30.660	Groundwater protection requirements for waste piles outside structures, including monitoring system requirements; groundwater protection standards (i.e., maximum contaminant levels), and potential alternate limits.	These requirements would not apply to thermal desorption facility if, as expected, the excavated sediments and soils do not constitute non-PCB state hazardous waste. Further, even if they did constitute such waste, the facility would be exempt from these requirements under MCP unless MDEP determines otherwise. However, if some materials to be treated did constitute such hazardous waste and the facility was not exempt from these	In the unlikely event that materials to be treated at thermal desorption facility were found to constitute non-PCB state hazardous waste, and the facility is not exempt under the MCP, the staging areas for such waste before treatment would have groundwater monitoring system and program consistent with these requirements.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-5.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

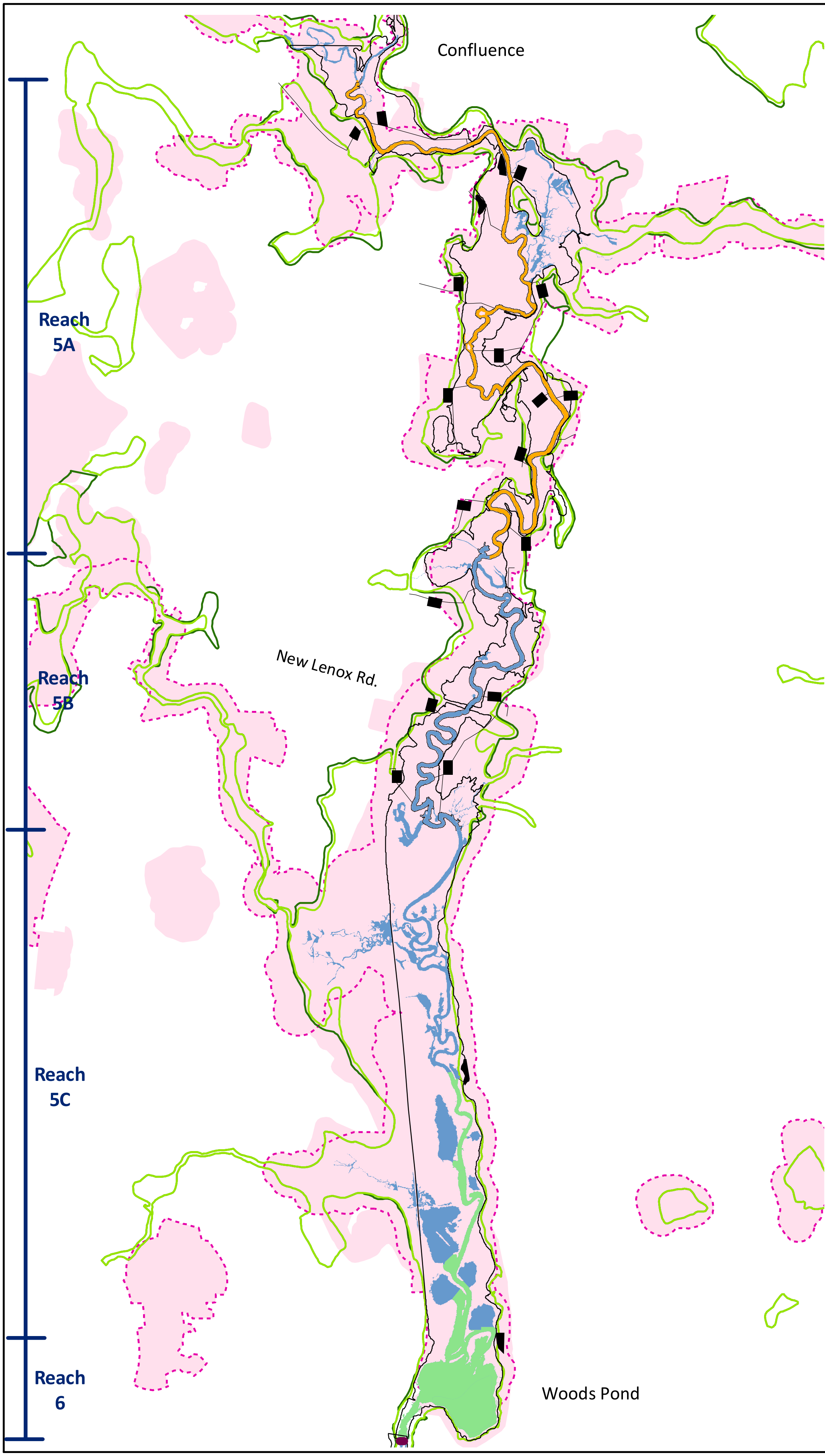
Table T-5.c: Alternative TD 5 (Thermal Desorption) [Assumed to Take Place at DeVos Site] with Potential On-Site Reuse of Portion of Treated Material) – Potential Action-Specific ARARs *

Authority/Regulation	Citation **	Synopsis of Requirements	Status (Applicability /Appropriateness)	Actions(s) To Be Taken To Achieve ARAR
			requirements under MCP, these requirements would be applicable to the staging piles for such waste at the facility.	
Massachusetts tank regulations	527 CMR 9.03, 9.04	Requirements for design and operation of above-ground storage tanks of > 10,000 gallons for any liquids other than water (527 CMR 9.03) and for above-ground storage tanks ≤ 10,000 gallons for flammable (Class I) liquids (527 CMR 9.04).	Applicable to above-ground storage of any non-water liquids in > 10,000 gallon tanks or storage of flammable liquids in ≤ 10,000 gallon tanks.	Would be met for these types of tanks.
Massachusetts regulations on beneficial use of solid waste	310 CMR 19.060	Requires demonstration that the materials to be reused are beneficial and pose an insignificant potential hazard to public health, safety, or the environment.	Relevant and appropriate to on-site reuse of treated material.	Under TD 5, a portion of treated material from the thermal desorption process would be used as backfill in the floodplain – a beneficial use. This material would be so used only if it is shown, through sampling and comparison to MCP Method 1 standards or other appropriate standards for unrestricted areas, to meet the requirement that it pose an insignificant risk.
To Be Considered				
TSCA PCB Spill Cleanup Policy	40 CFR Part 761, Subpart G	Policy used to determine adequacy of cleanup of spills resulting from the release of materials containing PCBs at concentration of 50 mg/kg or greater.	To be considered for any new PCB spills that occur during the work.	Would be considered in the event of any new PCB spill that occurs during construction or operation of the thermal desorption facility.

* Except as otherwise noted, this table does not repeat the ARARs listed as potential Location-Specific ARARs in Table T-5.b.

** ARARs consist only of the substantive requirements of the provisions cited in this column, not any administrative requirements included therein.

Figures



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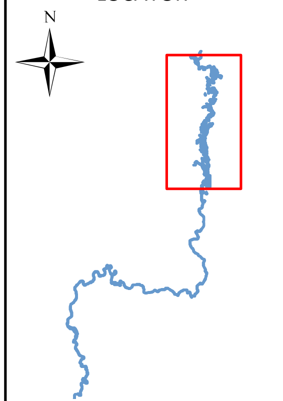

SCALE

1,500 750 0 1,500 Feet

LEGEND

- NHESP Estimated Habitats of Rare Wildlife (2008)
- NHESP Priority Habitats of Rare Species (2008)
- Dams
- 1 mg/kg PCB Isopleth
- Housatonic River
- Access Roads
- Staging Areas

Sediment Remediation

- Removal of Top 2 ft
- Thin-layer Capping

FEMA Flood Zones

- 100 year
- 500 year

SED 3 includes bank removal/stabilization for Reaches 5A and 5B.

Figure S-3
Impact of Alternative SED 3 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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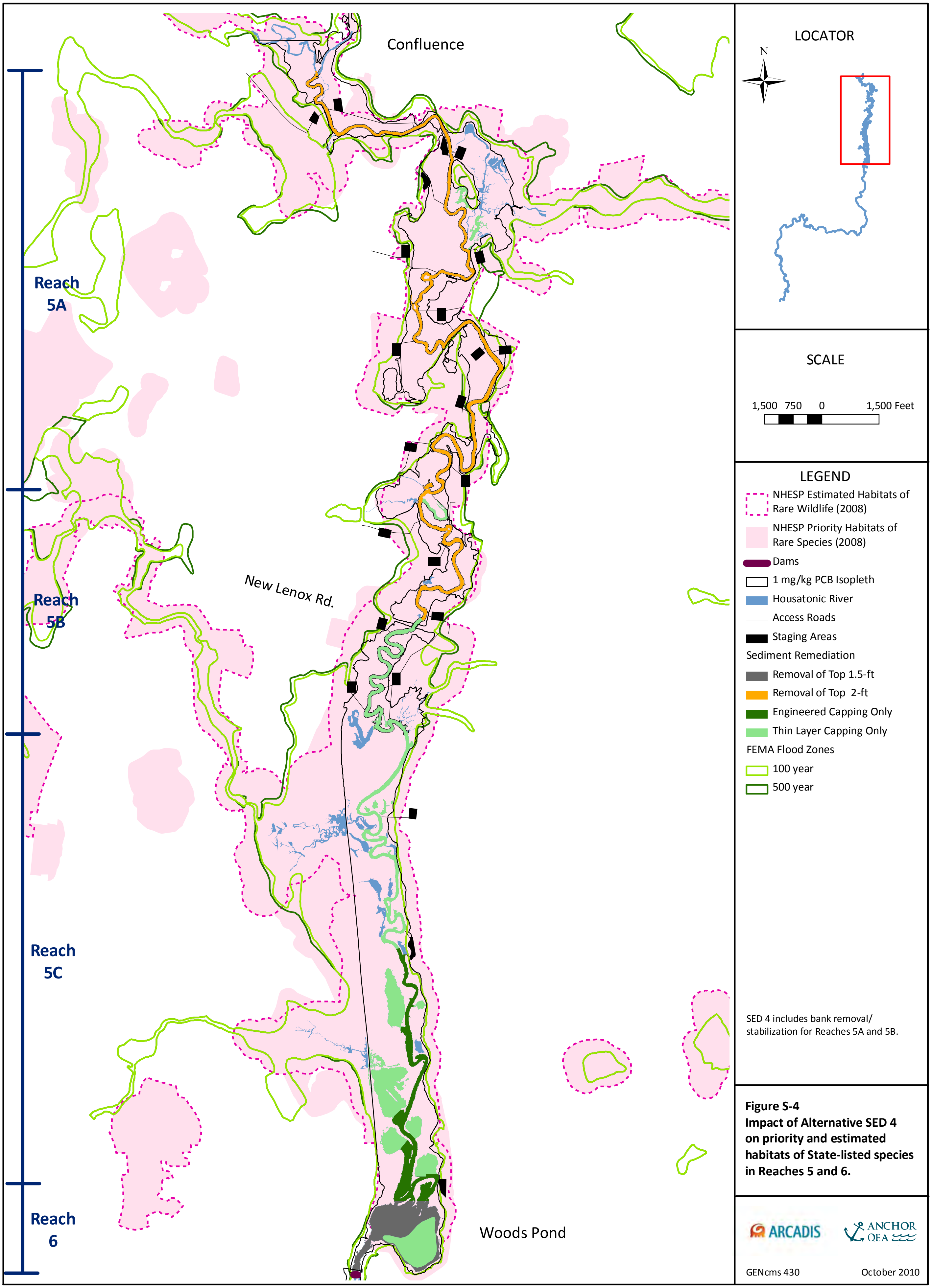

Figure S-4
Impact of Alternative SED 4 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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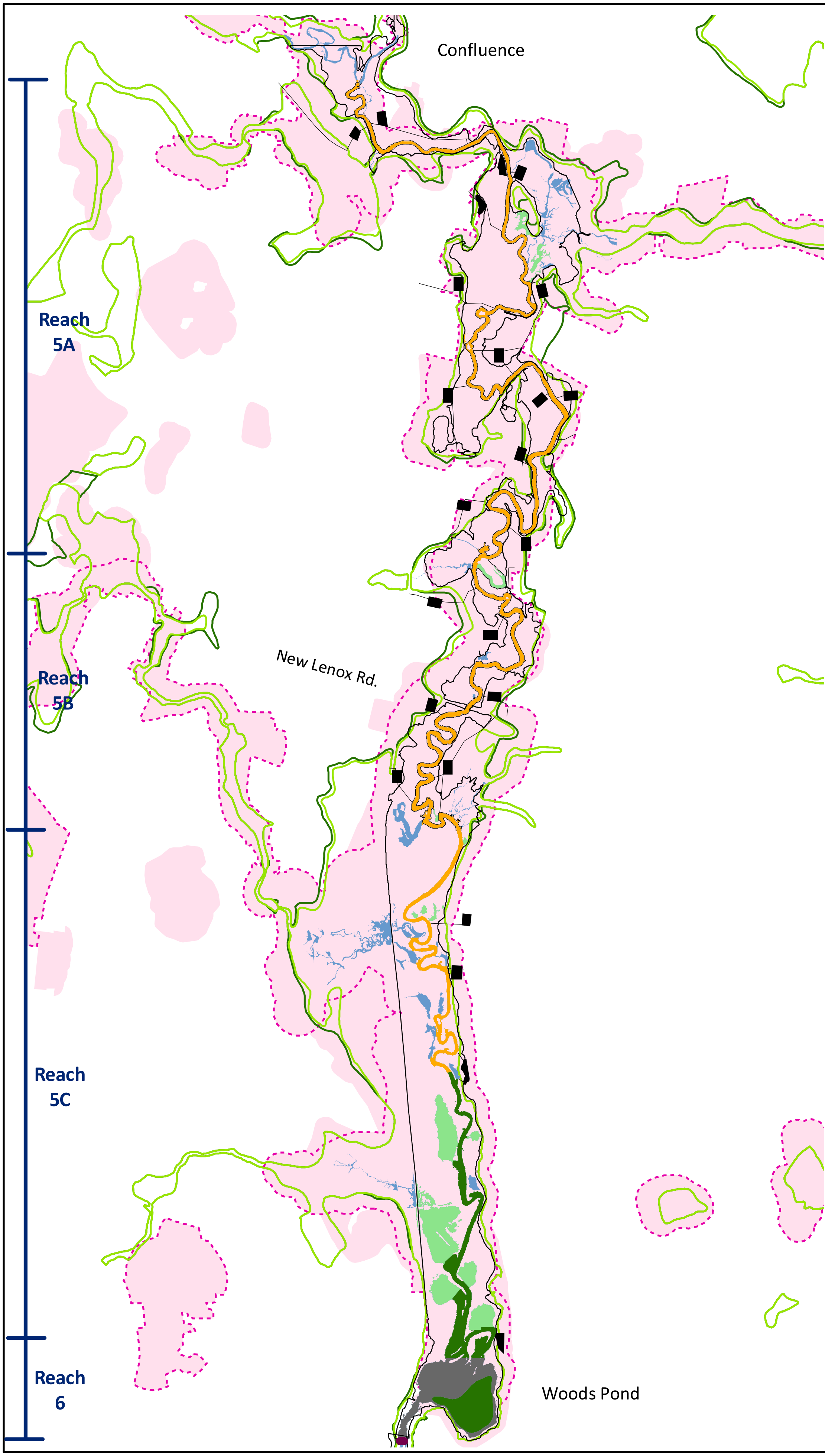

LOCATOR

N

SCALE

1,500 750 0 1,500 Feet

LEGEND

- NHESP Estimated Habitats of Rare Wildlife (2008)
- NHESP Priority Habitats of Rare Species (2008)
- Dams
- 1 mg/kg PCB Isopleth
- Housatonic River
- Access Roads
- Staging Areas

Sediment Remediation

- Removal of Top 1.5 ft
- Removal of Top 2 ft
- Engineered Capping Only
- Thin-layer Capping

FEMA Flood Zones

- 100 year
- 500 year

SED 5 includes bank removal/ stabilization for Reaches 5A and 5B.

Figure S-5a
Impact of Alternative SED 5 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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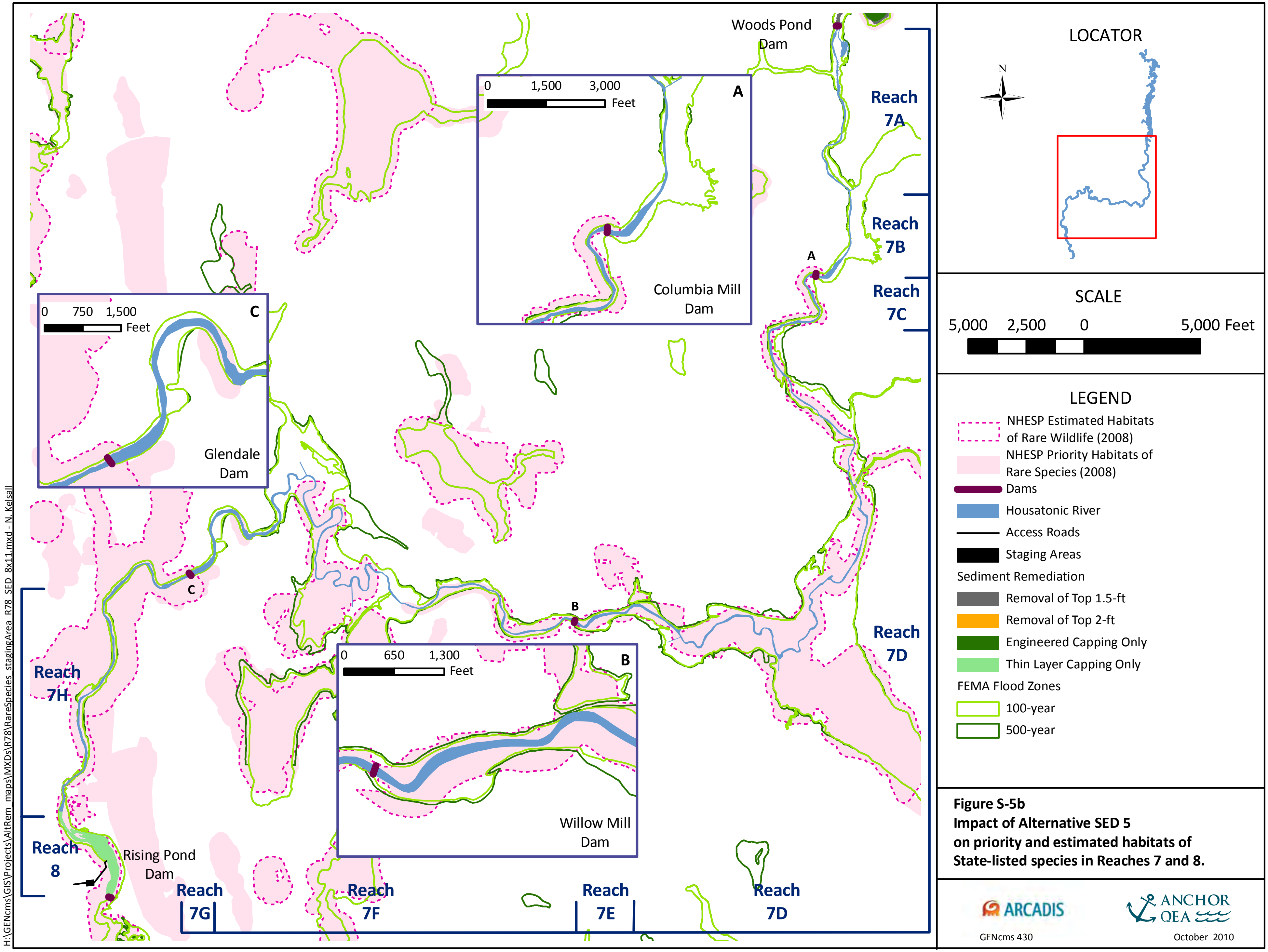

Figure S-5b
Impact of Alternative SED 5 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

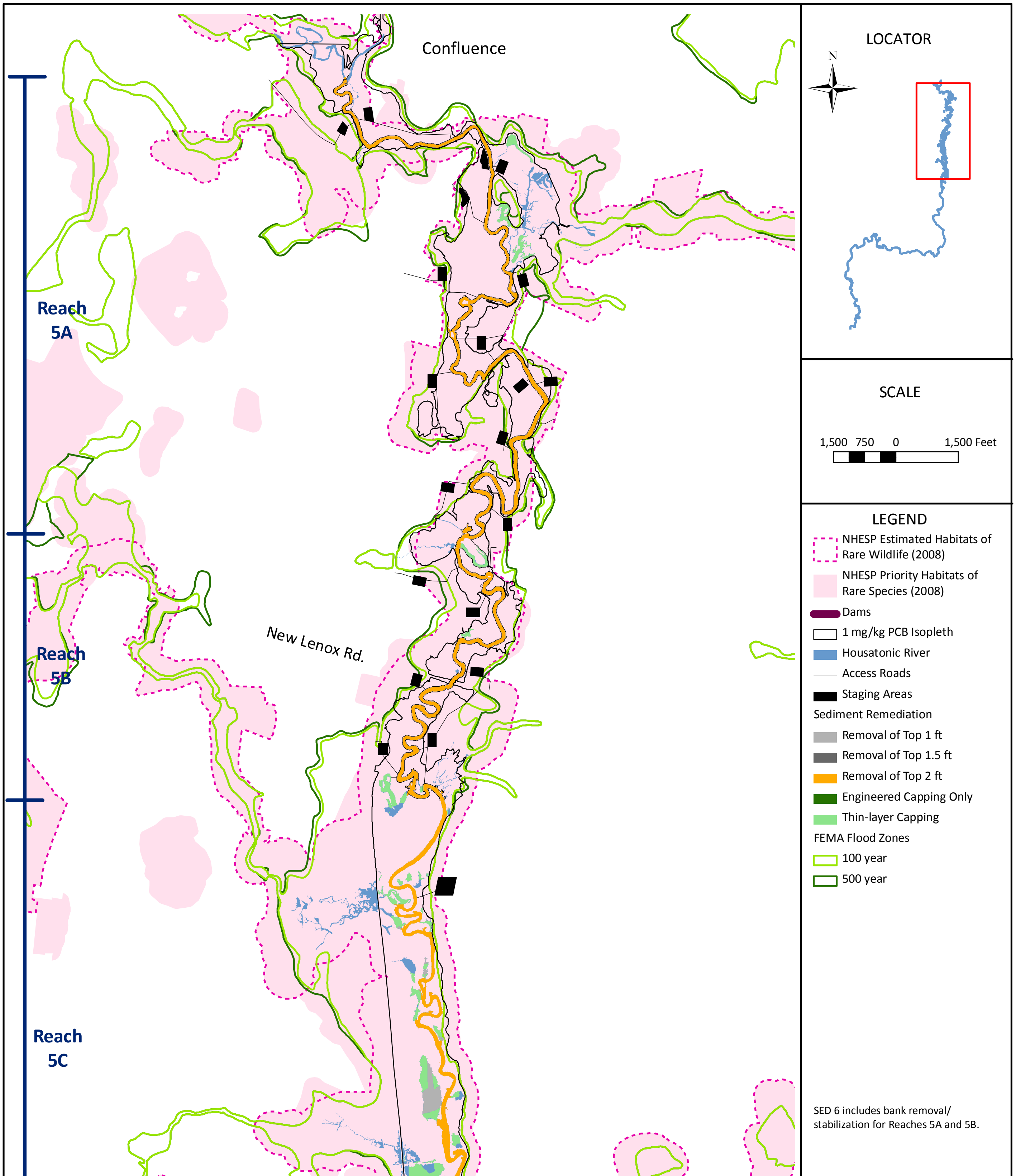

Figure S-6a
Impact of Alternative SED 6 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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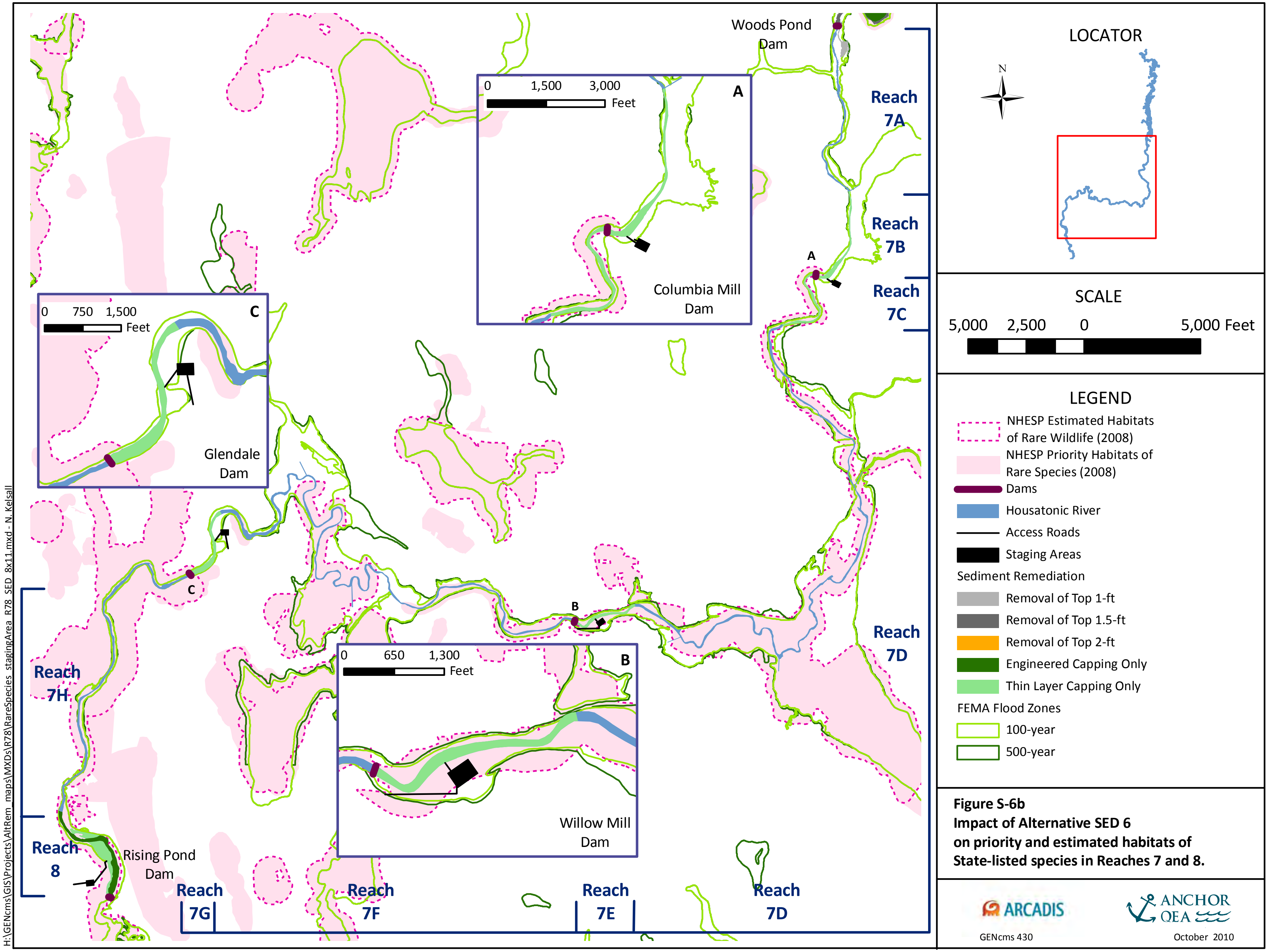

Figure S-6b
Impact of Alternative SED 6 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

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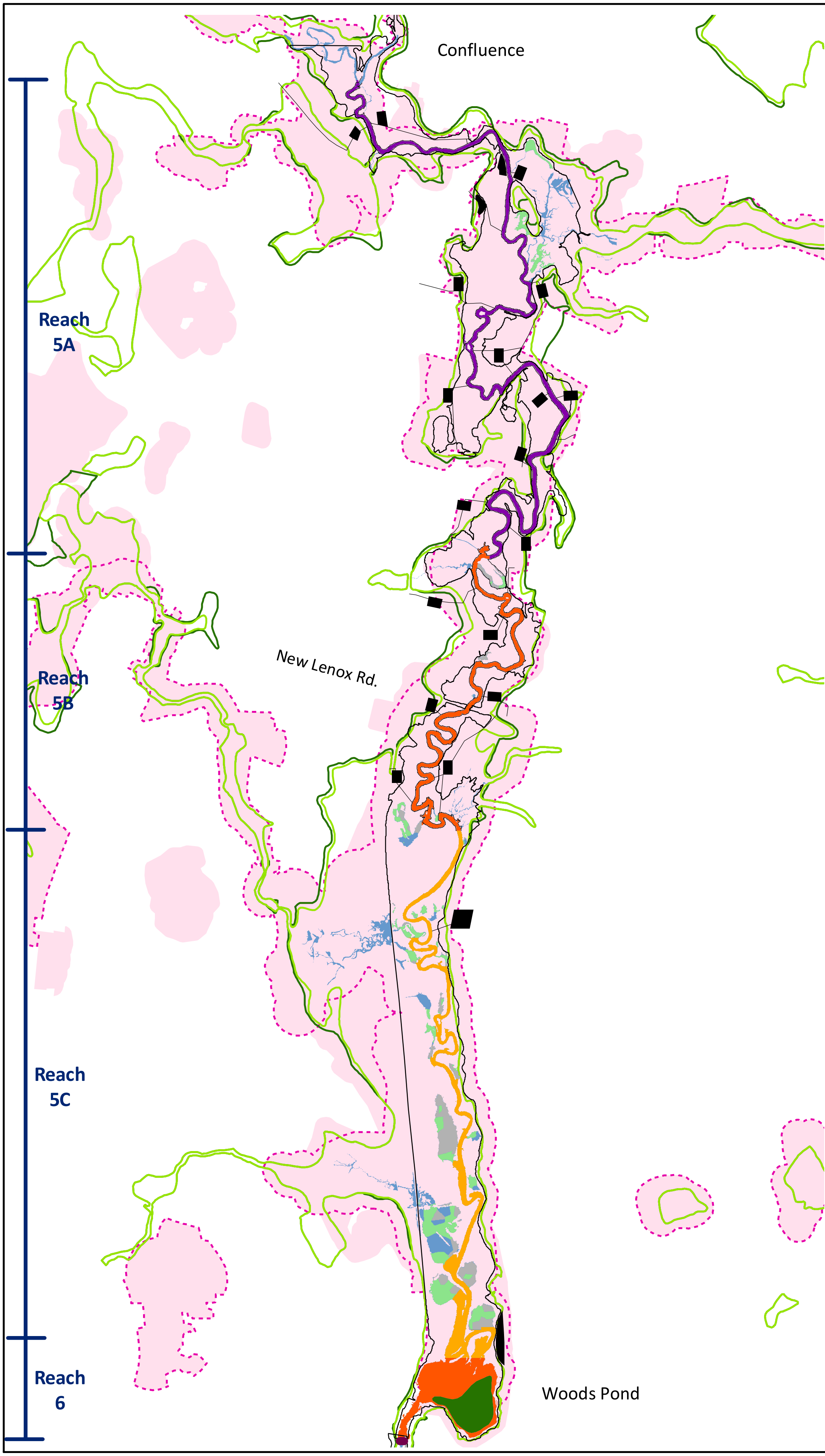

LOCATOR

N

SCALE

1,500 750 0 1,500 Feet

LEGEND

- NHESP Estimated Habitats of Rare Wildlife (2008)
- NHESP Priority Habitats of Rare Species (2008)
- Dams
- 1 mg/kg PCB Isopleth
- Housatonic River
- Access Roads
- Staging Areas

Sediment Remediation

- Removal of Top 1 ft
- Removal of Top 1.5 ft
- Removal of Top 2 ft
- Removal of Top 2.5 ft
- Removal of Top 3.0-3.5 ft
- Thin-layer Capping
- Engineered Capping Only

FEMA Flood Zones

- 100 year
- 500 year

SED 7 includes bank removal/ stabilization for Reaches 5A and 5B.

Figure S-7a
Impact of Alternative SED 7 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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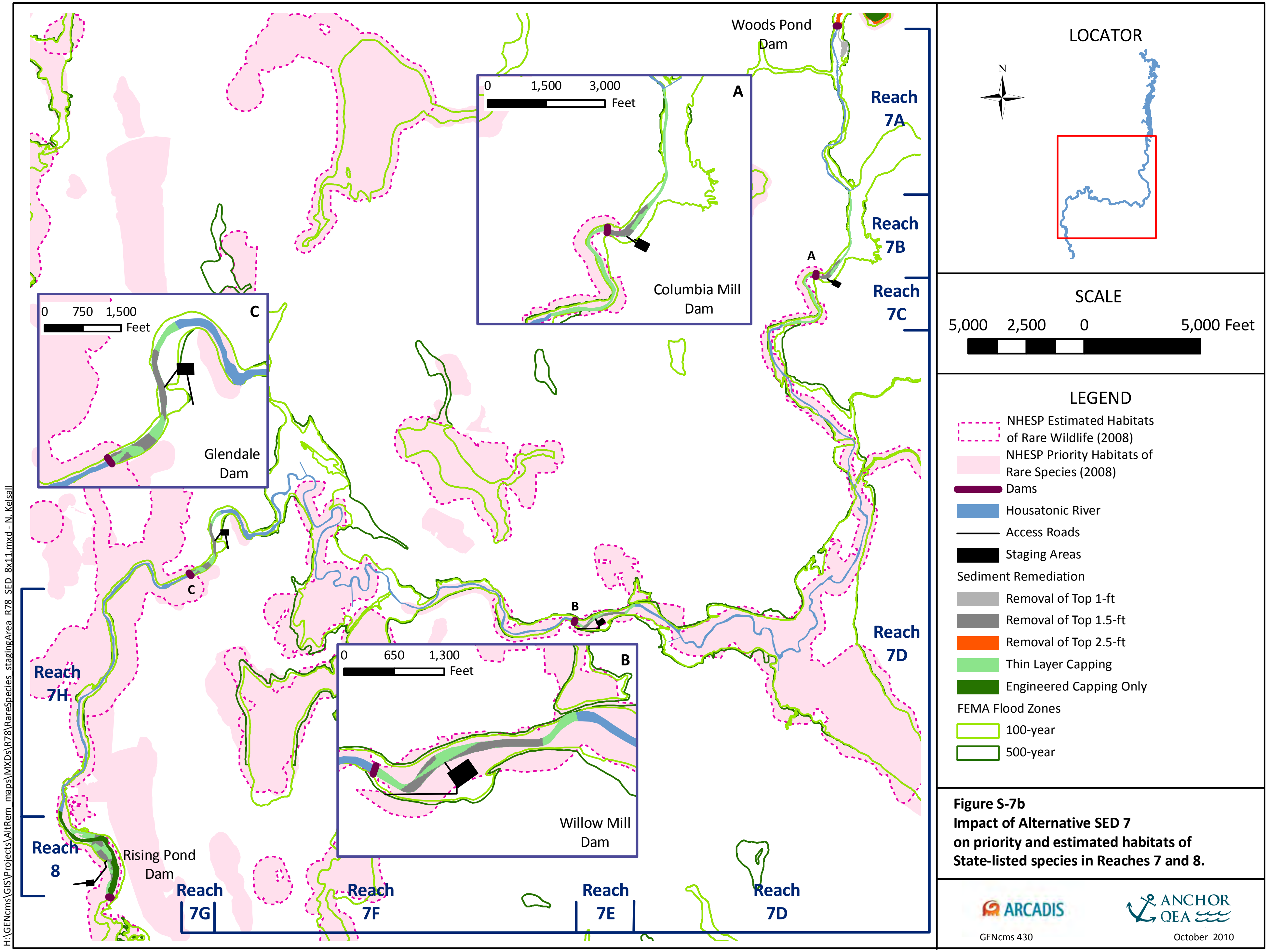
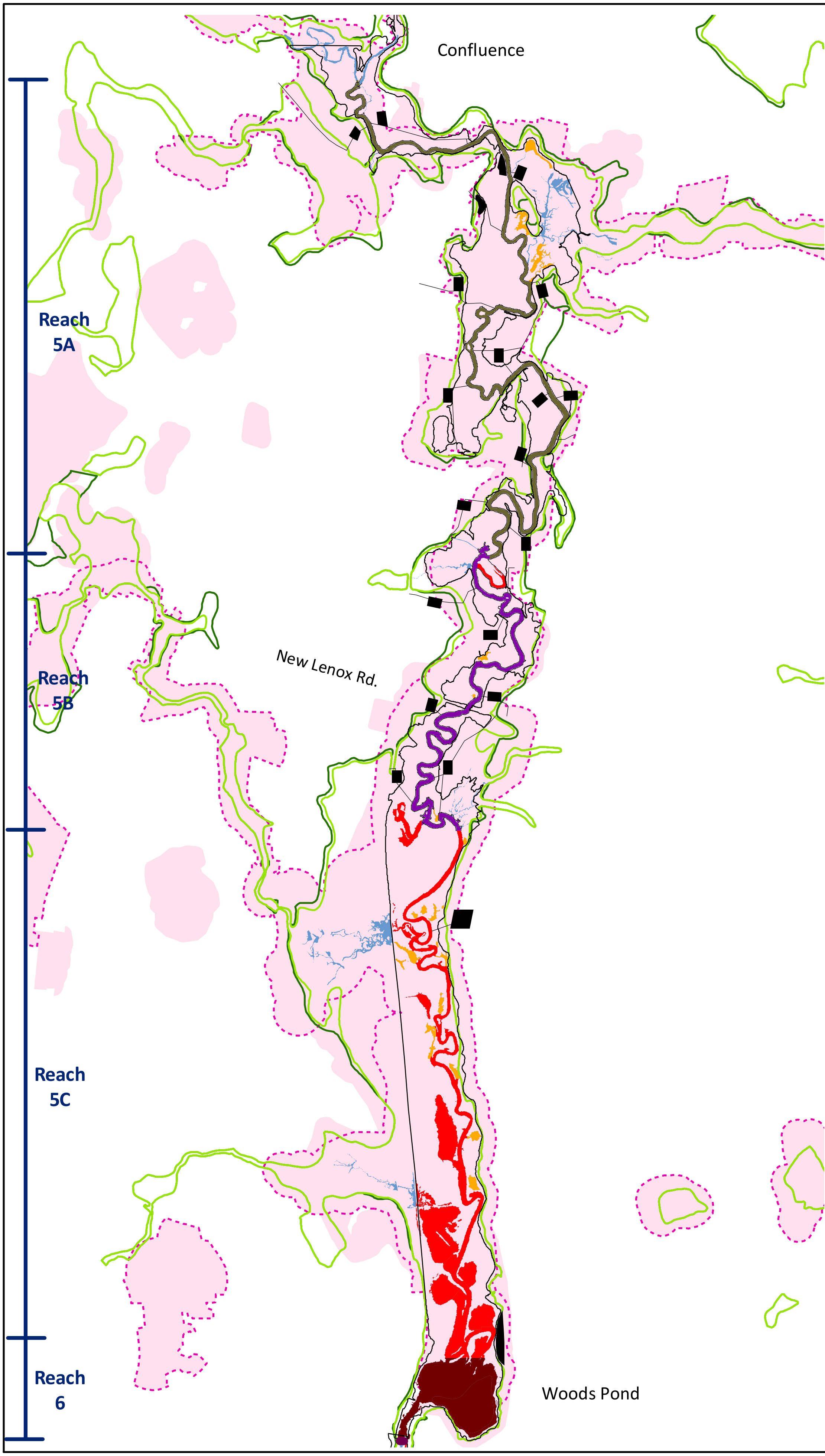


Figure S-7b
Impact of Alternative SED 7 on priority and estimated habitats of State-listed species in Reaches 7 and 8.



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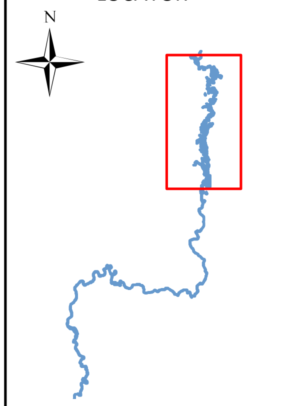

SCALE

1,500 750 0 1,500 Feet

LEGEND

- NHESP Estimated Habitats of Rare Wildlife (2008)
- NHESP Priority Habitats of Rare Species (2008)
- Dams
- 1 mg/kg PCB Isopleth
- Housatonic River
- Access Roads
- Staging Areas

Sediment Remediation

- Removal of Top 2 ft
- Removal of Top 3 ft
- Removal of Top 3.5 ft
- Removal of Top 4 ft
- Removal of Top 6 ft

FEMA Flood Zones

- 100 year
- 500 year

SED 8 includes bank removal/stabilization for Reaches 5A and 5B.

Figure S-8a
Impact of Alternative SED 8 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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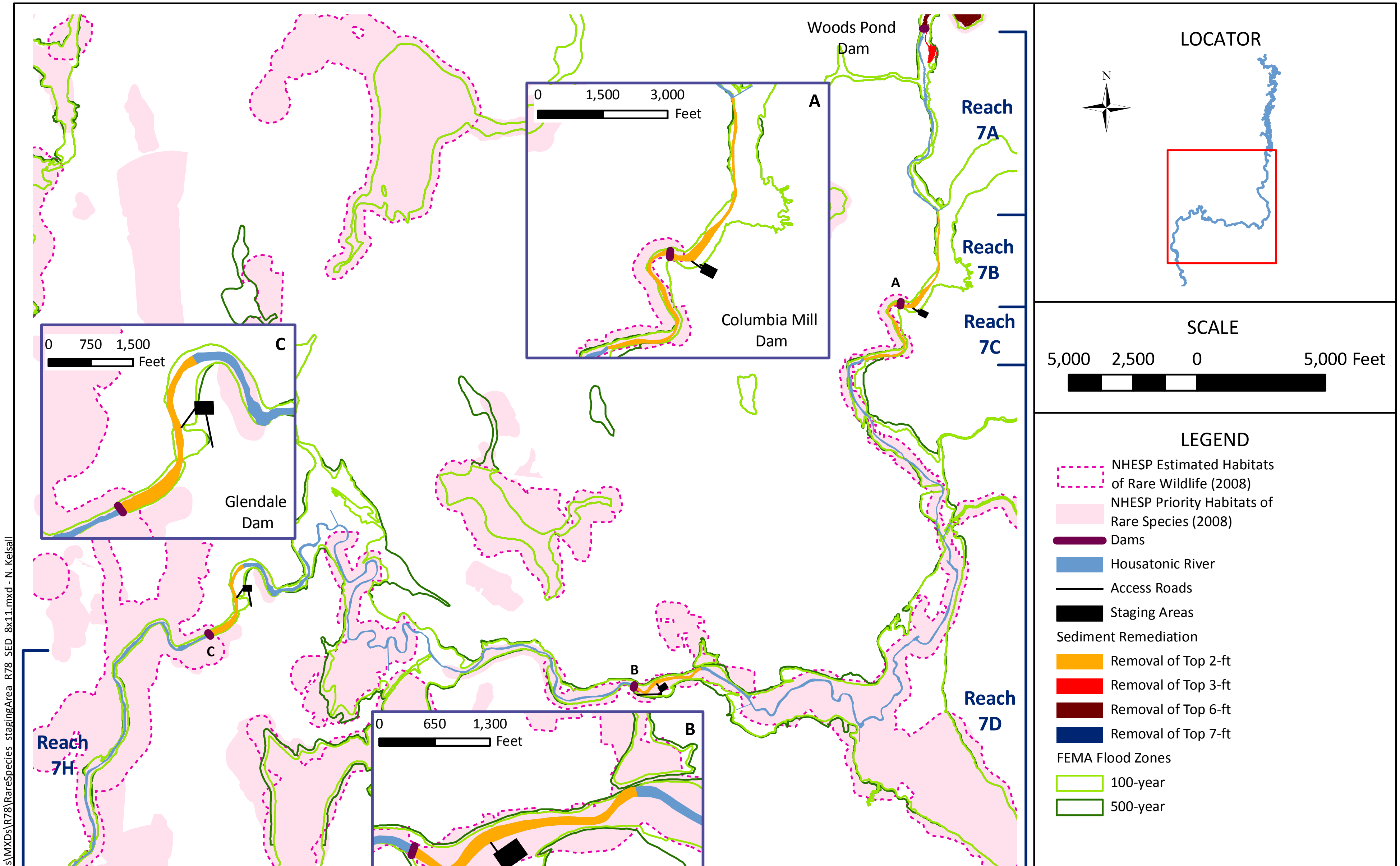

Figure S-8b
Impact of Alternative SED 8 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

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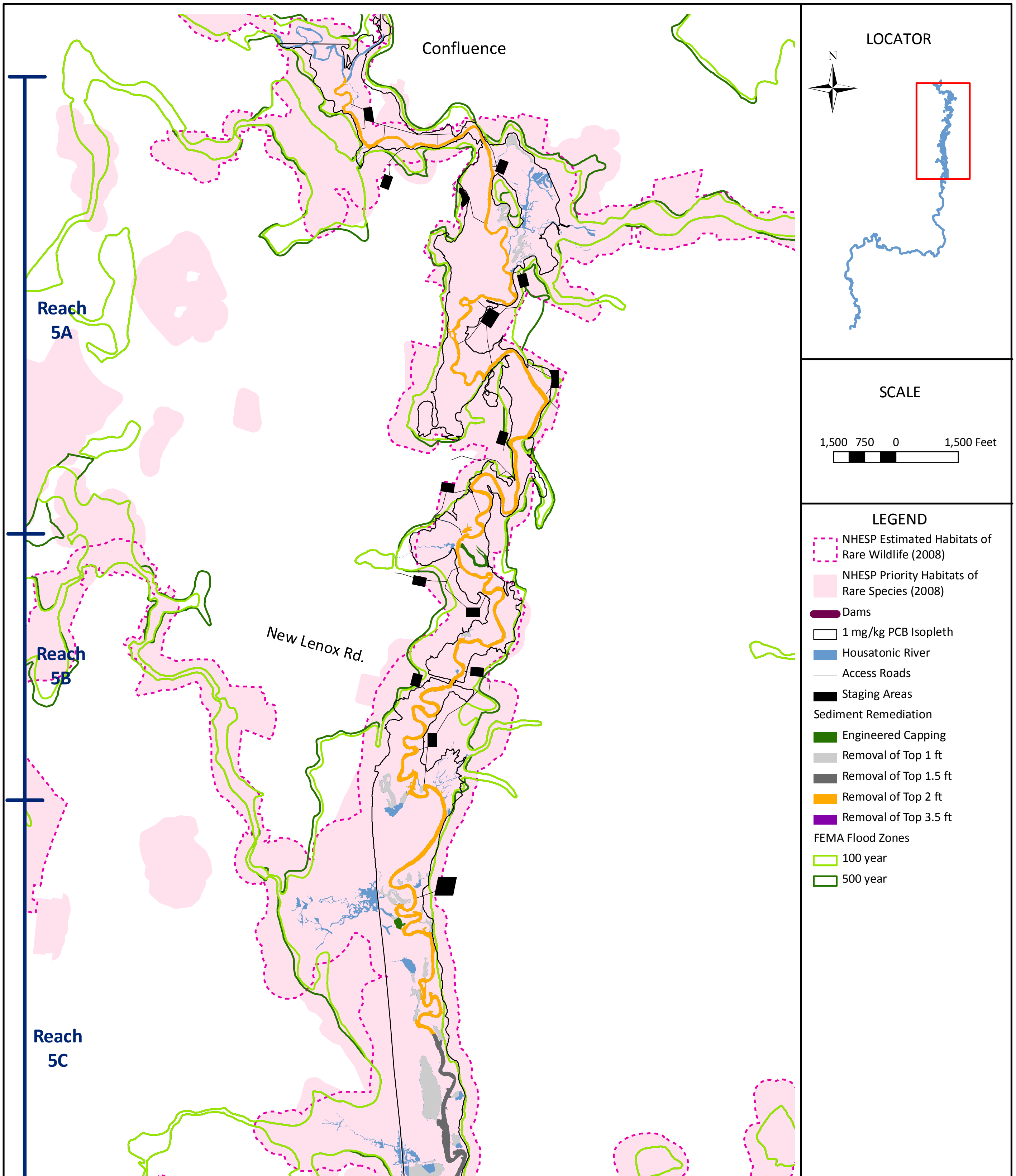

Figure S-9a
Impact of Alternative SED 9 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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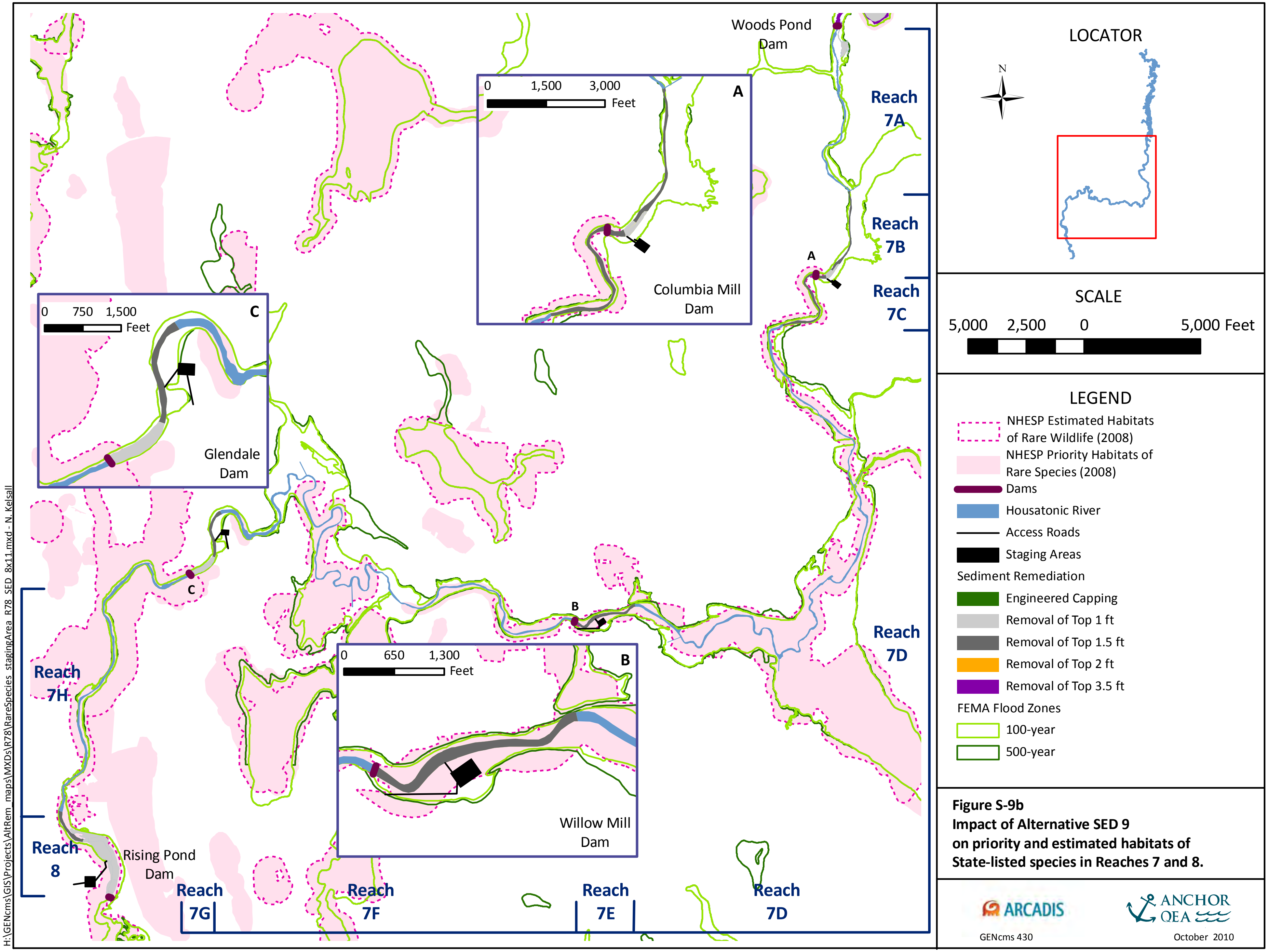

Figure S-9b
Impact of Alternative SED 9
on priority and estimated habitats of
State-listed species in Reaches 7 and 8.

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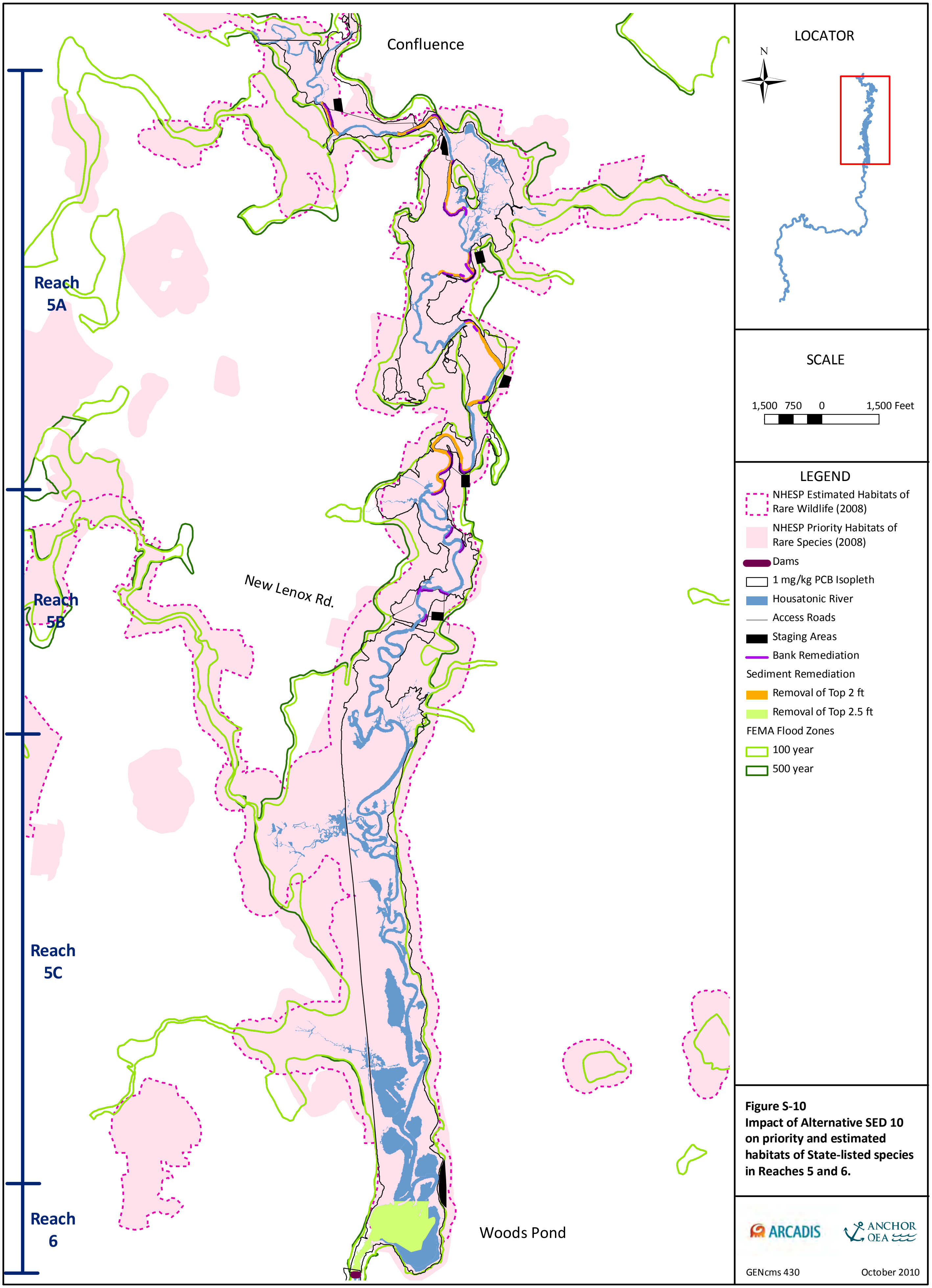

Figure S-10
Impact of Alternative SED 10 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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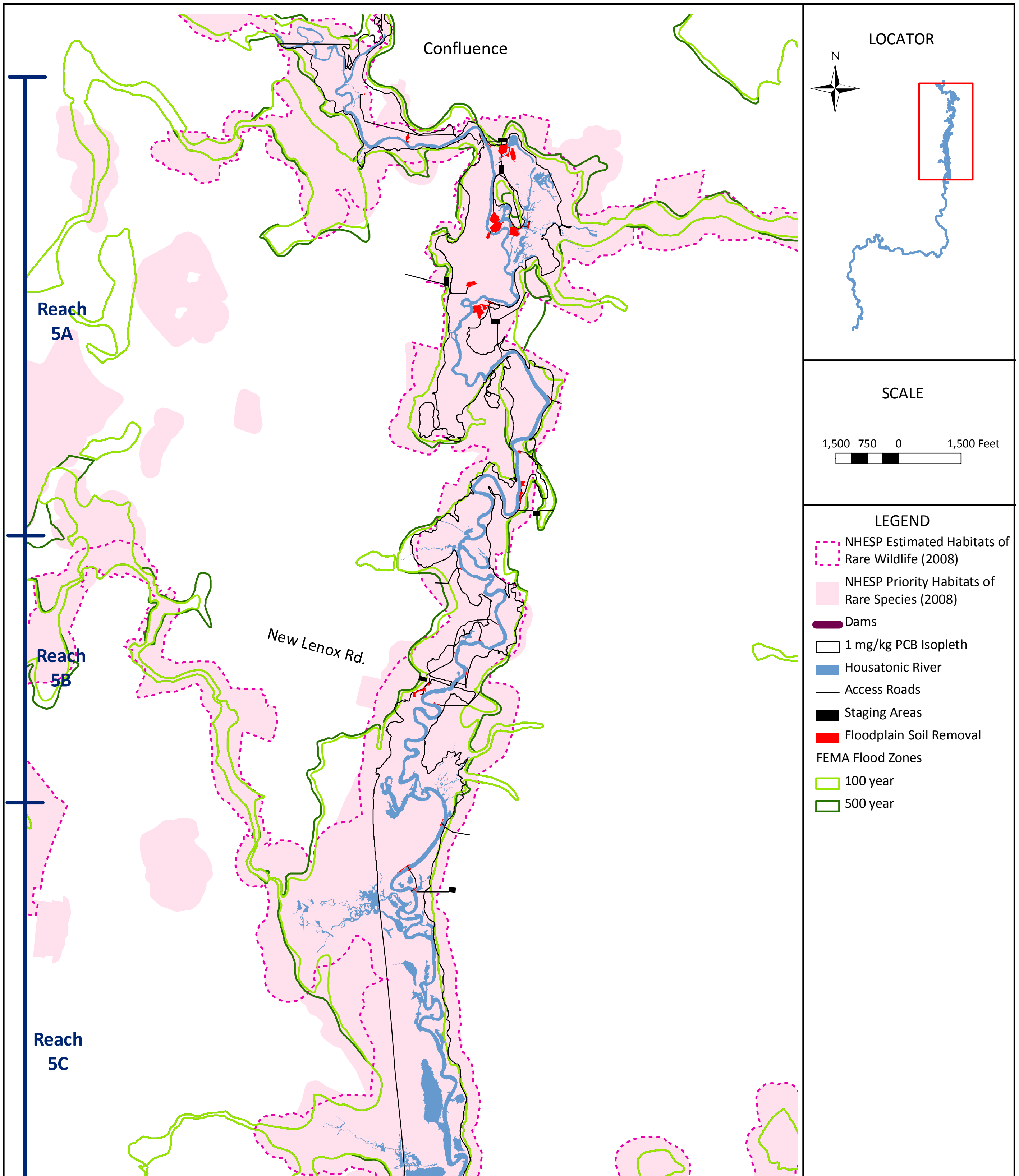

Figure F-2a
Impact of Alternative FP 2 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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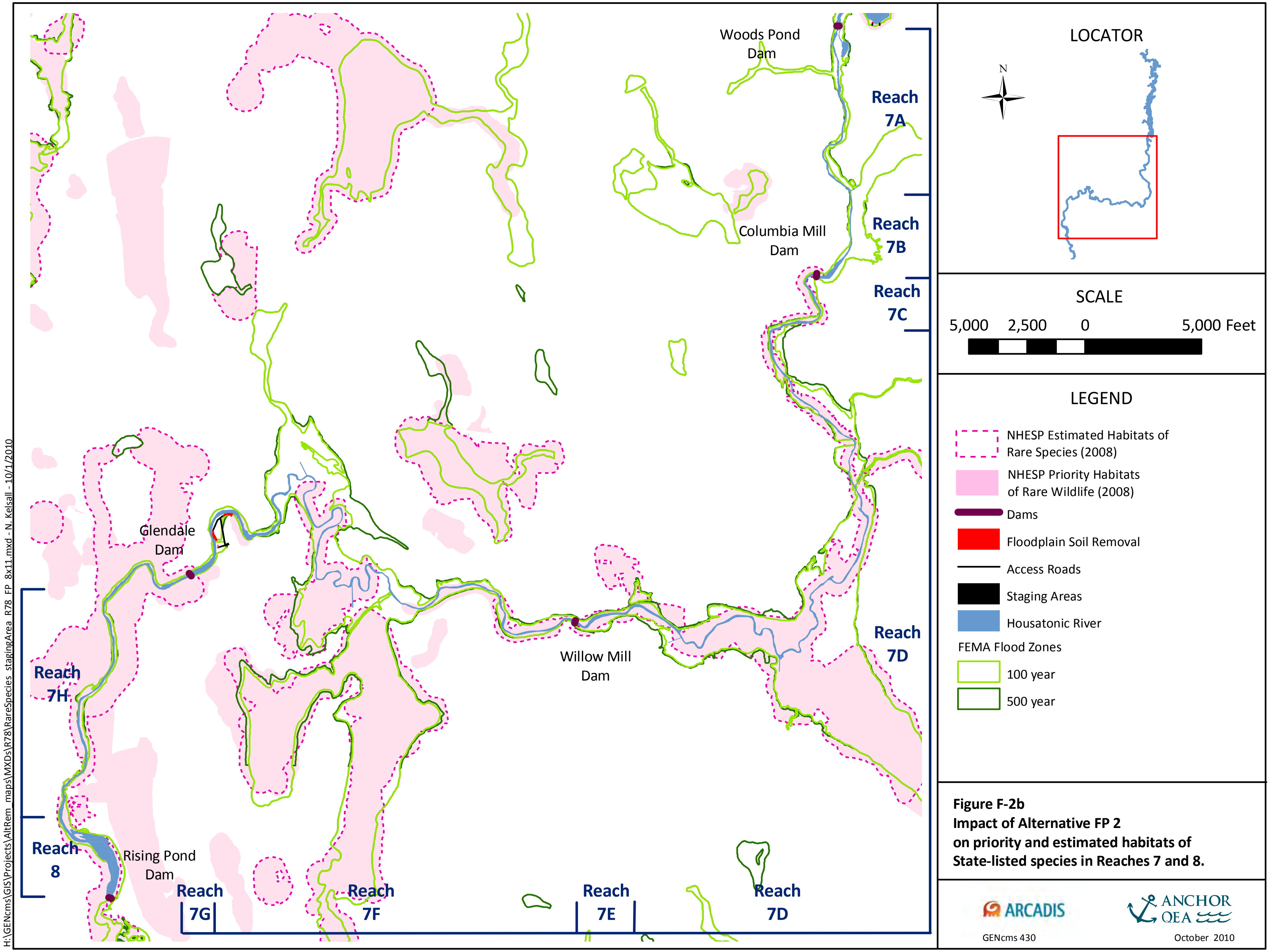

Figure F-2b
Impact of Alternative FP 2 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

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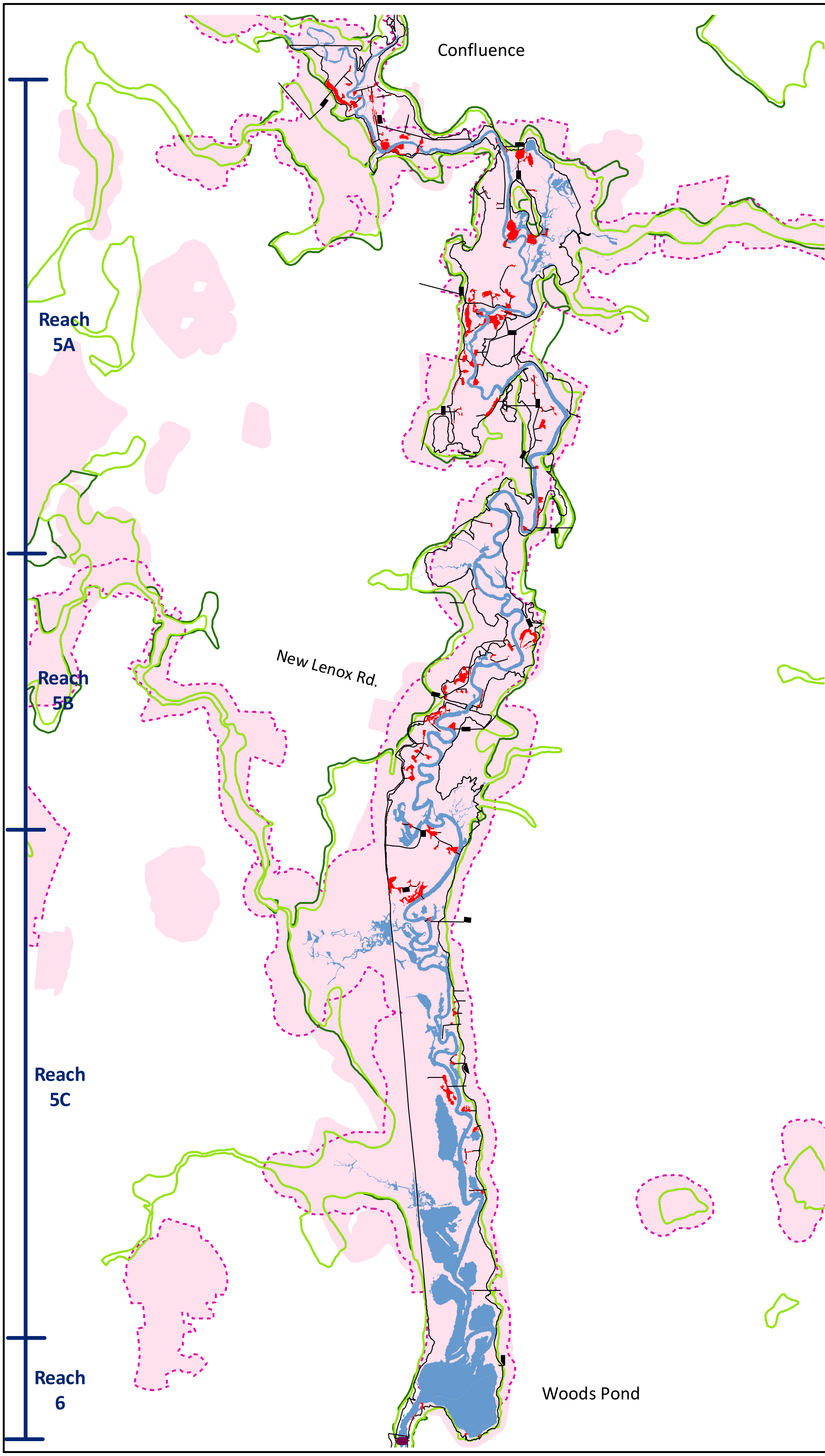

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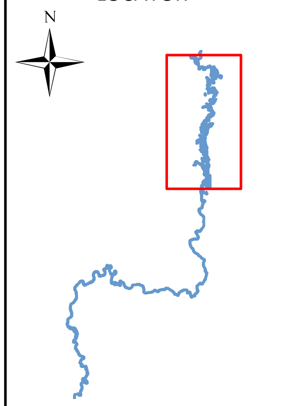

SCALE

1,500 750 0 1,500 Feet

LEGEND

- NHESP Estimated Habitats of Rare Wildlife (2008)
- NHESP Priority Habitats of Rare Species (2008)
- Dams
- 1 mg/kg PCB Isopleth
- Housatonic River
- Access Roads
- Staging Areas
- Floodplain Soil Removal

FEMA Flood Zones

- 100 year
- 500 year

Figure F-3a
Impact of Alternative FP 3 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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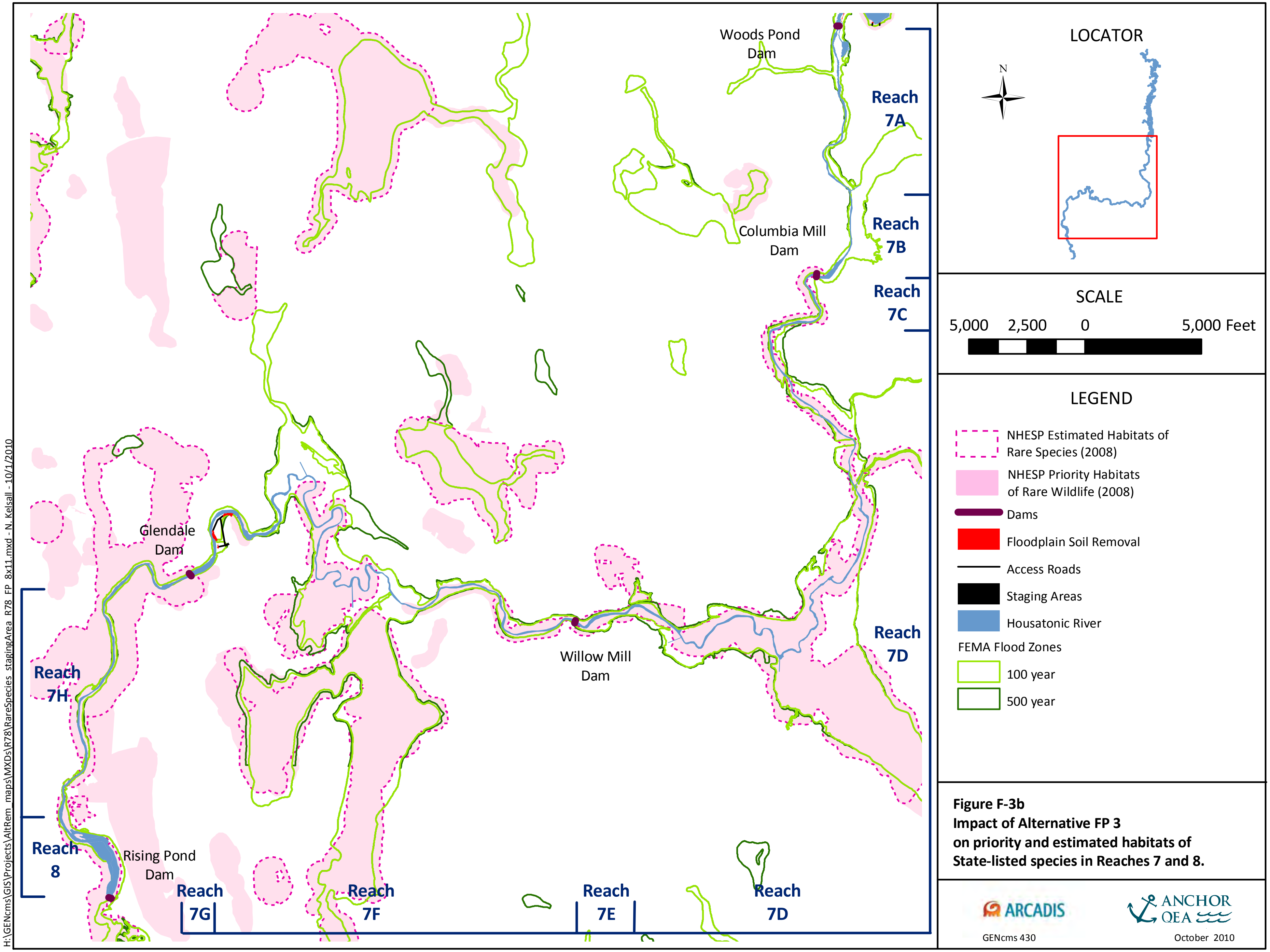
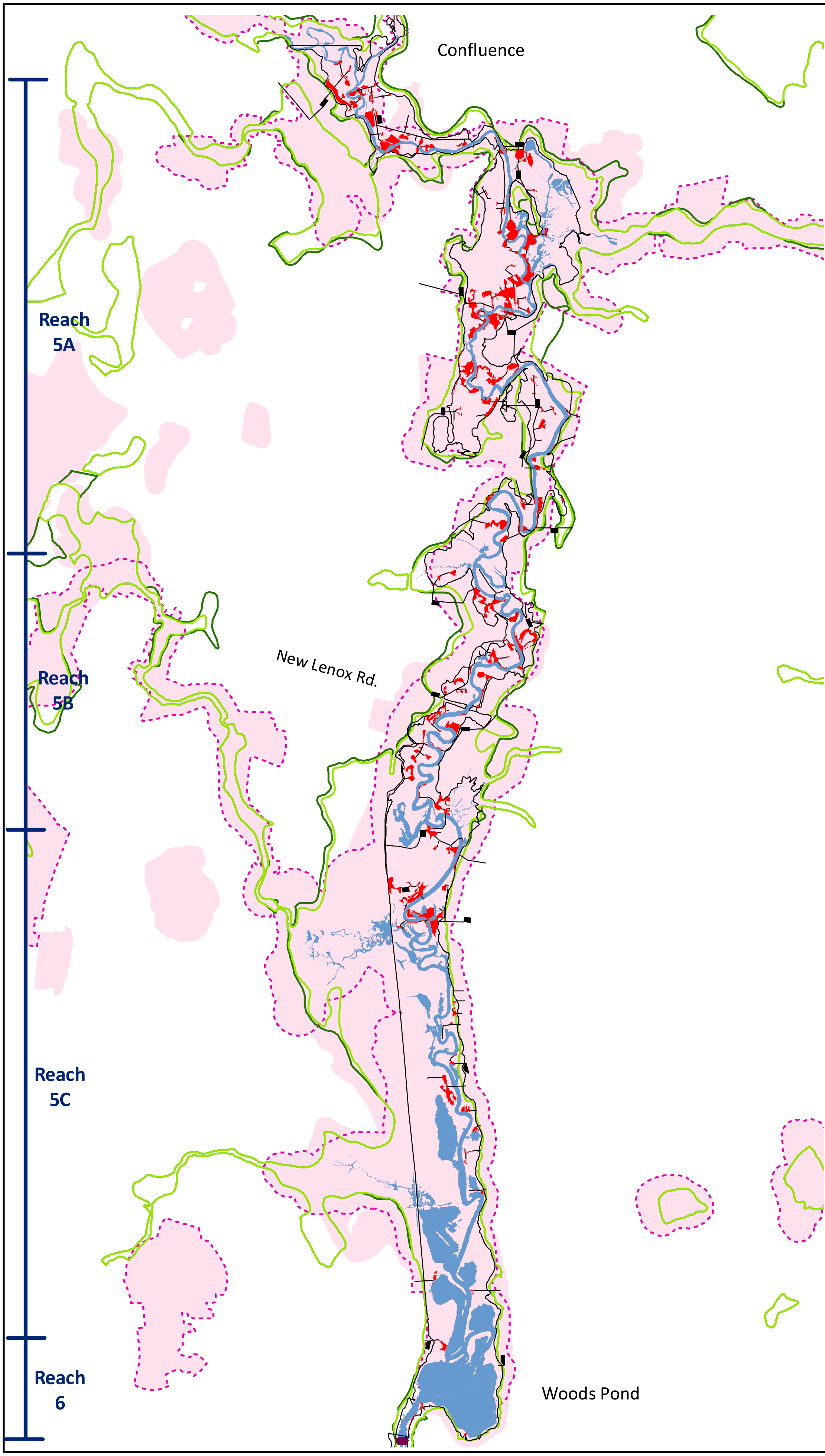


Figure F-3b
Impact of Alternative FP 3 on priority and estimated habitats of State-listed species in Reaches 7 and 8.



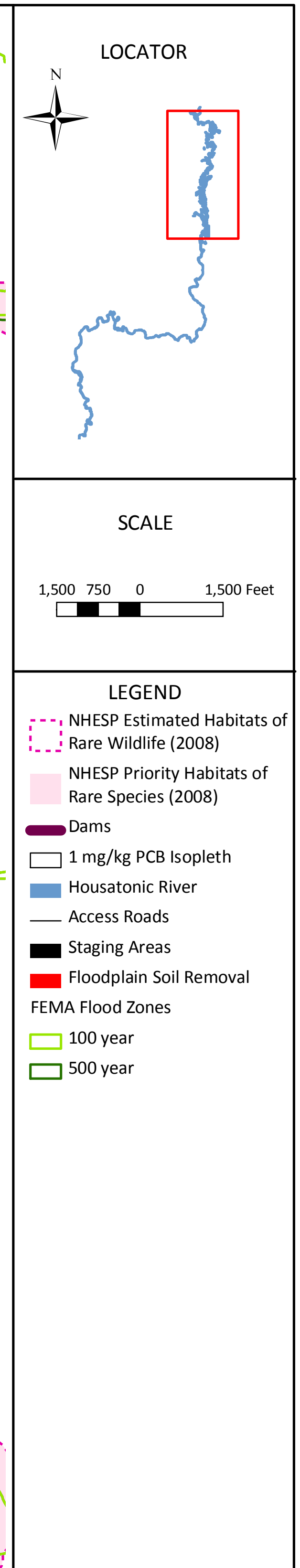


Figure F-4a
Impact of Alternative FP 4 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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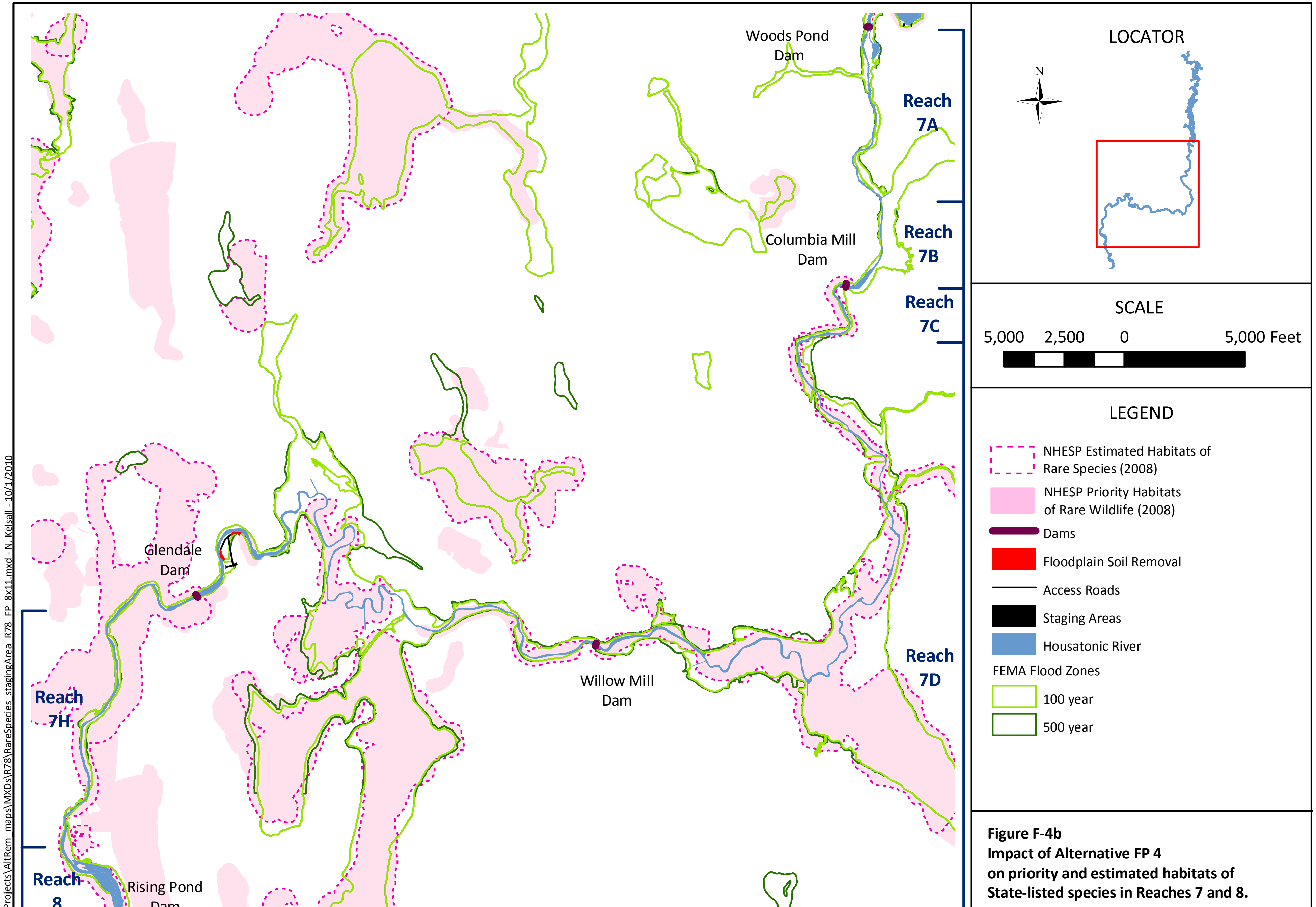

Figure F-4b
Impact of Alternative FP 4 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

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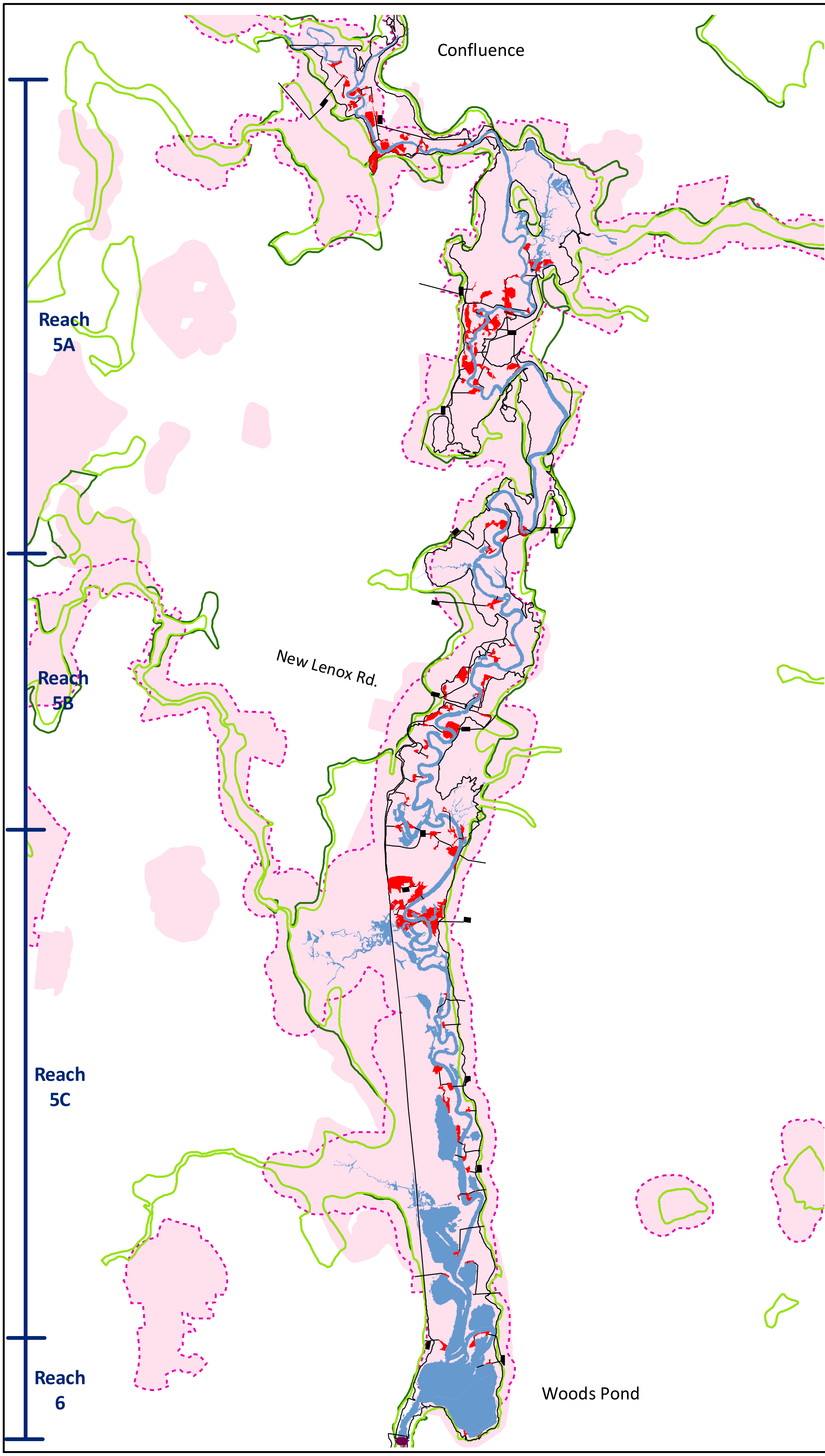

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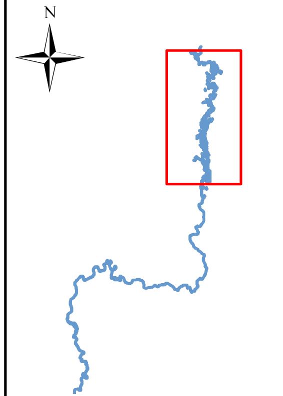

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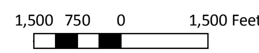

LEGEND

- NHESP Estimated Habitats of Rare Wildlife (2008)
- NHESP Priority Habitats of Rare Species (2008)
- Dams
- 1 mg/kg PCB Isopleth
- Housatonic River
- Access Roads
- Staging Areas
- Floodplain Soil Removal

FEMA Flood Zones

- 100 year
- 500 year

Figure F-5a
Impact of Alternative FP 5 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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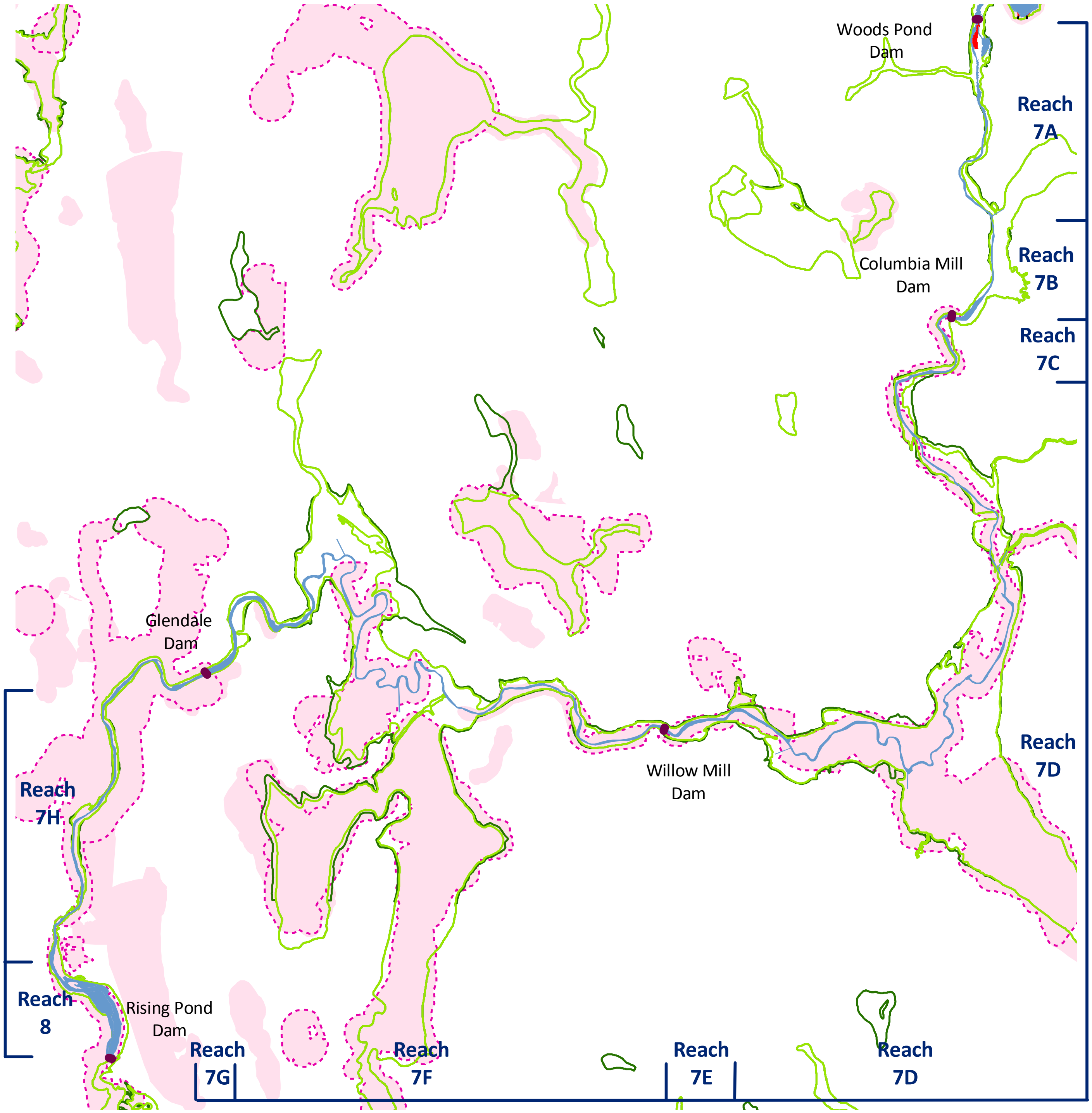

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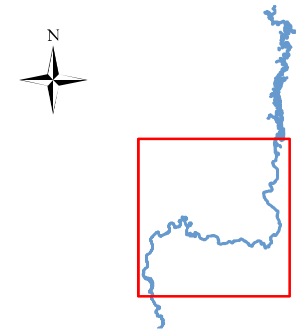

SCALE

5,000 2,500 0 5,000 Feet

LEGEND

- NHESP Estimated Habitats of Rare Species (2008)
- NHESP Priority Habitats of Rare Wildlife (2008)
- Dams
- Floodplain Soil Removal
- Access Roads
- Staging Areas
- Housatonic River

FEMA Flood Zones
- 100 year
- 500 year

Figure F-5b
Impact of Alternative FP 5 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

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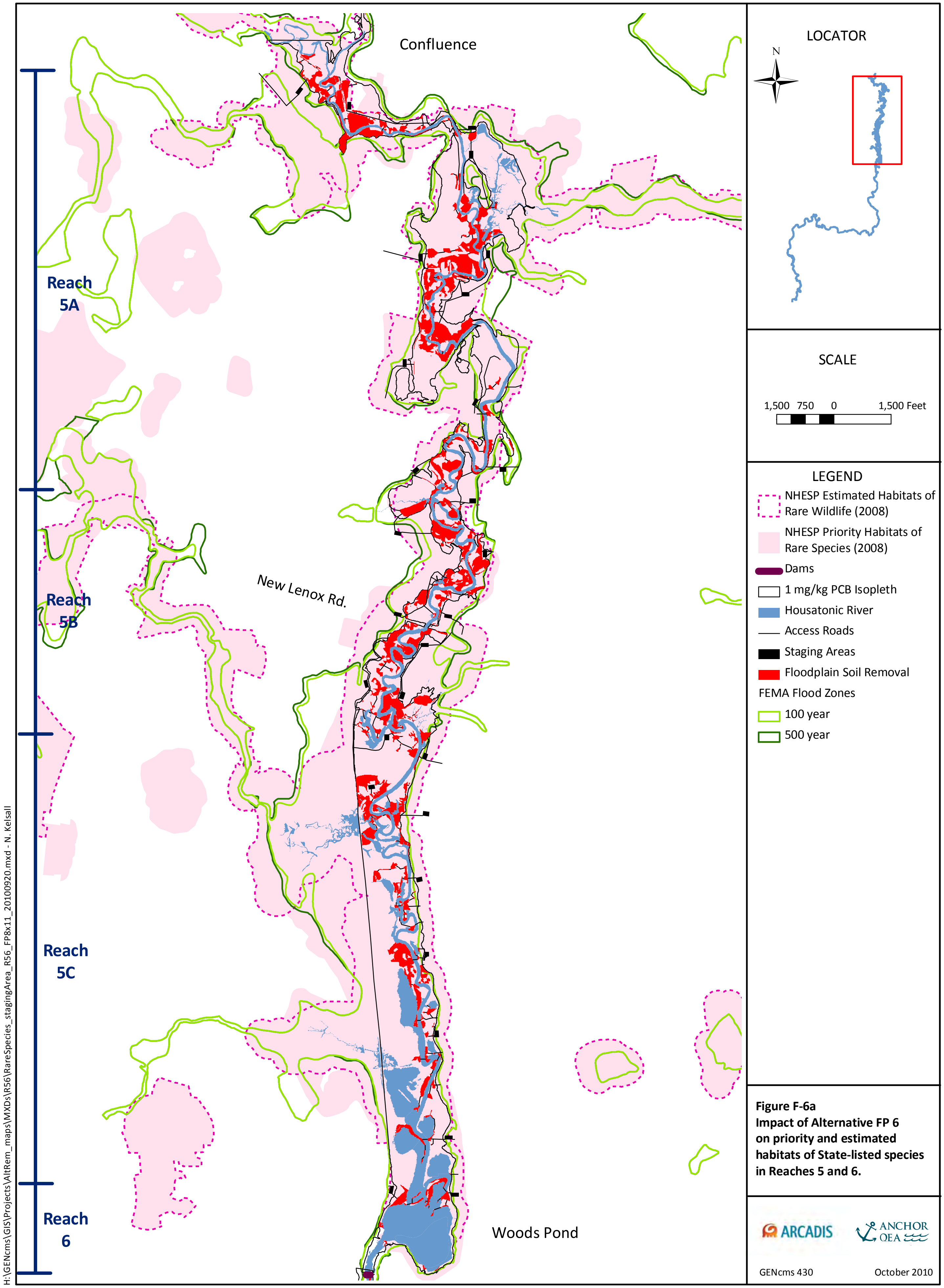

Figure F-6a
Impact of Alternative FP 6 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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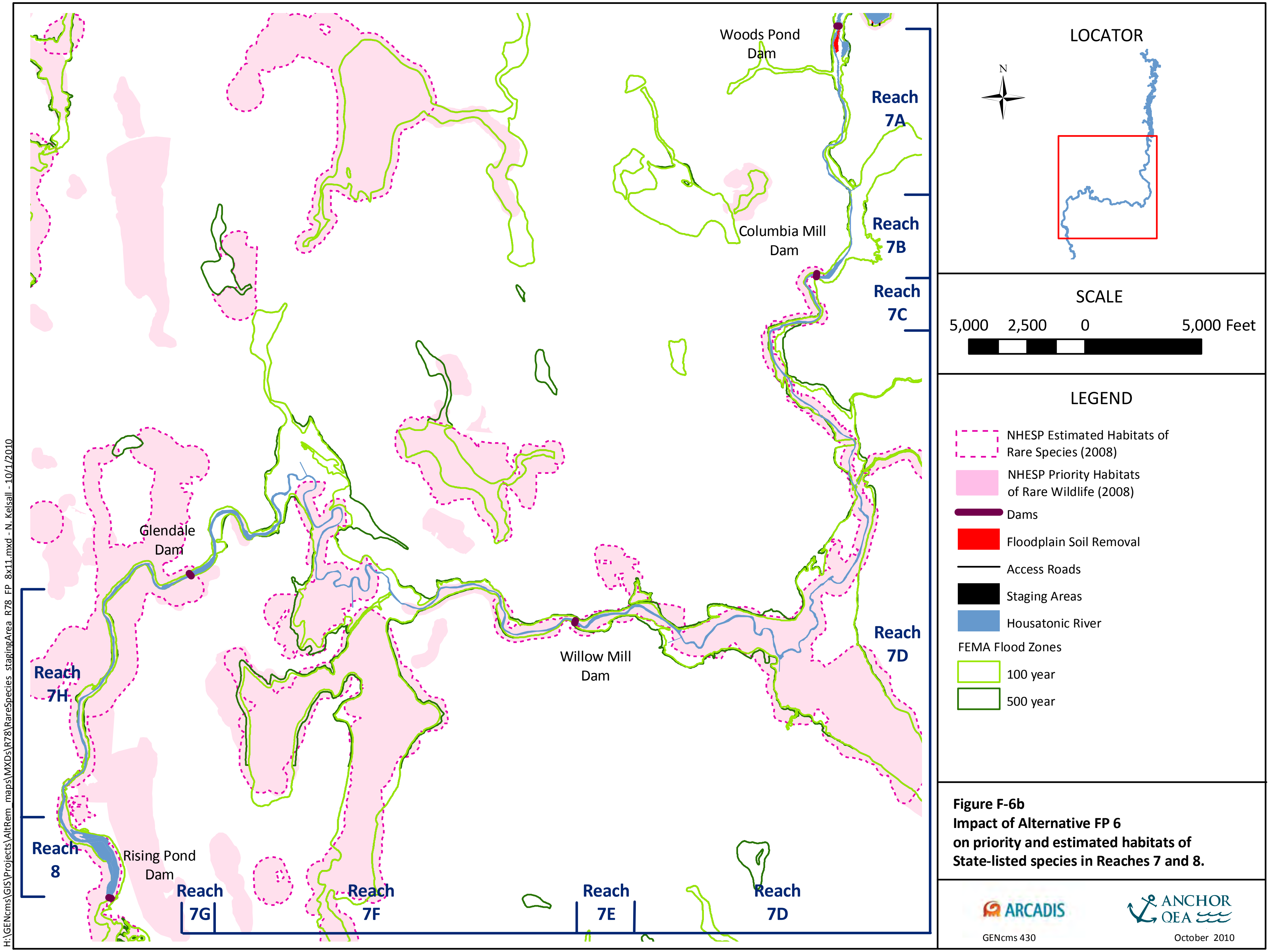

Figure F-6b
Impact of Alternative FP 6 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

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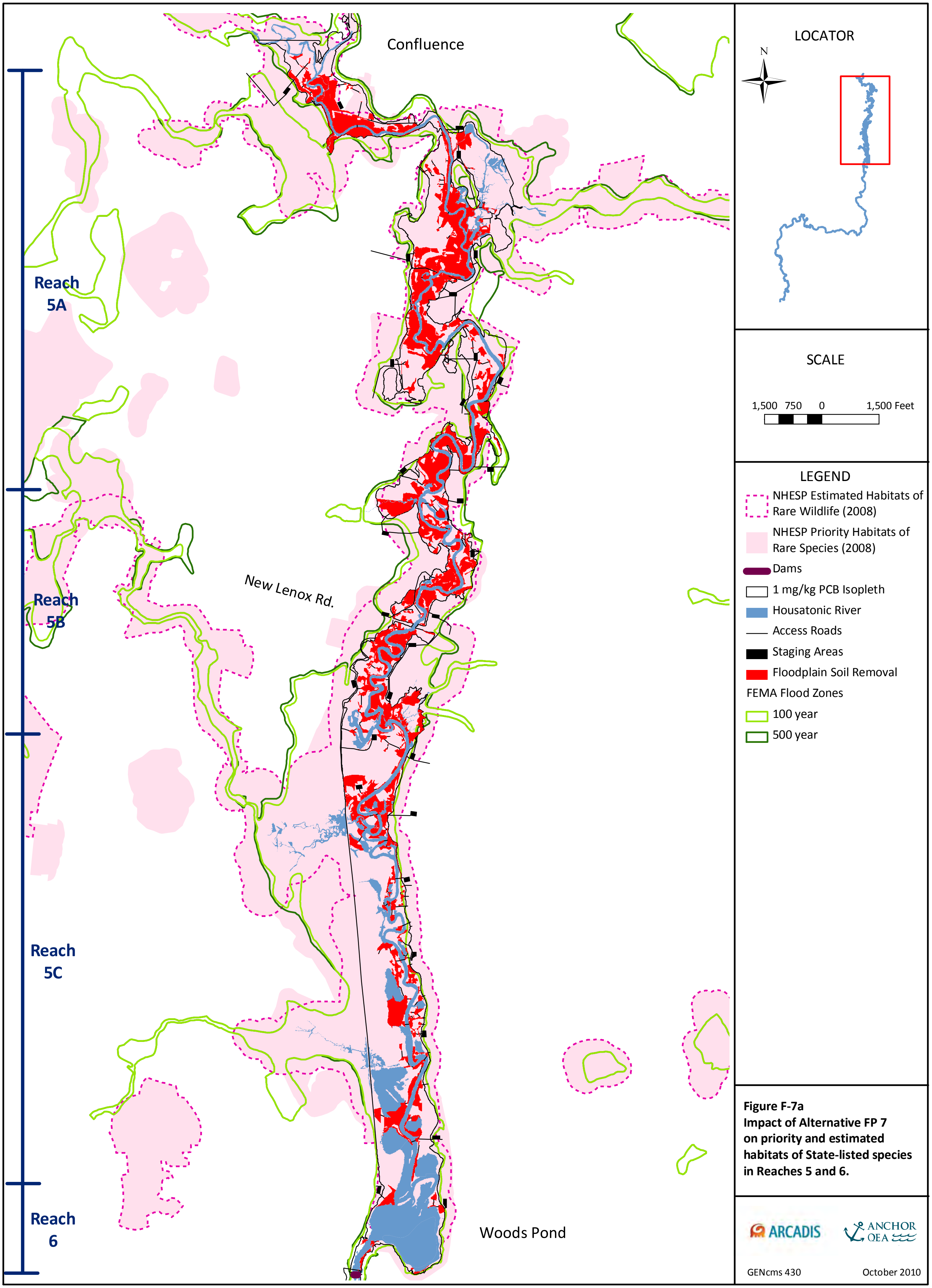

Figure F-7a
Impact of Alternative FP 7 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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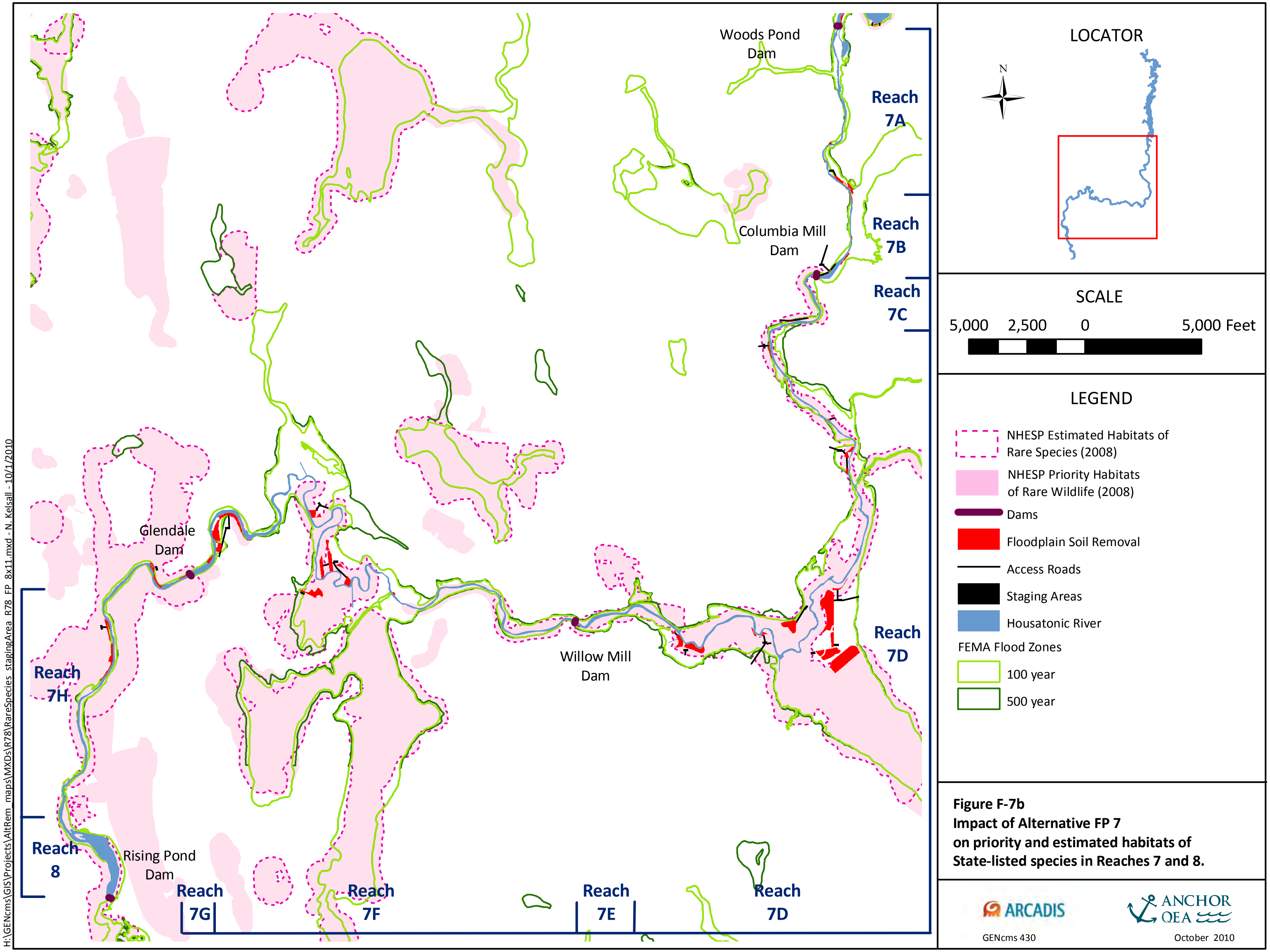
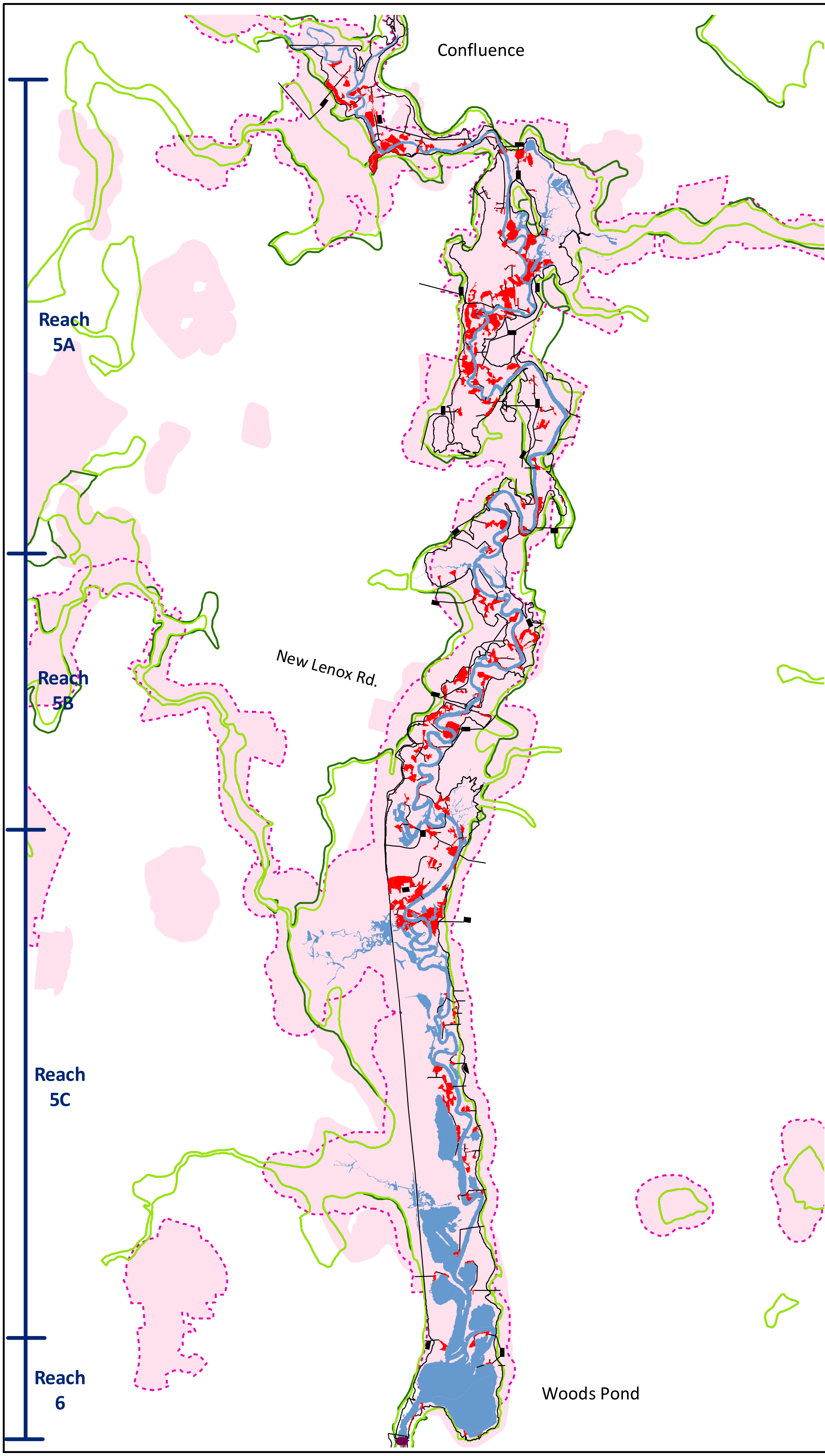


Figure F-7b
Impact of Alternative FP 7 on priority and estimated habitats of State-listed species in Reaches 7 and 8.



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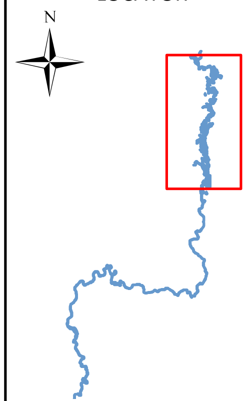

SCALE

1,500 750 0 1,500 Feet

LEGEND

- NHESP Estimated Habitats of Rare Wildlife (2008)
- NHESP Priority Habitats of Rare Species (2008)
- Dams
- 1 mg/kg PCB Isopleth
- Housatonic River
- Access Roads
- Staging Areas
- Floodplain Soil Removal

FEMA Flood Zones

- 100 year
- 500 year

Figure F-8a
Impact of Alternative FP 8 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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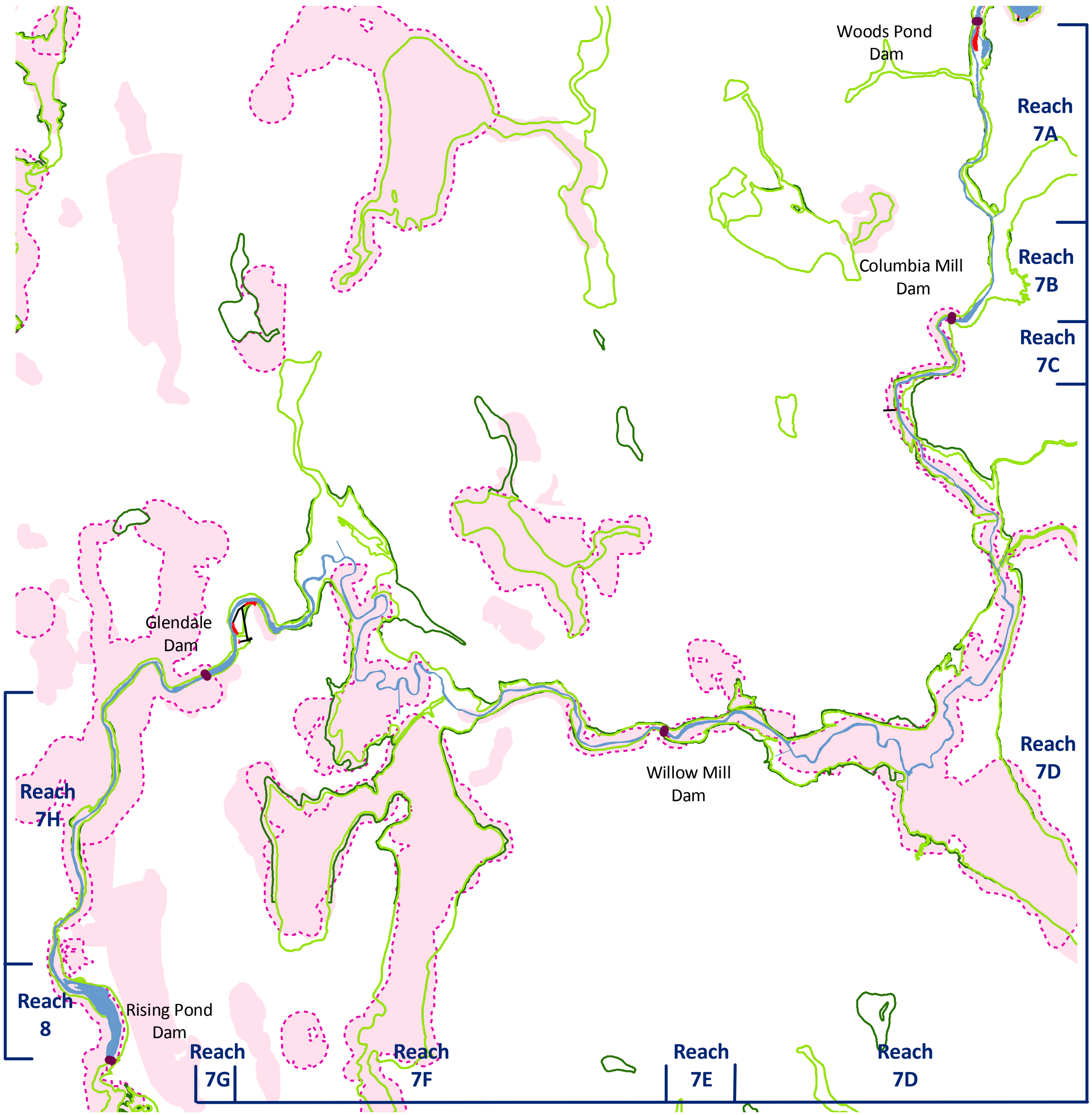

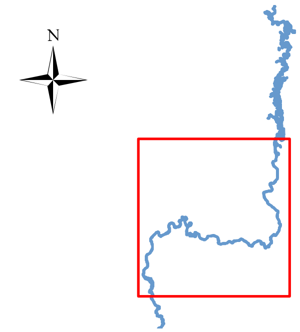

SCALE

5,000 2,500 0 5,000 Feet

LEGEND

- NHESP Estimated Habitats of Rare Species (2008)
- NHESP Priority Habitats of Rare Wildlife (2008)
- Dams
- Floodplain Soil Removal
- Access Roads
- Staging Areas
- Housatonic River

FEMA Flood Zones
- 100 year
- 500 year

Figure F-8b
Impact of Alternative FP 8 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

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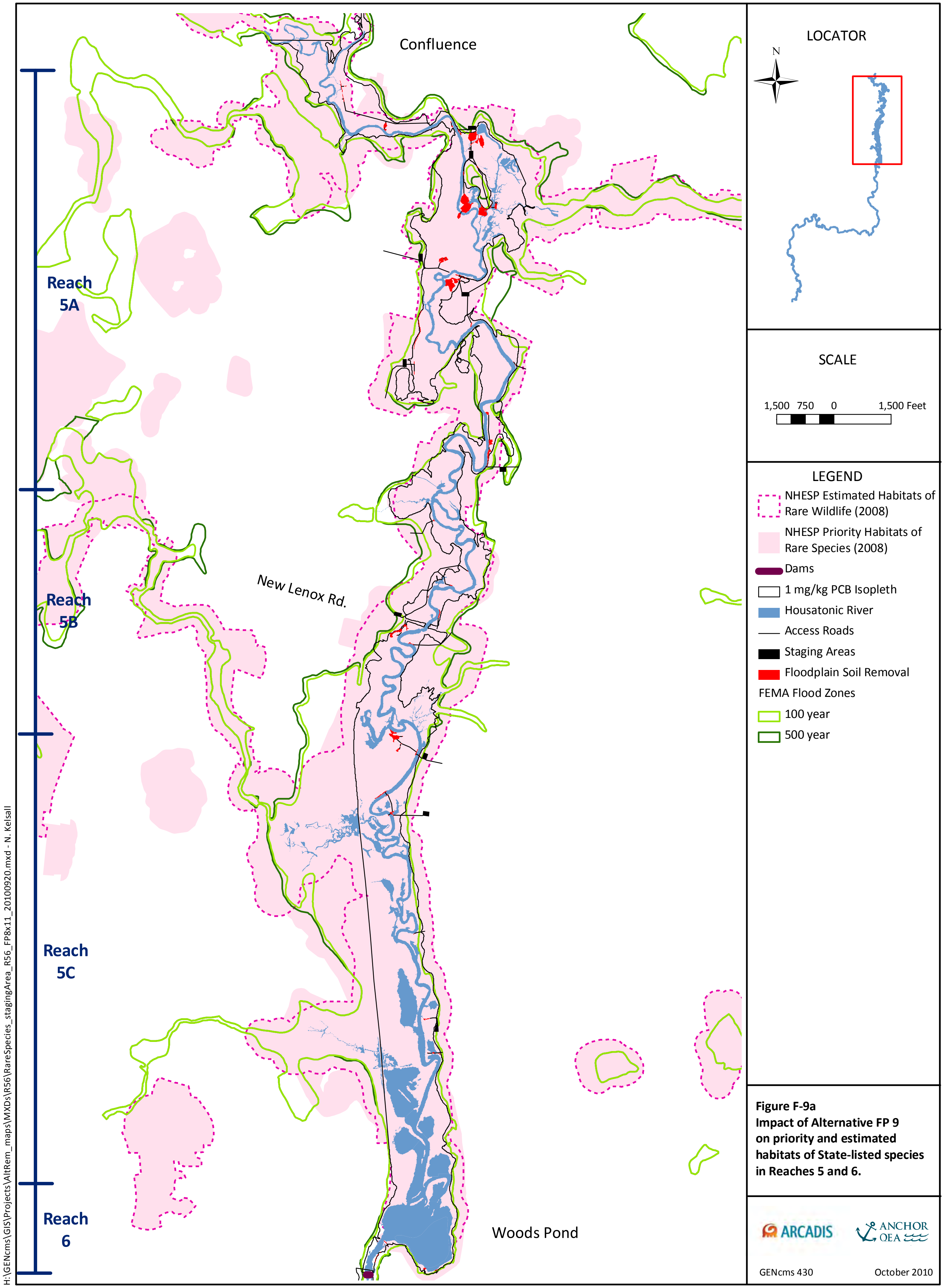

Figure F-9a
Impact of Alternative FP 9 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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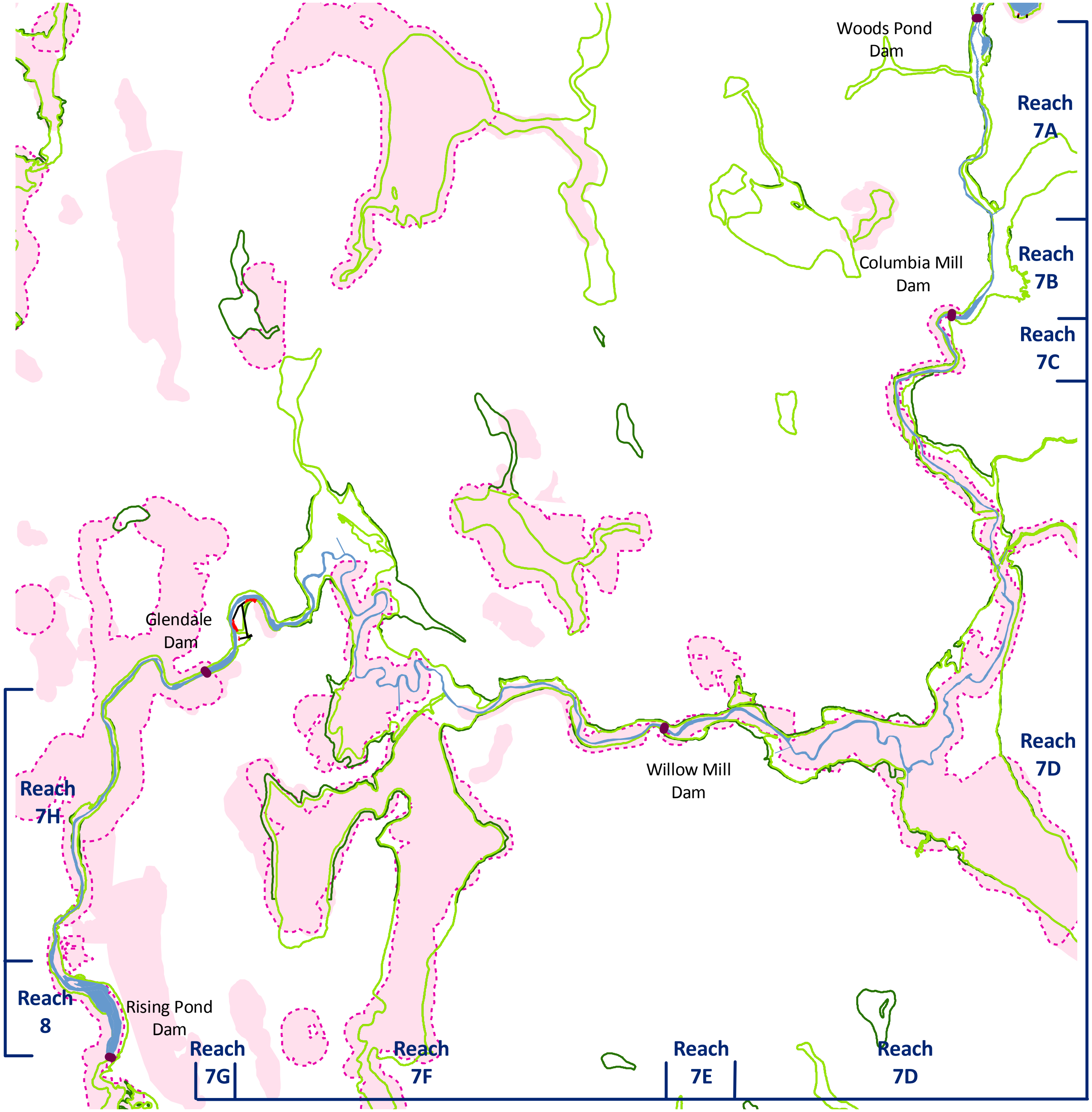

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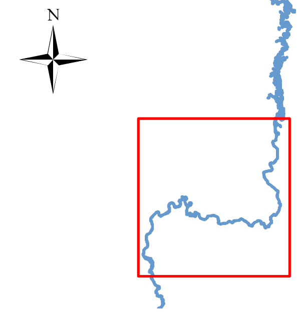

SCALE

5,000 2,500 0 5,000 Feet

LEGEND

- NHESP Estimated Habitats of Rare Species (2008)
- NHESP Priority Habitats of Rare Wildlife (2008)
- Dams
- Floodplain Soil Removal
- Access Roads
- Staging Areas
- Housatonic River

FEMA Flood Zones

- 100 year
- 500 year

Figure F-9b
Impact of Alternative FP 9 on priority and estimated habitats of State-listed species in Reaches 7 and 8.

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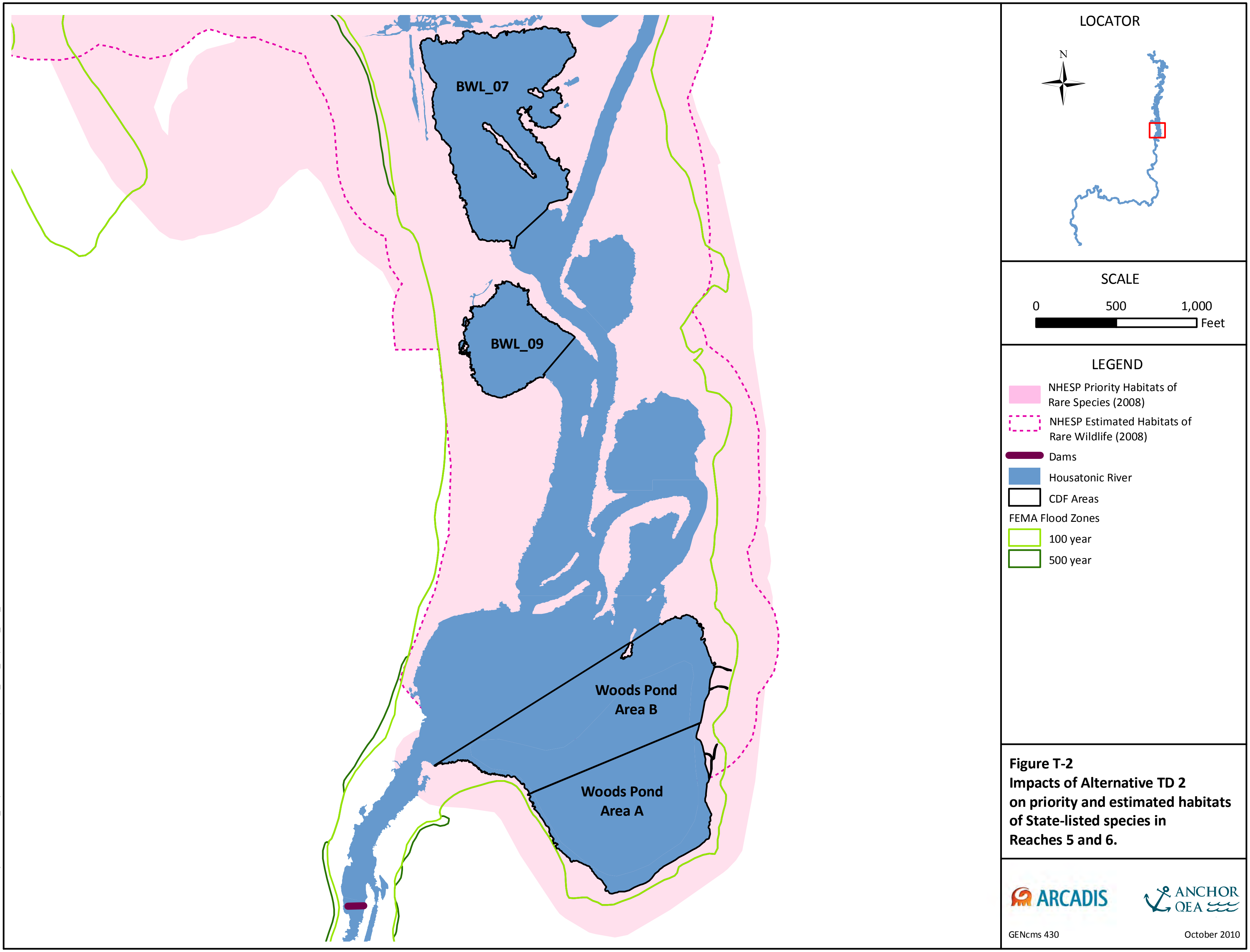

Figure T-2
Impacts of Alternative TD 2 on priority and estimated habitats of State-listed species in Reaches 5 and 6.

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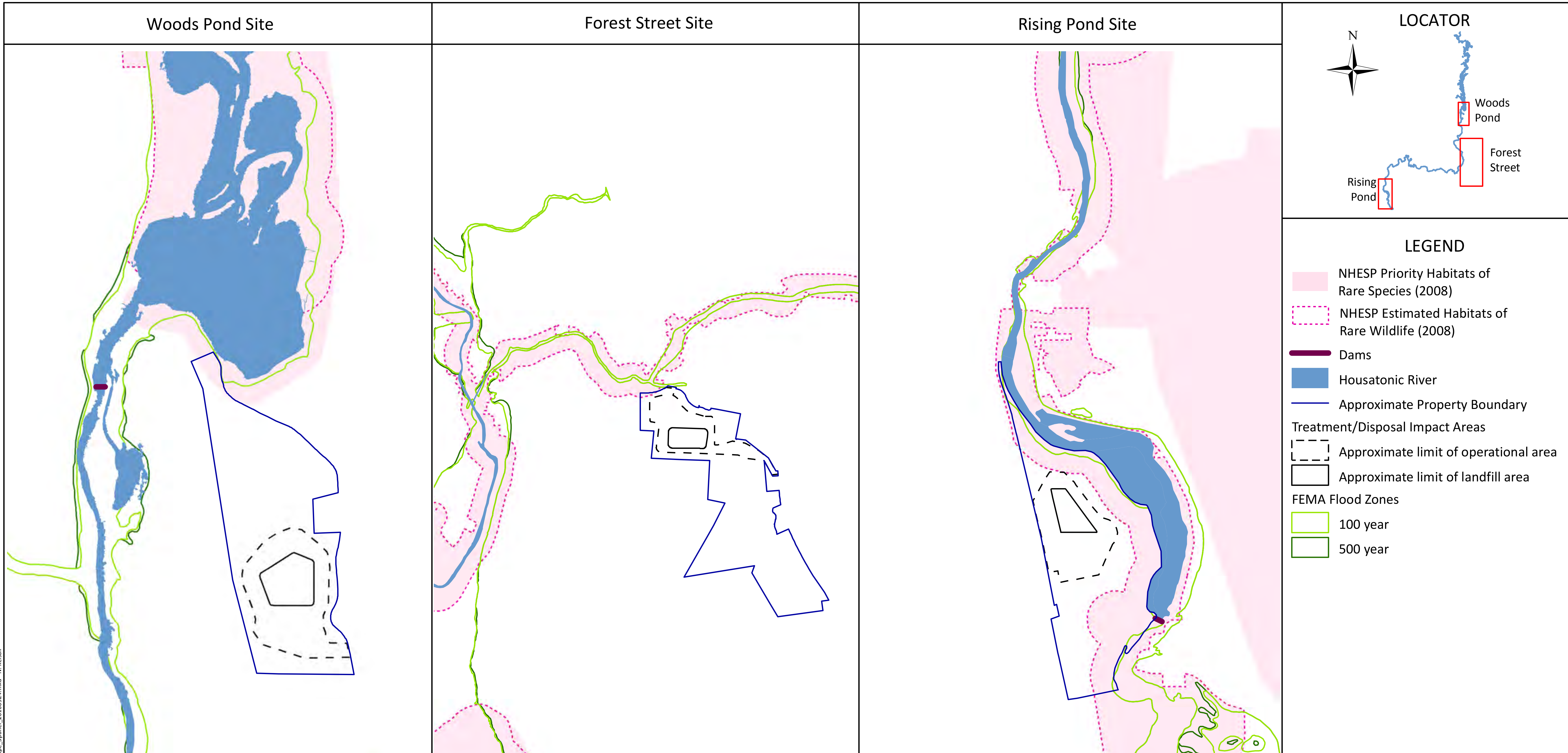

Figure T-3a
Proximity of Alternative TD 3 (minimum disposal volume) to priority and estimated habitats of State-listed species in Reaches 7 and 8.

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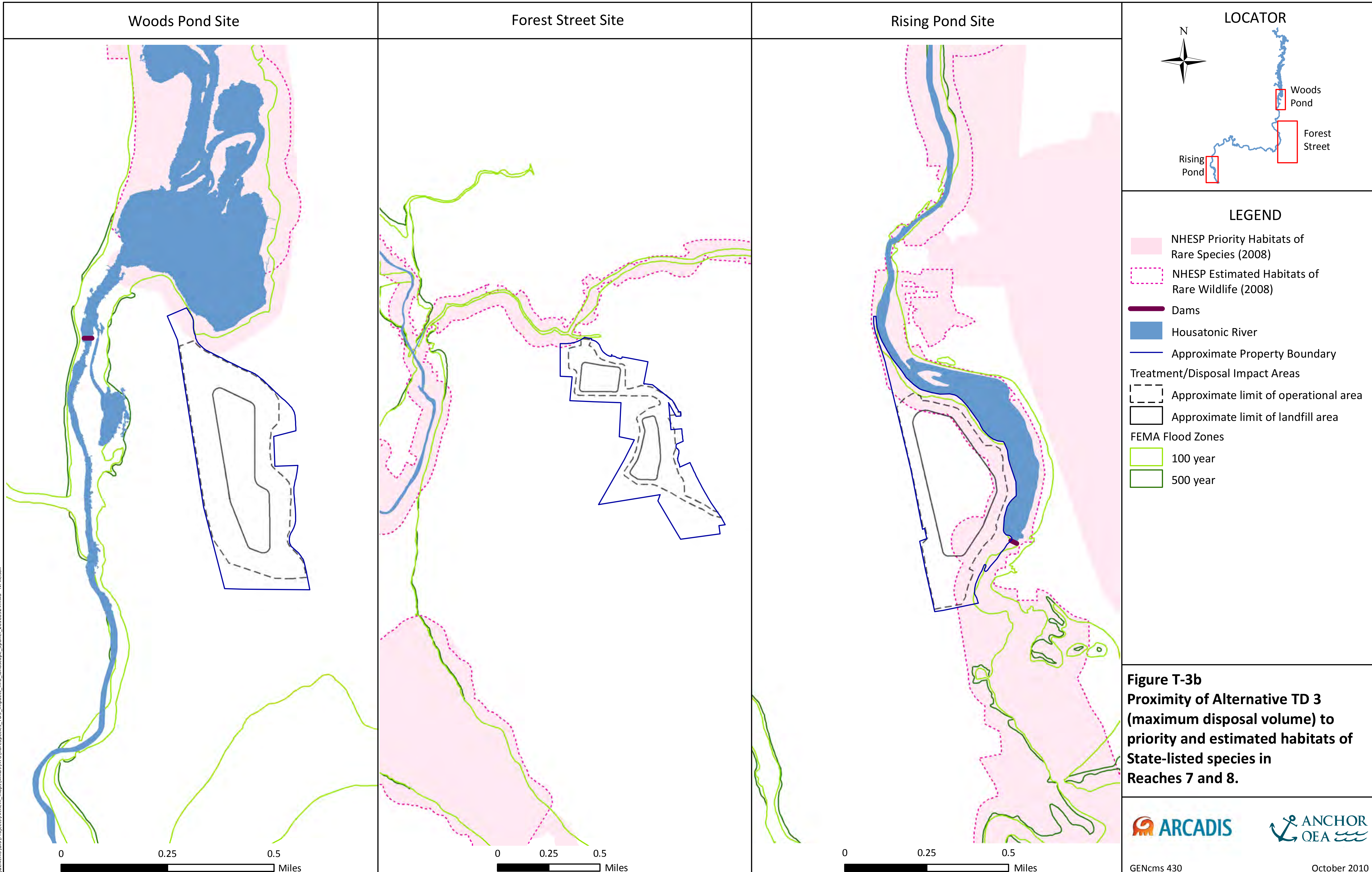
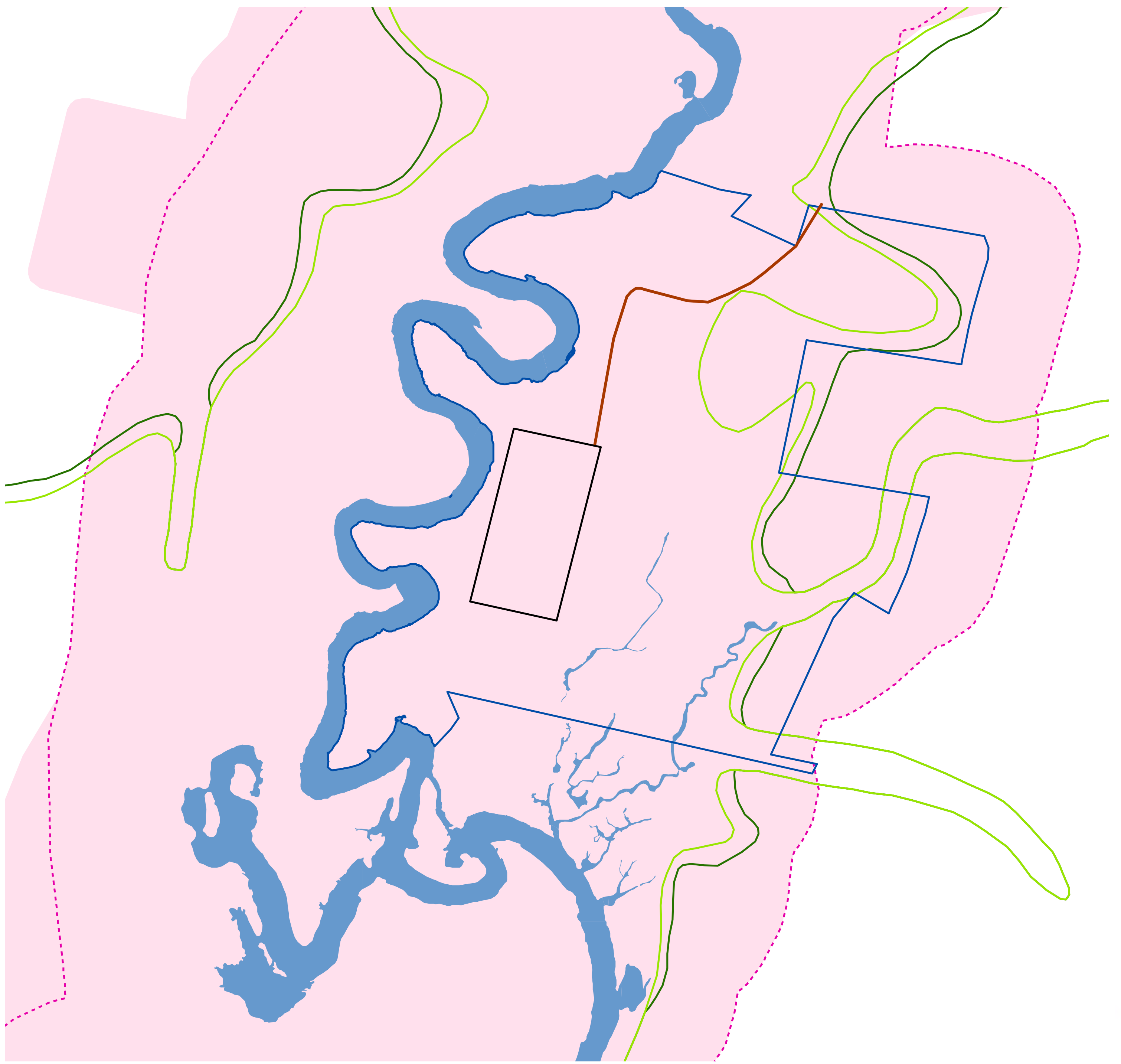


Figure T-3b
Proximity of Alternative TD 3 (maximum disposal volume) to priority and estimated habitats of State-listed species in Reaches 7 and 8.



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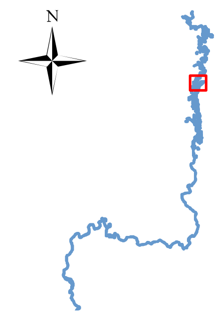

SCALE

0 250 500 Feet

LEGEND

NHESP Priority Habitats of Rare Species (2008)

NHESP Estimated Habitats of Rare Wildlife (2008)

Dams

Housatonic River

Approximate Property Boundary

Facility Road

Facility Location

FEMA Flood Zones

100 year

500 year

Figure T-4
Impacts of Alternatives
TD 4 and TD 5 on priority and estimated habitats of State-listed species in Reach 5.

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October 2010

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Appendix D

Basis for Target Floodplain Soil Concentrations Associated with PCB IMPG for Insectivorous Birds

APPENDIX D

Basis for Target Floodplain Soil Concentrations Associated with PCB IMPG for Insectivorous Birds

The Interim Media Protection Goals (IMPGs) specified in General Electric's (GE's) revised IMPG Proposal (GE, 2006) and approved by the United States Environmental Protection Agency (EPA) for insectivorous birds were based on EPA's assessment of potential risks to the wood duck (which was selected as a representative species for the insectivorous birds that reside and breed in the Rest of River area), as described in EPA's Ecological Risk Assessment (ERA; EPA, 2004). Those IMPGs apply to concentrations in wood duck invertebrate prey, which consists of both aquatic and terrestrial organisms. The IMPGs for wood duck invertebrate prey are 4.4 milligrams per kilogram (mg/kg) for polychlorinated biphenyls (PCBs) and 14 to 22 nanograms per kilogram (ng/kg) for dioxin toxicity equivalents (TEQs). Consistent with EPA's April 13, 2007 conditional approval letter for GE's Corrective Measures Study (CMS) Proposal (Condition 27), GE's evaluations in the CMS have focused on the IMPGs for total PCBs. Therefore, the IMPGs for TEQs are not further discussed.

As discussed in the text of this CMS Report, in order to be used to evaluate remedial alternatives, the IMPG for PCBs in wood duck invertebrate prey needed to be converted into corresponding PCB concentrations in media subject to evaluation in the CMS – namely, sediments and floodplain soils. This procedure was complicated by the fact that the invertebrate portion of the wood duck's diet consists of an aquatic invertebrate component (related to sediment and water column) and a terrestrial invertebrate component (related to floodplain soil). Thus, when calculating target sediment and floodplain soil concentrations associated with the prey-based IMPGs, the concentration in one component affects the allowable concentration in the other components – i.e., a higher concentration in sediments will require a lower concentration in soil in order to achieve the IMPG, and vice versa. Thus, it is not possible to derive a target concentration in one medium without knowing the concentration in the other.

In these circumstances, GE first selected a range of target sediment PCB concentrations that fall within the range of other sediment IMPGs (e.g., based on human direct contact and other ecological receptors). Those selected target PCB concentrations were 1, 3, and 5 mg/kg. GE then calculated target floodplain soil concentrations associated with achieving the PCB IMPG of 4.4 mg/kg in wood duck invertebrate prey assuming that the sediment PCB concentrations are equal to the selected target values. These calculations were initially presented in Appendix A to the CMS Proposal. However, EPA's April 13, 2007 conditional approval letter provided several comments on those calculations and directed GE to revise the calculations of target floodplain soil levels.

Based on those comments, this appendix describes the revised procedure used to calculate the target floodplain soil levels and presents revised calculations and target levels. These revised calculations were based on assumed target sediment concentrations of 1, 3, and 5 mg/kg. In accordance with EPA's comments, revised target floodplain soil concentrations have been calculated separately for each of the four subreaches of the Primary Study Area (PSA) (i.e., Reaches 5A, 5B, 5C/5D, and 6), due to subreach-specific differences in the total organic carbon content (TOC) of the surface sediments and in the biota-sediment accumulation factors (BSAFs).[1] The underlying equations, input variables, and results of this analysis are summarized in Table D-1 and are detailed below.

Derivation of Equation for Target Soil PCB Concentrations

As detailed in Attachment 29 of the revised IMPG Proposal, the prey-based IMPG is related to PCB concentrations in aquatic and terrestrial invertebrates as follows:

$$C_i = [(P_{ai} \times C_{ai}) + (P_{ti} \times C_{ti})] / (P_{ai} + P_{ti}) \qquad \text{Eqn. 1}$$

Where:

C_i = concentration of PCBs in invertebrate prey of wood ducks (mg/kg)

P_{ai} = proportion of wood duck diet comprised of aquatic invertebrates (unitless)

C_{ai} = concentration of PCBs in aquatic invertebrates (mg/kg)

P_{ti} = proportion of wood duck diet comprised of terrestrial invertebrates (unitless)

C_{ti} = concentration of PCBs in terrestrial invertebrates (mg/kg).

---

[1] These target floodplain soil concentrations have been applied in a more general way to the floodplain in further downstream reaches, as described in the text of this Report.

In order to differentiate between aquatic invertebrate prey that primarily reside in the water column and those that inhabit both the water column and the sediment (epibenthic organisms), Equation 1 is further broken out as:

$$C_i = [(P_{ei} \times C_{ei}) + (P_{wi} \times C_{wi}) + (P_{ti} \times C_{ti})] / (P_{ei} + P_{wi} + P_{ti}) \qquad \text{Eqn. 2}$$

Where:

P_{ei} = proportion of wood duck diet comprised of epibenthic invertebrates (unitless)

C_{ei} = concentration of PCBs in epibenthic invertebrates (mg/kg)

P_{wi} = proportion of wood duck diet comprised of water column invertebrates (unitless)

C_{wi} = concentration of PCBs in water column invertebrates (mg/kg)

P_{ti} = proportion of wood duck diet comprised of terrestrial invertebrates (unitless)

C_{ti} = concentration of PCBs in terrestrial invertebrates (mg/kg).

The lipid-normalized concentration of PCBs in epibenthic and water column invertebrates may be related to the organic carbon-normalized concentration of PCBs in sediment as follows (Ankley et al., 1992):

$$BSAF = (C_i / L) / (C_{sed} / TOC) \qquad \text{Eqn. 3}$$

Where:

BSAF = biota-sediment accumulation factor (unitless)

L = lipid content of invertebrates (%)

C_{sed} = concentration of PCBs in sediment (mg/kg)

TOC = total organic carbon content of sediment (%)

As detailed further below, separate BSAFs have been calculated for epibenthic and water column invertebrates and for different subreaches of the river. One would not expect a strong correlation between PCB concentrations in water column invertebrates and those in sediments given that such invertebrates are not in direct contact with sediment. Nonetheless, because water column invertebrates are about 20% of the wood duck pre-laying diet (Drobney and Fredrickson, 1979, as tabulated in the ERA at Vol. 5, Table G.2-

35), use of a BSAF specific to water column invertebrates allows more complete consideration of bioaccumulation of PCBs from sediment into all components of the wood duck diet.

Equation 3 can be rearranged to:

$C_i = BSAF \times C_{sed} \times 1/TOC \times L$ Eqn. 4

For the terrestrial component of the wood duck diet, the concentration of PCBs can be expressed as:

$C_{ti} = BAF_{ti} \times C_{soil}$ Eqn. 5

Where:

BAF_{ti} = soil-to-terrestrial invertebrate bioaccumulation factor (unitless)

C_{soil} = concentration of PCBs in floodplain soil (mg/kg)

Unlike the calculations of BSAFs, this relationship has not been normalized based on TOC and/or lipid content or varied by subreach due to the limited available empirical data on co-located soil and terrestrial invertebrate PCB concentrations, as further discussed below. In this situation, Equation 5 is the simplest model that yields the strongest relationship between the soil and terrestrial invertebrate PCB concentrations.

Equations 4 and 5 may be substituted into Equation 2 to yield:

$$C_i = [(P_{ei} \times BSAF_{ei} \times C_{sed} \times 1/TOC \times L_{ei}) + (P_{wi} \times BSAF_{wi} \times C_{sed} \times 1/TOC \times L_{ei})$$

$$+ (P_{ti} \times BAF \times C_{soil})] / (P_{ei} + P_{wi} + P_{ti}) \quad \text{Eqn. 6}$$

Solving Equation 6 for C_{soil} yields:

$$C_{soil} = C_i \times (P_{ti} + P_{wi} + P_{ei}) – [(P_{wi} \times BSAF_{wi} \times L_{wi} \times C_{sed} \times 1/TOC) +$$

$$(P_{ei} \times BSAF_{ei} \times L_{ei} \times C_{sed} \times 1/TOC)] / P_{ti} \times BAF_{ti} \quad \text{Eqn. 7}$$

As shown in Table D-1, Equation 7 was used to calculate subreach-specific target floodplain soil concentrations associated with the IMPG of 4.4 mg/kg for wood duck prey and sediment concentrations of 1, 3, and 5 mg/kg, based on the following assumptions regarding each of the equation’s variables.

Assumptions

Input values for Equation 7 were preferentially selected based on site-specific data, as presented in the ERA and supporting studies and datasets. The bases for all input assumptions are detailed below.

C_i – The target PCB concentration in the wood duck invertebrate prey was set equal to the EPA-approved IMPG of 4.4 mg/kg, derived in the revised IMPG Proposal (GE 2006, Appendix D, Attachment 29).

P_{ei} – The proportion of wood duck diet composed of epibenthic invertebrates was set equal to 0.367, based on Drobney and Fredrickson's (1979) diet data for the wood duck's pre-laying period (and as tabulated in the ERA at Vol. 5, Table G.2-35). Assignment of individual taxa in the wood duck's diet to the category of epibenthic or water column groups followed EPA's Food Chain Model (FCM) designations (EPA, 2006, pp. 2.4-1, 2.4-2 and Table 2.4-1).

P_{wi} - The proportion of wood duck diet composed of water column invertebrates was set equal to 0.197, also based on Drobney and Fredrickson's (1979) diet data for the wood duck's pre-laying period (and as tabulated in the ERA at Vol. 5, Table G.2-35). Assignment of individual taxa in the wood duck's diet to the category of epibenthic or water column groups followed EPA's FCM designations (EPA 2006, pp. 2.4-1, 2.4-1 and Table 2.4-1). P_{ei} and P_{wi} sum to 0.564, consistent with the ERA's assumption regarding the proportion of the wood duck diet composed of aquatic invertebrates (Vol. 5, Table G.2-33).

P_{ti} – The proportion of wood duck diet composed of terrestrial invertebrates was set equal to 0.196, consistent with the ERA (Vol. 5, Table G.2-33) and based on the diet during the pre-laying period (Drobney and Fredrickson, 1979; Drobney, 1980).

C_{sed} - Given the inter-related but unknown values of C_{sed} and C_{soil}, it was necessary to hold C_{sed} at fixed target levels in order to generate the C_{soil} values that are associated with each sediment concentration. Values of 1, 3, and 5 mg/kg were selected as example target sediment concentrations as discussed above.

BSAF – Biota-sediment accumulation factors for epibenthic invertebrates and water column invertebrates in Reaches 5A, 5B, 5C/5D, and 6 were calculated using EPA's FCM (EPA, 2006), based on simulations for 26 years (1979 through 2004) and average BSAFs for April through July of each year. The April through July period was selected because it encompasses the range from earliest nest initiation date to latest nest initiation date in Massachusetts (Grice and Rogers, 1965) and thus reflects the most active period of the wood duck's breeding season. Modeled BSAFs for water column feeders and epibenthic organisms are plotted in Figures D-1 and D-2, respectively, for each subreach of the PSA. BSAFs are also tabulated in Table D-1.

L_{ei} – The lipid content of epibenthic invertebrates was set equal to 1.5%, consistent with the findings of the FCM (EPA, 2006, Appendix C.1, pp. 1-5).

L_{wi} – The lipid content of water column invertebrates was set equal to 2%, consistent with the findings of the FCM (EPA, 2006, Appendix C.1, pp. 1-5).

TOC – As shown in Table B-1, subreach-specific values for the total organic carbon content of surface sediments (top 6 inches) were employed, based on the approved RCRA Facility Investigation (RFI) Report (QEA and BBL. 2003, Table 4-3).

BAF – A bioaccumulation factor of 0.31 was calculated from EPA's dataset for concentrations of PCBs in eight co-located litter invertebrate and composite soil samples collected from three sampling stations (13, 14, and 15) within the PSA (ERA, Vol 6, Appendix L). The underlying data are reproduced in Table D-2. Although EPA contractors had sampled both earthworms and litter invertebrates from these three stations, earthworm data were excluded from the BAF calculation because they are not a component of wood ducks' pre-laying diet (ERA, Vol. 5, Table G.2-35). The BAF of 0.31 reflects the median of BAFs calculated from all litter invertebrate results. Reach-specific BAFs were not calculated or applied due to the very low sample sizes per subreach (n = 0 to 3). However, as discussed below, the BAF of 0.31 is quite conservative compared to BAFs reported in the literature for terrestrial invertebrates.

Results

The target floodplain soil concentrations calculated using the above approach for each subreach and target sediment concentration are detailed in Table D-1 and summarized below:

Target Floodplain Soil Concentrations (mg/kg) Associated with IMPG for Wood Ducks

Assumed Sediment Concentration	Reach 5A	Reach 5B	Reach 5C/5D	Reach 6
1 mg/kg	50	48	53	**53**
3 mg/kg	39	33	49	**50**
5 mg/kg	**29**	**18**	**46**	**46**

Discussion

Of the input variables used to generate the target soil concentrations, the most significant uncertainty and variability are associated with the BSAF and the BAFs. In order to verify the appropriateness of the BSAF and BAFs applied, published papers and site-specific studies on bioaccumulation of PCBs by aquatic and terrestrial invertebrates that form significant portions of the wood duck diet were reviewed. As further detailed below, the literature review confirmed the appropriateness of the selected values.

The BSAFs used in the analysis (0.20 to 1.3) were derived from the FCM and vary according to prey type and river subreach. Other sources of BSAFs considered but rejected for this analysis include empirical data from the ERA (tree swallow stomach content data, D-net invertebrate data, and a 7-day *Lumbriculus* bioaccumulation study), BSAFs generated for the Kalamazoo River site, and theoretical predictions based on equilibrium partitioning. These potential sources are discussed below.

Data from ERA: Empirically derived BSAFs require consideration of co-located data on concentrations of PCBs in sediment and invertebrates, as well as invertebrate lipid content and sediment TOC. The tree swallow stomach contents analyzed for PCBs as part of the ERA cannot be used to generate BSAFs because it is not possible to link the tree swallow prey samples to specific sediment sampling locations from which the prey were harvested by individual tree swallows. Although assumptions could theoretically be made through spatial averaging of sediment concentrations within foraging distance of each tree swallow's nest box, considerable variability would result because prey concentrations differ among collections from closely located nest boxes (which would share virtually the same foraging area). Similarly, co-located sediment samples also were lacking for the invertebrates collected for the ERA using D-nets. While the 7-day *Lumbriculus variegatus* bioaccumulation study conducted as part of the ERA does have co-located sediment and invertebrate data, that study is limited for purposes of generating wood duck target levels because *Lumbriculus* is not a component of the wood duck diet and because seven days is not likely a sufficient test duration to achieve steady state.

Data from Kalamazoo River: Kay et al. (2005) used empirical data to generate BSAFs for benthic invertebrates, aquatic emergent insects, and several other types of organisms for total PCBs for the Kalamazoo River site and a reference site. The lipid-normalized BSAF for benthic invertebrates and aquatic emergent insects from the Kalamazoo River were 0.439 and 0.18, respectively, while those from the reference site were somewhat higher (1.15 and 0.597, respectively) (Kay et al., 2005). Because these BSAFs are not specific to the Housatonic River, they are less applicable to this analysis than those generated by the FCM. However, they do offer a bounding range of BSAFs that illustrates that the BSAFs generated by the FCM are within the range supported by empirically derived BSAFs for total PCBs.

Equilibrium Partitioning: The ERA (Vol. 4, p. D-39) reported that equilibrium partitioning theory for PCBs yields a BSAF of approximately 2 for benthic invertebrates (Parkerton 1993, McFarland 1994). The RFI Report (QEA and BBL, 2003, p. 8-51) noted that average or median BSAFs for benthic organisms generally lie between 1.5 and 3 for PCBs with logarithm of octanol-water partitioning coefficients (log Kow) in the range of 6 to 7 (Tracey and Hansen, 1996; QEA, 1999; Wong et al., 2001). However, equilibrium partitioning theory alone may not be sufficient to explain variability in uptake of PCBs by aquatic organisms, especially water column and epibenthic species. Furthermore, Di Toro et al. (1991) noted that equilibrium partitioning theory is a relatively poor predictor of uptake when sediment TOC is very low (i.e., less than 0.2%). Although TOC in the different subreaches of the PSA is at least an order of magnitude higher than that minimum threshold (see Table D-1), it is possible that this limitation of equilibrium partitioning theory would cause it to perform less well in subreaches with relatively low TOC than in those with much higher TOC.

For all of these reasons, the model-derived BSAFs were judged most applicable to the estimation of target floodplain soil concentrations protective of wood ducks.

The BAF used in the analysis (0.31) is the median of calculated BAFs from eight co-located litter invertebrate and floodplain soil samples collected within the PSA as part of the ERA.

The majority of published studies on bioaccumulation of PCBs by terrestrial invertebrates focus on earthworms. As previously discussed, because earthworms are not a significant portion of the wood duck's diet, they were excluded from the calculation of site-specific BAFs. Published earthworm bioaccumulation studies were excluded from the literature review for the same reason, which left two pertinent articles (Blankenship et al., 2005. and Paine et al.. 1993).

Blankenship et al. (2005) reported total PCB concentrations for above-ground terrestrial invertebrates (excluding earthworms) and co-located soil samples collected from the Kalamazoo River Superfund Site. Arithmetic mean concentrations of total PCBs in terrestrial invertebrates and soil were reported to be 0.34 and 6.5 mg/kg, respectively, which yield a BAF of 0.05. Geometric mean concentrations in invertebrates and soil were 0.10 and 4.7 mg/kg, respectively, which yield a BAF of 0.02. In a 14-day bioaccumulation test on uptake of Aroclor 1254 in soil by house crickets, Paine et al. (1993) observed BAFs ranging from 0.07 to 0.19 for soil concentrations ranging from 100 to 2,000 mg/kg. The BAF associated with the lowest soil concentration (100 mg/kg) was 0.11. Relative to these two studies, the site-specific BAF of 0.31 is quite conservative.[2] Use of the highest of the literature-derived BAF (0.19) would increase the target soil levels by 1.6-fold.

In conclusion, target floodplain soil PCB concentrations that are associated with the four selected target sediment concentrations and based on the PCB IMPG of 4.4 mg/kg in the invertebrate prey of wood ducks range from 18 to 53 mg/kg, depending on the subreach and target sediment concentration.[3] This analysis is based on site-specific data and is conservative relative to available data published in the peer-reviewed literature.

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[2] The BAF and the target soil concentration are inversely related, such that higher BAFs will yield lower target soils concentrations.

[3] See Section 5.2.3.3 of text for discussion of the application of these target concentrations to the subreaches within the PSA and to further downstream reaches.

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Table D-1. Derivation of Target Floodplain Soil Concentrations Associated with PCB IMPG for Wood Ducks

Subreach	Sediment Concentration C_{sed} (mg/kg)	Organic Carbon Concentration TOC_{sed} (%)	Biota-Sediment Accumulation Factor (Water Column Organisms) $BSAF_{wi}$	Biota-Sediment Accumulation Factor (Epibenthic Organisms) $BSAF_{ei}$	Lipids (Water Column Organisms) L_{wi} (%)	Lipids (Epibenthic Organisms) L_{ei} (%)	Target Soil Concentration C_{soil} (mg/kg)
5A	1	1.4	0.202	0.665	2.0	1.5	50
5A	3	1.4	0.202	0.665	2.0	1.5	39
5A	5	1.4	0.202	0.665	2.0	1.5	29
5B	1	1.4	0.409	0.849	2.0	1.5	48
5B	3	1.4	0.409	0.849	2.0	1.5	33
5B	5	1.4	0.409	0.849	2.0	1.5	18
5C/5D	1	8.0	0.608	1.226	2.0	1.5	53
5C/5D	3	8.0	0.608	1.226	2.0	1.5	49
5C/5D	5	8.0	0.608	1.226	2.0	1.5	46
6	1	8.0	0.469	1.267	2.0	1.5	53
6	3	8.0	0.469	1.267	2.0	1.5	50
6	5	8.0	0.469	1.267	2.0	1.5	46

Notes:

$$IMPG = C_{soil} = \frac{\left\{C_i \times (P_{ti} + P_{wi} + P_{ei}) - \left[\left(P_{wi} \times BSAF_{wi} \times L_{wi} \times C_{sed} \times \frac{1}{TOC}\right) + \left(P_{ei} \times BSAF_{ei} \times L_{ei} \times C_{sed} \times \frac{1}{TOC}\right)\right]\right\}}{P_{ti} \times BAF_{ti}}$$

Basis for all assumptions detailed in text.

P_{ti} = 0.196

P_{wi} = 0.197

P_{ei} = 0.367

C_i = 4.4 mg/kg

BAF_{ti} = 0.31

Table D-2. Litter Invertebrate-Floodplain Soil PCB Bioaccumulation Factors

Field Sample ID	Date Collected	Sample Plot	Litter Invert. PCB Conc. (mg/kg)	Co-located Surface (0-6") Soil PCB Conc. (mg/kg)	Bioaccumulation Factor
H3-TW13LI01-0-0G10	08/10/00	13-1 and 13-3	4.1	9.6	0.42
H3-TW13LI02-0-0G10	08/10/00	13-9	3.6	10.8	0.33
H3-TW13LI03-0-0G11	08/11/00	13-7	4.9	16.3	0.30
H3-TW14LI01-0-0G15	08/15/00	14-4, 14-5, and 14-6	3.8	34.9	0.11
H3-TW14LI02-0-0G15	08/15/00	14-1, 14-2, and 14-3	3.5	66.1	0.05
H3-TW14LI03-0-0G16	08/16/00	14-1 and 14-8	2.3	69.8	0.03
H3-TW15LI01-0-0G09	08/09/00	15	1.4	0.8	1.81
H3-TW15LI02-0-0G10	08/10/00	15	2.8	0.8	3.58

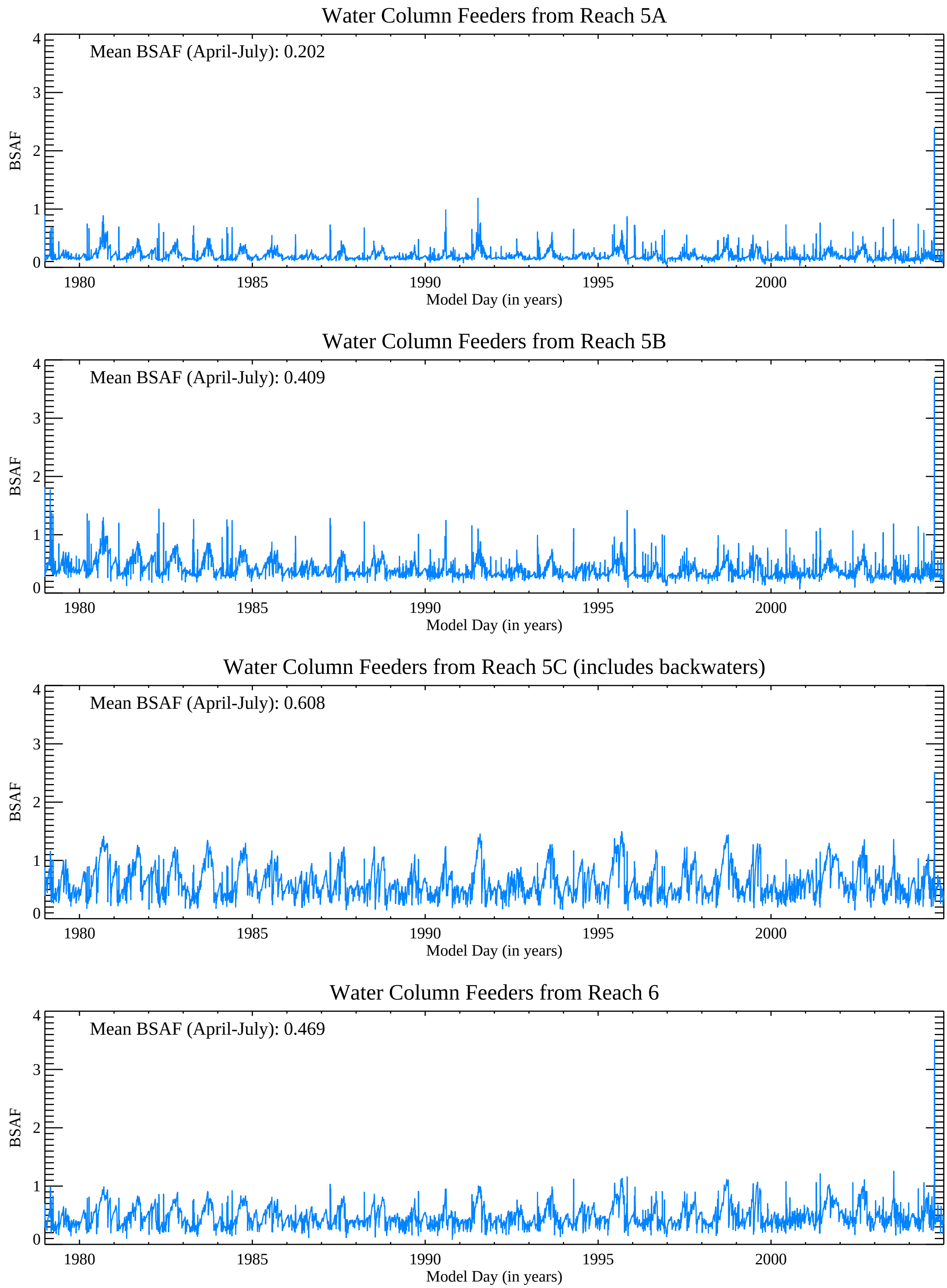

Figure D-1. Biota-Sediment Accumulation Factors Derived from Food Chain Model

Notes: Values for mean BSAF were calculated from all years (1979 to 2004) from days between Apr. 1st through July. 31st.

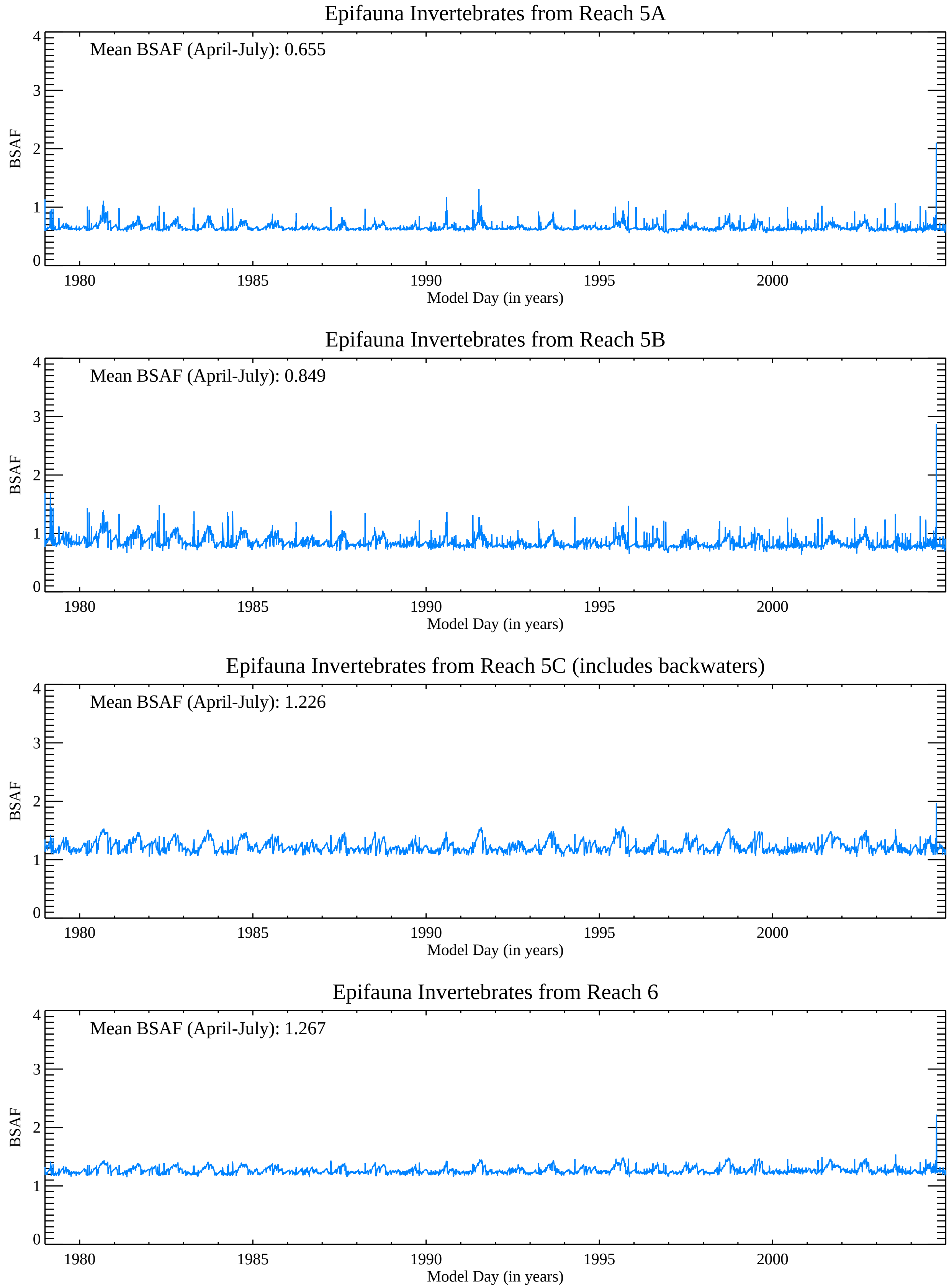

Figure D-2. Biota-Sediment Accumulation Factors Derived from Food Chain Model

Notes: Values for mean BSAF were calculated from all years (1979 to 2004) from days between Apr. 1st through July. 31st.

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Appendix E

Methodology for Developing Target Floodplain Soil PCB Concentrations Associated with the IMPGs for Mink

APPENDIX E

Methodology for Developing Target Floodplain Soil PCB Concentrations Associated with the IMPGs for Mink

1. Introduction

The Interim Media Protection Goals (IMPGs) approved by the U.S. Environmental Protection Agency (EPA) for piscivorous mammals (mink and otter) include a range of 0.984 to 2.43 milligrams per kilogram (mg/kg) for polychlorinated biphenyls (PCBs), applicable to the dietary items of those mammals (GE, 2006). These IMPGs were based on an assessment of potential risks to the American mink (*Mustela vison*), as described in EPA's Ecological Risk Assessment (ERA; EPA, 2004). EPA directed GE, in its conditional approval letter for the CMS Proposal, to use mink as the representative species for evaluating achievement of these IMPGs in the Corrective Measures Study (CMS). However, because the IMPGs apply to PCB concentrations in the tissue of the mink's prey, these IMPGs cannot be applied directly in the CMS, but need to be translated into media that are subject to evaluation in the CMS. This is complicated by the fact that the mink's prey consists of a highly diverse mixture of aquatic and terrestrial organisms. As a result, the total PCB concentration in the mink's diet is affected by sediment PCB concentrations and floodplain soil PCB concentrations, and the concentrations in one such medium will affect the allowable concentration in the other medium. In its conditional approval letter for the CMS Proposal, EPA directed GE to develop a methodology for determining target floodplain soil concentrations associated with the mink IMPGs based on a range of assumed sediment concentrations.

GE initially proposed such a methodology in the CMS Proposal Supplement (ARCADIS BBL and QEA, 2007b). In its July 11, 2007 conditional approval letter for that Supplement, EPA directed GE to make a number of changes in that methodology. After GE invoked dispute resolution on several of those directives, EPA modified some of its directives in a letter dated August 29, 2007. This Appendix describes the revised methodology that has been used, in accordance with EPA's July 11, 2007 conditional approval letter (as modified in its August 29, 2007 letter), to develop target floodplain soil levels associated with the IMPGs for mink.

To convert the dietary IMPG values into target floodplain soil concentrations, the first step was to select a range of target sediment PCB concentrations that fall within the range of other sediment IMPGs (e.g., based on human direct contact and other ecological receptors). The target sediment concentrations selected were 1, 3, and 5 mg/kg. Using these target sediment concentrations (i.e., assuming that the sediment concentrations are at these levels), the floodplain soil concentrations associated with achieving the high and low ends of the dietary IMPG range (rounded to 0.98 and 2.4 mg/kg) in mink prey were then calculated.

The underlying equations, assumptions, and results of this analysis are detailed below. The target PCB concentrations have been developed for the Housatonic River floodplain from data obtained in the Primary Study Area (PSA), which consists of subreaches 5A, 5B, 5C, and 6, as well as the backwaters in the lower part of Reach 5 (referred to as Reach 5D). Based on EPA's letter dated August 29, 2007, these subreaches have been combined into the following two averaging areas: Reach 5A/5B and Reach 5C/5D/6. Although GE considers that the habitat contained in these two areas is too small to support a local population of mink, GE has used this approach in accordance with EPA's directive. Consequently, separate target PCB soil concentrations protective of mink have been developed for these two averaging areas; these target concentrations vary depending on the assumed sediment PCB concentration in the same area. As further directed by EPA, the target soil concentrations conservatively assume that the mink forage exclusively within the defined Rest of River floodplain (i.e., the 1 mg/kg PCB isopleth), rather than also in areas outside that isopleth, even though foraging in tributaries and uncontaminated areas outside the isopleth is likely. The resulting target floodplain soil concentrations have been used in evaluating the ability of floodplain remedial alternatives to achieve the mink IMPGs in the PSA, and have also been used in making such evaluations on a screening-level basis for further downstream areas.

2. Derivation of Equation for Target Soil PCB Concentrations

The objective was to derive an equation that estimates target soil PCB concentrations protective of mink at a given target sediment PCB concentration. Such an equation must account for the uptake of PCBs by mink prey from both the river sediments and floodplain soils. The equation must subtract the PCB contribution of the aquatic prey items (based on target sediment levels of 1, 3, or 5 mg/kg) from the allowable PCB concentration in the total prey (based on the IMPGs) to determine the allowable concentration of PCBs from terrestrial prey items. The derivation of such an equation requires first quantifying the fraction of each prey item in the mink's diet and each item's associated PCB tissue concentrations to estimate the total PCB concentration in the prey.

The diet-based IMPG is related to PCB concentrations in the aquatic and terrestrial prey of mink as follows:

$$C_p = (P_i \times C_i) + (P_f \times C_f) + (P_a \times C_a) + (P_{ab} \times C_{ab}) + (P_{tb} \times C_{tb}) + (P_{am} \times C_{am}) + (P_{tm} \times C_{tm}) \qquad \text{Eqn. 1}$$

where

C_p = target PCB concentration in total mink prey, set equal to the EPA-approved IMPG values (mg PCBs/kg diet)

P_i= proportion of diet from aquatic invertebrates

P_f = proportion of diet from fish

P_a= proportion of diet from amphibians and reptiles

P_{ab}= proportion of diet from aquatic birds

P_{tb}= proportion of diet from terrestrial birds

P_{am}= proportion of diet from aquatic mammals

P_{tm}= proportion of diet from terrestrial mammals

C_i= PCB concentration in aquatic invertebrates (mg PCBs/kg invertebrate)

C_f = PCB concentration in fish (mg PCBs/kg fish)

C_a= PCB concentration in amphibians and reptiles (mg PCBs/kg amphibian/reptile)

C_{ab}= PCB concentration in aquatic birds (mg PCBs/kg bird)

C_{tb}= PCB concentration in terrestrial birds (mg PCBs/kg bird)

C_{am}= PCB concentration in aquatic mammals (mg PCBs/kg mammal)

C_{tm}= PCB concentration in terrestrial mammals (mg PCBs/kg mammal)

This equation is similar to the one used in Section 3.7 of the revised IMPG Proposal (GE, 2006), except that birds and mammals are split into aquatic and terrestrial components to account for the separate source of PCBs for these groups.

Having defined the relationship between the mink's total dietary exposure and the tissue concentrations in the individual prey items, it is necessary to define the relationships between the prey and the PCB concentrations in the sediments and soils to which they are exposed. For organisms exposed to sediment, multiplication factors (known as biota-sediment accumulation factors [BSAFs]) represent the relationship between the lipid-normalized concentration of PCBs in aquatic prey and the organic carbon (OC)-normalized concentration of PCBs in sediment (Ankley et al. 1992). Using aquatic invertebrate prey of the mink as an example, the BSAF is as follows:

$$BSAF_i = (C_i / LIPID_i) / (C_{sed} / FOC_{sed}) \qquad \text{Eqn. 2}$$

where

$BSAF_i$ = biota-sediment accumulation factor for aquatic invertebrates (kg OC/kg lipid)

C_i = PCB concentration in aquatic invertebrates (mg PCBs/kg invertebrate)

$LIPID_i$ = fraction of body weight in lipids for aquatic invertebrates (kg lipid/kg invertebrate)

C_{sed} = PCB concentration in sediment (mg PCBs/kg sediment)

FOC_{sed} = fraction of total organic carbon in sediment (kg total OC/kg sediment)

Solving Equation 2 for the PCB concentration in aquatic invertebrate prey, C_i, yields:

$$C_i = BSAF_i \times C_{sed} \times (LIPID_i / FOC_{sed}) \qquad \text{Eqn. 3}$$

For organisms exposed to soil, the relationship between the soil and tissue concentrations is usually described by bioaccumulation factors (BAFs) instead of BSAFs. BAFs are typically not based on lipid-normalized tissue and OC-normalized soil concentrations. Using terrestrial mammalian prey as an example, the BAF is calculated as follows:

$$BAF_{tm} = C_{tm} / C_{soil} \qquad \text{Eqn. 4}$$

where

BAF_{tm} = soil-to-terrestrial mammal bioaccumulation factor (kg soil/kg mammal)

C_{tm} = PCB concentration in terrestrial mammal tissue (mg PCBs/kg mammal)

C_{soil} = PCB concentration in floodplain soil (mg PCBs/kg soil)

Solving Equation 4 for concentration of PCBs in terrestrial mammalian prey yields

$$C_{tm} = BAF_{tm} \times C_{soil} \qquad \text{Eqn. 5}$$

After developing a relationship similar to Equation 3 for each aquatic prey item and a relationship similar to Equation 5 for each terrestrial prey item, all the sediment-prey and soil-prey relationships can be substituted into Equation 1 as follows:

C_p = [(P_i x $BSAF_i$ x C_{sed} x $LIPID_i$ /FOC_{sed}) + (P_f x $BSAF_f$ x C_{sed} x $LIPID_f$ /FOC_{sed}) + (P_a x $BSAF_a$ x C_{sed} x $LIPID_a$ /FOC_{sed}) + (P_{ab} x $BSAF_{ab}$ x C_{sed} x $LIPID_{ab}$ /FOC_{sed}) + (P_{tb} x BAF_{tb} x C_{soil}) + (P_{am} x $BSAF_{am}$ x C_{sed} x $LIPID_{am}$ /FOC_{sed}) + (P_{tm} x BAF_{tm} x C_{soil})] Eqn. 6

where

$BSAF_i$= biota-sediment accumulation factor for aquatic invertebrates (kg OC/kg lipid)

$BSAF_f$ = biota-sediment accumulation factor for fish (kg OC/kg lipid)

$BSAF_a$= biota-sediment accumulation factor for amphibians and reptiles (kg OC/kg lipid)

$BSAF_{ab}$= biota-sediment accumulation factor for aquatic birds (kg OC/kg lipid)

BAF_{tb}= bioaccumulation factor from soil for terrestrial birds (kg soil/kg birds)

$BSAF_{am}$= biota-sediment accumulation factor for aquatic mammals (kg OC/kg lipid)

BAF_{tm}= bioaccumulation factor from soil for terrestrial mammals (kg soil/kg mammal)

$LIPID_i$= lipid content of aquatic invertebrates (kg lipid/kg invertebrate)

$LIPID_f$ = lipid content of fish (kg lipid/kg fish)

$LIPID_a$= lipid content of amphibians and reptiles (kg lipid/kg amphibian/reptile)

$LIPID_{ab}$= lipid content of aquatic birds (kg lipid/kg bird)

$LIPID_{am}$= lipid content of aquatic mammals (kg lipid/kg mammal)

Solving Equation 6 for C_{soil} yields:

C_{soil} = {C_p – [(C_{sed} /FOC_{sed}) x [(P_i x $BSAF_i$ x $LIPID_i$) + (P_f x $BSAF_f$ x $LIPID_f$) + (P_a x $BSAF_a$ x $LIPID_a$) + (P_{ab} x $BSAF_{ab}$ x $LIPID_{ab}$) + (P_{am} x $BSAF_{am}$ x $LIPID_{am}$)]]} / [(P_{tb} x BAF_{tb}) + (P_{tm} xBAF_{tm})] Eqn. 7

However, this equation does not completely represent the relationship between the mink's dietary exposure and the sediment and soil concentrations of PCBs because aquatic birds in the mink's diet (mainly waterfowl) feed not only on aquatic invertebrates (as indicated in Equations 6 and 7) but also on terrestrial invertebrates (e.g., as shown for wood duck [*Aix sponsa*] in Vol. 5, Table G.2-33 of the ERA). To account for this, the total PCB concentration in the aquatic bird must be split into two components, one defined by uptake from sediments using a BSAF and one defined by uptake from soils using a BAF. It was assumed that the total concentration in the aquatic bird (C_{ab}) could be represented by the following equation:

$$C_{ab} = C_{aba} + C_{abt} \qquad \text{Eqn. 8}$$

where

C_{aba} = concentration of PCBs in aquatic birds that is derived from the aquatic portion of their diet (mg PCBs/kg bird)

C_{abt} = concentration of PCBs in aquatic birds that is derived from the terrestrial portion of their diet (mg PCBs/kg bird)

Data are unavailable for C_{aba} and C_{abt} in aquatic bird tissue, but these terms can be calculated if $BSAF_{ab}$ and BAF_{ab} are known; details on calculation of $BSAF_{ab}$ and BAF_{ab} and associated assumptions are described in Section E.3 (Input Data and Assumptions) below. Conceptually, C_{aba} and C_{abt} are equal to the proportion of the diet consisting of aquatic or terrestrial prey multiplied by the estimated concentration of PCBs in a theoretical aquatic bird feeding exclusively (100%) on aquatic or terrestrial prey items, respectively, as follows:

$$C_{aba} = P_{aba} \times C_{ab,100\%aquatic\ prey} \qquad \text{Eqn. 9}$$

$$C_{abt} = P_{abt} \times C_{ab,100\%terrestrial\ prey} \qquad \text{Eqn. 10}$$

where

P_{aba} = the proportion of the aquatic bird invertebrate diet consisting of aquatic invertebrates = 0.74

P_{abt} = the proportion of the aquatic bird invertebrate diet consisting of terrestrial invertebrates = 0.26

$C_{ab,100\%aquatic\ prey}$ = PCB concentration in aquatic bird feeding exclusively on aquatic prey

$C_{ab,100\%terrestrialprey}$ = PCB concentration in aquatic bird feeding exclusively on terrestrial prey

The proportions, P_{aba} and P_{abt}, were obtained from the diet of the wood duck (Table G.2-33 of the ERA), the species used to represent aquatic birds. The proportion of the wood duck's diet that is vegetation (24% during pre-egg laying period) was not included because it was assumed that PCB accumulation through that route is minimal compared to bioaccumulation from consumption of invertebrates.

Using the approach in Equation 3 for aquatic prey-derived PCB concentrations and Equation 5 for terrestrial prey-derived PCB concentrations, it follows that:

$C_{ab100\%aquatic\ prey} = BSAF_{ab}\ x\ C_{sed}\ x\ (LIPID_{ab}/FOC_{sed}$ Eqn. 11

$C_{ab100\%terrestrial\ prey} = BAF_{ab}\ x\ C_{soil}$ Eqn. 12

Substituting Equations 11 and 12 into Equations 9 and 10 yields:

$C_{aba} = P_{aba}\ x\ [BSAF_{ab}\ x\ C_{sed}\ x\ (LIPID_{ab}/FOC_{sed})]$ Eqn. 13

$C_{abt} = P_{abt}\ x\ [BAF_{ab}\ x\ C_{soil}]$ Eqn. 14

The aquatic bird PCB concentration, C_{ab}, can be calculated by substituting Equations 13 and 14 into Equation 8:

$C_{ab} = [P_{aba}\ x\ BSAF_{ab}\ x\ C_{sed}\ x\ (LIPID_{ab}/FOC_{sed})] + [P_{abt}\ x\ BAF_{ab}\ x\ C_{soil}]$ Eqn. 15

Finally, substituting Equation 15 for C_{ab} in Equation 1, followed by the derivation of Equations 6 and 7 using the same approach outlined previously, yields the final correct equation for calculating the target soil concentration (revised version of Equation 7):

$C_{soil} = \{C_p - (C_{sed}/FOC_{sed})\ x\ [(P_i\ x\ BSAF_i\ x\ LIPID_i) + (P_f\ x\ BSAF_f\ x\ LIPID_f) + (P_a\ x\ BSAF_a\ x\ LIPID_a) + (P_{ab}\ x\ P_{aba}\ x\ BSAF_{ab}\ x\ LIPID_{ab}) + (P_{am}\ x\ BSAF_{am}\ x\ LIPID_{am})]\} / [(P_{ab}\ x\ P_{abt}\ x\ BAF_{ab}) + (P_{tb}\ x\ BAF_{tb}) + (P_{tm}\ xBAF_{tm})]$ Eqn. 16

Equation 16 was used to calculate the target soil concentration associated with the high and low IMPG values of 0.98 and 2.4 mg/kg for the prey of mink, based on the following input data and assumptions regarding each of the equation's variables.

3. Input Data and Assumptions

Input values were selected based on site-specific data from the combined Reaches 5A/5B and 5C/5D/6, as presented in the ERA, the RCRA Facility Investigation Report (RFI Report; BBL and QEA, 2003), and supporting studies and datasets. In a few cases, where site-specific data were not available, data from another PCB river/floodplain site, the Kalamazoo River in Michigan, were used. The input values used in Equation 16 are listed in Table E-1, with more detailed supporting information provided in Tables E-2 through E-8. The input data and assumptions used to derive these values are described below.

Foraging Range of Mink

As directed by EPA, the method conservatively assumes that 100% of the foraging range of mink is contained within the 1 mg PCBs/kg soil isopleth, even though the percentage most likely is lower.

Acceptable PCB Concentration in Diet (C_p)

The target PCB concentrations in the mink diet were set equal to the high and low ends of the EPA-approved IMPG range, 0.98 and 2.4 mg/kg, as described in the revised IMPG Proposal (GE, 2006).

Dietary Composition (*P*)

As previously noted, the ERA indicated that the mink diet is diverse and includes aquatic invertebrates, fish, mammals, birds, and amphibians and reptiles. In addition, the mammal and bird portions of the diet include both aquatic and terrestrial species. Representative species for each of these prey groups were chosen to develop bioaccumulation factors. The species chosen were selected based on both known preferences in the mink diet and availability of data for those species, preferably in the PSA. For example, crayfish were selected to represent aquatic invertebrates because they are listed as the primary aquatic invertebrate in the mink diet for many studies (Table I-2.1 of the ERA) and because tissue data from the PSA were available. The short-tailed shrew (*Blarina brevicauda*) and white-footed mouse (*Peromyscus leucopus*) were selected to represent the terrestrial mammals in the diet. The wood duck represented the aquatic birds, and the house wren (*Troglodytes aedon*), black-capped chickadee (*Poecile atricapilla*), and American robin (*Turdus migratorius*) represented the terrestrial birds. The muskrat (*Ondatra zibethicus*) represented aquatic mammals. Tissue PCB concentration data were available from the PSA for each of those species except the muskrat. The muskrat was selected even though data from the PSA were not available because it is a primary aquatic mammal in the mink diet (based on volumetric data in Table I.2-2 of the ERA).

The assumed proportions of fish, mammals, birds, invertebrates, and amphibians and reptiles in the mink diet were derived from the values used in the ERA (Vol. 6, Table I.2-2). The further delineation of aquatic versus terrestrial birds and mammals was derived based on the mean percentages averaged across diet studies reported in Table I.2-1 of the ERA. The specific species and proportions of each dietary item were set as follows:

P_i – proportion of mink diet consisting of aquatic invertebrates (represented by crayfish) = 0.36

P_f – proportion of mink diet consisting of fish (represented by fish in the size class of 7 to 20 cm) = 0.23

P_a – proportion of mink diet consisting of amphibians and reptiles (represented by wood frogs, leopard frogs, and bullfrogs) = 0.15

P_{ab} – proportion of mink diet consisting of aquatic birds (represented by the wood duck) = 0.08[1]

P_{tb} – proportion of mink diet consisting of terrestrial birds (represented by chickadees, robins, and wrens) = 0.03

P_{am} – proportion of mink diet consisting of aquatic mammals (represented by the muskrat) = 0.07

P_{tm} – proportion of mink diet consisting of terrestrial mammals (represented by shrews and mice) = 0.08

Concentration in Sediment (C_{sed})

It was necessary to assume a range of target concentrations of sediment to calculate protective soil concentrations. For the purpose of this assessment, C_{sed} was fixed at 1, 3, and 5 mg/kg, and Equation 16 was solved for the corresponding C_{soil} values.

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[1] The proportion in the aquatic bird diet is further split into aquatic-feeding and terrestrial-feeding components.

Biota-Sediment Accumulation Factors (BSAFs)

BSAFs were calculated for each of the aquatic prey types represented in the mink's diet. For aquatic invertebrates, amphibians and reptiles, and aquatic mammals, BSAFs were calculated for each tissue sample in the database, which represented an individual animal, except for some frog samples. For some frog samples (i.e., all 7 wood frog tissue samples and for 8 of the 15 leopard frog samples in Table E-4), the tissue samples in the database represented tissue composites of more than one individual from the same pond. In accordance with EPA's letter of August 29, 2007, the higher of the median or geometric mean of the individual BSAFs was used to represent bioaccumulation for each of these prey types. In contrast, for the fish and aquatic birds, a single BSAF was calculated for each averaging area rather than using individual BSAFs. For fish, the food chain model (FCM) previously developed by EPA for the Rest of River (EPA, 2006) was used to calculate the BSAF. For aquatic birds, individual BSAFs were not used because of high overlap in home ranges of individual ducks and lack of information about specific feeding locations. Details on these methods and the derivation of BSAFs for each prey item are discussed below. In all analyses, half of the reported detection limit was used for non-detects of analytes.

$BSAF_i$ - The BSAF for aquatic invertebrates was based on BSAFs reported in the RFI Report (Figure 8.34 in that report). Those values were developed using PCB concentrations and lipid measurements in site-specific crayfish tissue. Concentrations of OC-normalized PCBs in river sediment (0 to 6 inches) were averaged by river mile and co-located with crayfish tissue concentrations to calculate individual BSAF values. The higher of the median or geometric mean of these individual BSAFs (Table E-2) for each averaging area (i.e., Reach 5A/5B and Reach 5C/5D/6) was used in the final target soil calculation.

$BSAF_f$ – The FCM developed by EPA for the Rest of River modeling (EPA, 2006) was used to calculate the $BSAF_f$. The FCM calculates PCB concentrations in fish of multiple trophic levels as a function of dissolved- and particulate-phase PCB exposure concentrations from sediment and the water column, and accounts for many factors, including the lipid content in fish and fraction of total organic carbon (FOC) in the sediments. Because mink feed frequently in backwater areas, PCBs and FOC in the backwater areas of each subreach were included when calculating predicted concentrations in the fish tissue for each averaging area. Fish sizes were limited to age classes that correspond to the sizes eaten by mink, 7 to 20 cm (as specified in the ERA). The fish species simulated by the FCM were averaged to produce a weighted composite mink exposure concentration based on an assumed mink fish diet of 2/3 predatory fish (largemouth bass in the model) and 1/3 bottom and forage fish (average of model results for brown bullhead, sunfish, white sucker, and cyprinids), based on Alexander (1977).

The calculation of the $BSAF_f$ with FCM involved several steps. Sediment PCB concentrations (specified on an OC-normalized basis) change daily in the FCM based on inputs from the PCB fate and transport model (EPA, 2006). Annual estimates of OC-normalized surface sediment (averaged over reach-specific exposure depths that were in the range of 3 to 6 inches) and lipid-normalized fish tissue concentrations in each subreach were calculated by averaging the daily modeled concentrations over the autumn period (when the majority of fish tissue data were collected) for each year of the 26-year model validation period (1979 through 2004). The autumn estimate was assumed to represent an annual estimate (a comparison of these two values indicated they were very similar). Each annual subreach estimate was combined into one value for each averaging area, weighting the average by subreach length. A regression line (with the intercept forced through zero) was fit through the resultant 26 annual estimates of lipid-normalized fish PCB concentrations and OC-normalized sediment PCB concentrations for each averaging area. The slope of each regression was used as the final $BSAF_f$ for each averaging area (Table E-3).

$BSAF_a$ – Each of the frog species assumed to represent the amphibian and reptile portion of the mink diet is potentially exposed to sediments and soils. However, for the purpose of this analysis, it was assumed that each frog's primary route of exposure was from aquatic sources. Site-specific tissue data for each of these frog species were compiled and paired with sediment data to derive individual BSAFs. The wood frog and leopard frog tissue samples were collected from discrete, small ponds, and the individual BSAFs for those species were developed by matching each individual (or composite) frog tissue concentration with the spatially weighted average surface sediment concentration (0 to 6 inches) in the pond from which that frog tissue sample was collected. For the bullfrogs (which were collected from the larger Woods Pond and from backwaters of the river), individual tissue concentrations were matched with the co-located or closest available surface (0- to 6-inch) sediment sample to derive individual BSAFs (Table E-4). For all bullfrogs and some individual leopard frogs, it was necessary to calculate the whole-body concentration from a tissue-mass weighted average of the concentrations reported for individual body parts (e.g., ovary, leg, and offal) before estimating the individual sample $BSAF_a$. The final BSAF for amphibians for each averaging area was the higher of the median or geometric mean of these individual BSAFs, after combining data for all three frog species from that area.

$BSAF_{ab}$ – Because measured aquatic bird PCB concentrations are a mixture of PCB uptake from terrestrial and aquatic sources, the derivation of the $BSAF_{ab}$ and the BAF_{ab} for aquatic birds differs from that used for the other species. The $BSAF_{ab}$ represents the bioaccumulation of PCBs by the wood duck based on consumption of only aquatic

invertebrates, whereas the BAF_{ab} represents the bioaccumulation by the wood duck based on consumption of only terrestrial invertebrates.

To calculate the $BSAF_{ab}$, first it was assumed that $BSAF_{ab}$ for the sediment equals the bioaccumulation factor for the soil (BAF_{ab}) when the BAF_{ab} is lipid- and OC-normalized in the same manner that the $BSAF_f$ was normalized. This requires multiplying the BAF_{ab} by $FOC_{soil}/LIPID_{ab}$ (see section on Bioaccumulation Factors for Soil, below, for the derivation of lipid- and OC-normalized BAF_{ab}). Thus, it is assumed that:

$$BSAF_{ab} = BAF_{ab} \times FOC_{soil}/LIPID_{ab} \qquad \text{Eqn. 17}$$

The justification for this assumption is that the dominant type of food was the same for both aquatic- and terrestrial-feeding waterfowl (invertebrates), and thus the relative bioaccumulation of PCBs in the bird should be similar in both aquatic and terrestrial habitats, as long as both bioaccumulation factors are normalized for lipid content and FOC. Also, this assumption was required to solve for $BSAF_{ab}$ because it reduces the number of unknown variables in Equation 18 below.

The equation used to calculate the $BSAF_{ab}$ for aquatic birds feeding on aquatic invertebrates was derived from the following equation, which is similar to Equation 15 except that lipid and FOC terms are added (that could cancel out) to create a lipid- and OC-normalized BAF_{ab}:

$$C_{ab} = [P_{aba} \times BSAF_{ab} \times C_{sed} \times (LIPID_{ab}/FOC_{sed})] + [P_{abt} \times (BAF_{ab} \times FOC_{soil}/LIPID_{ab}) \times C_{soil} \times LIPID_{ab}/FOC_{soil}] \qquad \text{Eqn. 18}$$

Based on the assumption in Equation 17, $BSAF_{ab}$ can be substituted for the lipid- and OC-normalized BAF_{ab} (BAF_{ab} x $FOC_{soil}/LIPID_{ab}$) in Equation 18 and factored out to yield:

$$C_{ab} = BSAF_{ab} \times \{[P_{aba} \times C_{sed} \times (LIPID_{ab}/FOC_{sed})] + [P_{abt} \times C_{soil} \times (LIPID_{ab}/FOC_{soil})]$$

Eqn. 19

Solving for $BSAF_{ab}$ in Equation 19 yields:

$$BSAF_{ab} = C_{ab}/\{LIPID_{ab} \times [(P_{aba} \times C_{sed}/FOC_{sed}) + (P_{abt} \times C_{soil}/FOC_{soil})]\} \qquad \text{Eqn. 20}$$

Data used to calculate the $BSAF_{ab}$ included: (1) the average PCB concentration (C_{ab}) and average lipid content of wood ducks ($LIPID_{ab}$) in Reaches 5 and 6; and (2) the spatially weighted average PCB (C_{sed}, C_{soil}) and FOC (FOC_{sed}, FOC_{soil}) concentrations in the sediment and soil (top 0-6 inches) in wood duck habitat in Reaches 5 and 6 (see Appendix B, Table B-4 of the CMS Proposal [ARCADIS BBL and QEA, 2007a] for total organic carbon [TOC] polygon data in sediment). It was assumed all of the river and its backwaters in these reaches were potential aquatic bird habitat and that suitable aquatic bird habitat in the floodplain excluded areas defined as unsuitable wood duck habitat on Figure 4-7 in Section 4.2.3.3 of the main Revised CMS Report (based on criteria defined by Woodlot Alternatives 2002). It is important to note that the tissue data for wood duck in the EPA database were identified by reach (i.e., Reaches 5 and 6), not by subreach (i.e., Reaches 5A, 5B, 5C, and 5D) (Table E-5); thus, it was not possible to calculate tissue concentrations associated with Reach 5A/5B versus Reach 5C/5D/6. In addition, it was not possible to co-locate tissue and sediment data other than by reach. Therefore, the available tissue and lipid data were averaged across each of the reaches, and the averages were paired with the average sediment data for each reach to derive a single $BSAF_{ab}$ for each reach. Accordingly, the BSAFs for this species reflect the relationship between the lipid-normalized average concentration in tissue and the OC-normalized average concentration in soils in Reach 5 (including 5C and 5D) and Reach 6, rather than the median or geometric mean of individual BSAFs. The resultant $BSAF_{ab}$ for Reach 5 was applied to Reach 5A/5B, and the $BSAF_{ab}$ for Reach 6 was applied to Reach 5C/5D/6. This reach adjustment provided an approximated aquatic bird BSAF (and BAF) and lipid content for each averaging area. In this connection, it should be noted that, in developing the PCB target soil concentrations, the FOC in the sediment for each averaging area was the same value for all species, including the aquatic bird (i.e., only one FOC value was used in Equation 16).

Because only duck breast and liver tissue data were available, the ERA presented three methods for estimating whole-body PCB tissue concentrations (Appendix I, Section I.2.1.5.3). For the purpose of this evaluation and to be consistent with whole-body data presented in Appendix L of the ERA, whole-body tissue concentrations were based on the assumption that the lipid-normalized PCB concentrations of the breast tissue are the same as the lipid-normalized concentrations of the offal.

$BSAF_{am}$ – Given the absence of site-specific data on aquatic mammals, the BSAF for aquatic mammals was derived from data collected for the Kalamazoo River, Michigan (Table E-6), in an area that has PCBs in sediments and floodplain soils (Kay et al. 2005). Individual BSAFs were calculated by pairing the tissue concentration of each muskrat trapped with the average sediment concentration (top 6 inches) of samples located within the muskrat foraging range (~ 300 m distance of the trapping location or, in the absence of data within 300 m, the closest sediment sample). The higher of the median or geometric mean of these individual BSAFs was used for both averaging areas.

Bioaccumulation Factors for Soil (BAFs)

BAFs, representing the ratio of the PCB concentration in tissue to the PCB concentration in soil, were calculated for each of the terrestrial-feeding taxonomic groups included in the mink's diet, specifically songbirds, small mammals, and terrestrial-feeding aquatic birds. Similar to the method used for the aquatic species, BAFs were derived for each individual terrestrial animal and then combined by taxonomic group for each averaging area to develop one BAF for each such group in each averaging area. Except for the aquatic birds, the median or geometric mean of the individual BAFs, whichever was higher, was used as the BAF for each prey component in each averaging area. A more detailed description of the methods used for each prey type is provided below.

BAF_{tb} - The bioaccumulation factor for adult terrestrial birds could not be calculated directly from site-specific data because PCB tissue concentrations in adults were unavailable. However, PCB concentrations in eggs were available for three species: American robins, house wrens, and black-capped chickadees. To estimate PCB concentrations in adults, an adult-to-egg ratio observed in house wrens from the Kalamazoo River (0.51; Neigh et al. 2006) was applied to the PCB estimates in eggs for the Housatonic River floodplain.

The house wren and black-capped chickadee eggs were obtained from tree swallow boxes in three main nest box locations described in the ERA. A buffer with a distance of 56 m (to approximate 1-hectare foraging areas) was placed around the cluster of nests in each of the three locations, and the spatially weighted average surface soil PCB concentrations (0 to 6 inches) were calculated for the soils within each of the three buffers. The estimated adult-tissue PCB concentrations developed from an egg in each nest found in each area were paired with the average soil PCB concentrations in the buffer (Table E-7) to develop individual BAFs. The robin eggs were collected from nests identified during a robin productivity study (Arcadis G&M 2002). To derive BAFs for robins, the tissue concentrations for these birds were paired with the average soil PCB concentration estimated from samples within 25 m of the nest (or with the PCB concentration in the closest soil sample if no soil samples were available within 25 m of the nest). To develop the final terrestrial bird BAF for each averaging area, the data for all three species were pooled (Table E-7), and the higher of the geometric mean or median value of the individual BAFs for that area was selected.

BAF_{tm} - The bioaccumulation factor for terrestrial mammals (BAF_{tm}) was based on site-specific tissue data for the short-tailed shrew and white-footed mouse and on spatially weighted surface-soil PCB concentrations (0 to 6 inches) within 35 m of the sampling location for each animal. Individual BAFs were calculated for each of the available tissue samples (Table E-8). To develop the final BAF for terrestrial mammals in each averaging area, the data for both species were combined and the higher of the geometric mean or median value of the individual BAFs for that area was selected.

BAF_{ab} - The calculation of the bioaccumulation factor for aquatic birds feeding on terrestrial prey (BAF_{ab}) differs from the calculation of BAFs for the other terrestrial species because the PCB concentration in the aquatic bird is a composite of PCBs coming from aquatic and terrestrial prey – unlike the PCB concentrations in terrestrial birds and mammals, which are assumed to bioaccumulate PCBs exclusively from terrestrial prey. Therefore, the PCB accumulation that comes from aquatic prey ($BSAF_{ab}$) must be accounted for before the BAF_{ab} can be calculated.

To derive BAF_{ab}, it was assumed that uptake of PCBs from terrestrial invertebrates by an aquatic bird is a process similar to that same bird's uptake of PCBs from aquatic invertebrates. Consequently, unlike the BAFs for the other terrestrial species, BAF_{ab} was assumed to be affected by the lipid content and soil FOC as follows:

$$\text{Lipid- and OC-normalized } BAF_{ab} = (C_{ab}/LIPID_{ab}) / (C_{soil} / FOC_{soil}) \qquad \text{Eqn. 21}$$

where

FOC_{soil} = fraction of total organic carbon in soil (kg total OC/kg soil)

Substituting the un-normalized BAF_{ab} for C_{ab}/C_{soil} (by definition $BAF_{ab} = C_{ab}/C_{soil}$ for an aquatic bird feeding 100% on terrestrial invertebrates) into Equation 21 yields:

$$\text{Lipid- and OC-normalized } BAF_{ab} = BAF_{ab} \times (FOC_{soil}/LIPID_{ab}) \qquad \text{Eqn. 22}$$

Based on the assumption stated previously that the $BSAF_{ab}$ equals the normalized BAF_{ab}

$$BSAF_{ab} = BAF_{ab} \times FOC_{soil}/LIPID_{ab} \qquad \text{Eqn. 23}$$

the un-normalized BAF_{ab} can be calculated after re-arranging Equation 23 as follows:

$$BAF_{ab} = BSAF_{ab} \times LIPID_{ab}/FOC_{soil} \qquad \text{Eqn. 24}$$

The un-normalized BAF_{ab} also can be calculated using the following equation:

$$BAF_{ab} = C_{abt}/(C_{soil} \times P_{abt}) \qquad \text{Eqn. 25}$$

This shows that the BAF_{ab} represents the bioaccumulation of PCBs into an aquatic bird feeding 100% on terrestrial food sources. In Equation 25, P_{abt} is the proportion of the bird diet that is terrestrial, which is required in the equation to mathematically increase the intake rate of terrestrial food from the actual partial rate to the theoretical rate of 100% of the diet.

As noted previously in the discussion of the $BSAF_{ab}$, the available wood duck tissue concentrations could not be separated by subreach; therefore, the BAFs for aquatic birds reflect the relationships between the reach-specific average PCB and lipid concentrations in tissue and the average PCB and FOC concentrations in soils across Reaches 5 (including 5C and 5D) and 6, rather than the median or geometric mean of individual BAFs. Areas containing unsuitable wood duck habitat (as shown on Figure 4-7 in Section 4.2.3.3 of the main Revised CMS Report, based on criteria defined by Woodlot Alternatives, 2002) were excluded from the calculation of the average soil PCB and FOC concentrations because the ducks would not feed in those areas. The resultant BAF for Reach 5 was applied to Reach 5A/5B and the BAF for Reach 6 was applied to Reach 5C/5D/6.

Lipid ($LIPID_i$, $LIPID_f$, $LIPID_a$, $LIPID_{ab}$, $LIPID_{am}$)

The lipid content of each aquatic prey species used in Equation 16 was derived by averaging the available tissue data across all individuals on which the BSAF calculations for an averaging area were based. The lipid data for each individual for each species are presented in Tables E-2 to E-6, except Table E-3, where an average from the FCM is reported.

Fraction Organic Carbon (FOC)

The estimate of the FOC in sediments that was used in Equation 16 was the spatially weighted average FOC value for surface sediments within Reaches 5A/5B and 5C/5D/6, including the mainstream of the river and its adjacent backwaters.

4. Results

Estimated target floodplain soil PCB concentrations associated with the upper and lower bounds of the mink IMPGs at the three target sediment PCB concentrations are presented in Table E-9 for each averaging area. In cases where the calculated value was negative, the target floodplain soil concentration is listed as "not achievable," indicating that, at that target sediment PCB concentration, the PCB contribution from aquatic prey alone would exceed the IMPG, and thus the IMPG cannot be attained regardless of the floodplain soil PCB concentration. For Reach 5A/5B, the estimated target floodplain soil PCB concentrations associated with the three target sediment concentrations range from not achievable to approximately 3.4 mg/kg for the low-end IMPG of 0.98 mg/kg and from not achievable to approximately 17 mg/kg for the high-end IMPG of 2.4 mg/kg, depending on the sediment concentration. For Reach 5C/5D/6, the target soil concentrations range from not achievable to approximately 7 mg/kg for the low-end IMPG and from approximately 12 mg/kg to 20 mg/kg for the high-end IMPG, depending on the sediment concentration.

Table E-9. Target Floodplain Soil PCB Concentrations Associated with Mink IMPG.

Target Sediment PCB Concentration (mg/kg)	Target Soil PCB Concentration (mg/kg) for IMPG = 0.98 mg/kg	Target Soil PCB Concentration (mg/kg) for IMPG = 2.4 mg/kg
Reach 5A/5B		
1	3.42	16.63
3	not achievable	5.12
5	not achievable	not achievable
Reach 5C/5D/6		
1	6.87	19.55
3	2.98	15.66
5	not achievable	11.78

5. Sensitivities, Uncertainties, and Conservatism in Model

The model used in these calculations is sensitive to changes in the BAFs and BSAFs. At low target sediment concentrations, the model output is more sensitive to estimates of the terrestrial BAFs than the aquatic BSAFs, particularly considering that tissue concentrations of PCBs in terrestrial birds and mammals are higher on average than for aquatic animals (Tables E-2 to E-8). However, at higher sediment concentrations, the aquatic animals, particularly the fish, have a stronger influence. The model is also sensitive to large changes in the sediment FOC, which varies greatly between the river and backwaters. For this reason, it was important to include the backwater habitat of the mink in the model. Uncertainty exists with the terrestrial passerine data, because only nest (eggs and chicks) data were available, and the proportionality factor that was multiplied by the egg PCB concentrations to obtain adult PCB concentrations was obtained from data from the Kalamazoo River floodplain (Neigh et al., 2006). Additionally, BSAFs for muskrat were based on data from the Kalamazoo River.

Use of the FCM to obtain fish tissue concentrations of PCBs has some limitations. First, for many of the fish species included in the analysis (e.g., sunfish), tissue concentrations are more closely correlated with PCB concentrations in the water column than with those in sediment. As a result, actual PCB concentrations in tissue samples from these species may be lower than those predicted by the linear relationship with sediment in the predictive model. Second, the range of sediment PCB concentrations in Reaches 5 and 6 for which the FCM was calibrated is much higher than the target sediment concentrations of 1 to 5 mg/kg. Supplemental analyses suggest the model could underestimate bottom-fish concentrations (e.g., suckers, bullheads) at low sediment concentrations by up to a factor of two. Third, the accuracy of the model in predicting fish tissue concentrations in the backwaters is unknown because no fish have been collected in those areas to compare to model results.

As noted above, the model assumes that mink forage exclusively within the 1 mg/kg PCB isopleth. In fact, however, very few mink likely forage entirely within that area without also foraging in tributaries and other areas outside the 1 mg/kg isopleth. Thus, this model is highly conservative.

6. References

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Table E-1 – Description of Variables in Equation 16, which Predicts Target Soil Concentrations Protective of Mink

Variable	Description (units in parentheses)	Value for Reach 5A/5B	Value for Reach 5C/5D/6	Basis
C_p	Target concentration of PCBs in prey (mg/kg)	0.98-2.4		IMPG Proposal
P_i	Proportion of mink diet comprised of aquatic invertebrates	0.36		ERA
P_f	Proportion of mink diet comprised of fish	0.23		ERA
P_a	Proportion of mink diet comprised of amphibians and reptiles	0.15		ERA
P_{ab}	Proportion of mink diet comprised of aquatic birds	0.08		Table I.1-2, ERA
P_{tb}	Proportion of mink diet comprised of terrestrial birds	0.03		Table I.1-2, ERA
P_{am}	Proportion of mink diet comprised of aquatic mammals	0.07		Table I.2-2, ERA
P_{tm}	Proportion of mink diet comprised of terrestrial mammals	0.08		Table I.2-2, ERA
P_{aba}	Proportion of aquatic bird diet comprised of aquatic prey	0.74		ERA
P_{abt}	Proportion of aquatic bird diet comprised of terrestrial prey	0.26		ERA
C_{sed}	Target concentrations of PCBs in sediment (mg/kg)	1,3,5		Range assumed
$BSAF_i$	Biota-sediment accumulation factor for aquatic invertebrates (kg organic carbon/kg lipid)	0.56	1.23	Table E-2
$BSAF_f$	Biota-sediment accumulation factor for fish (kg organic carbon/kg lipid)	1.32	1.33	Table E-3
$BSAF_a$	Biota-sediment accumulation factor for amphibians and reptiles (kg organic carbon/kg lipid)	0.55	2.36	Table E-4
$BSAF_{ab}$	Biota-sediment accumulation factor for aquatic birds feeding on aquatic prey (kg organic carbon/kg lipid)	1.72	0.318	Table E-5
$BSAF_{am}$	Biota-sediment accumulation factor for aquatic mammals (kg organic carbon/kg lipid)	0.57		Table E-6
BAF_{tb}	Bioaccumulation factor from soil for terrestrial birds (kg soil/kg bird)	2.43	1.13	Table E-7
BAF_{tm}	Bioaccumulation factor from soil for terrestrial mammals (kg soil/kg bird)	0.339	0.918	Table E-8
BAF_{ab}	Bioaccumulation factor from soil for aquatic birds feeding on terrestrial prey (kg soil/kg bird)	0.348	0.208	Table E-5
$LIPID_i$	Proportion of lipids in invertebrates	0.011	0.009	Table E-2
$LIPID_f$	Proportion of lipids in fish	0.030	0.030	Table E-3
$LIPID_a$	Proportion of lipids in amphibians and reptiles	0.017	0.011	Table E-4
$LIPID_{ab}$	Proportion of lipids in aquatic birds	0.017	0.062	Table E-5
$LIPID_{am}$	Proportion of lipids in aquatic mammals	0.024		Table E-6
FOC_{sed}	Fraction of organic carbon in sediment (kg total carbon/kg sediment)	0.025	0.089	Spatially-weighted value for averaging areas

Note:

1. Values are unitless unless specified.

Table E-2 – Data Used to Calculate $BSAF_i$ and Average Lipid Content of Aquatic Invertebrates (Crayfish)

Field Sample ID	River Mile	Tissue PCB (mg/kg)	Lipid Fraction	Sediment PCB (mg /kg OC)	Individual $BSAF_i$
Reach 5A/5B					
H3-TD05OVWB-F002	132.07	40.35	0.019	3567	0.60
H3-TD05OVWB-M023	132.07	9.94	0.004	3567	0.70
H3-TD05OVWB-M022	132.07	52.14	0.011	3567	1.33
H3-TD05OVWB-M021	132.07	9.42	0.009	3567	0.29
H3-TD05OVWB-M020	132.07	8.08	0.008	3567	0.28
H3-TD05OVWB-M014	132.07	15.93	0.01	3567	0.45
H3-TD05OVWB-M008	132.07	13.12	0.008	3567	0.46
H3-TD05OVWB-M007	132.07	21.85	0.014	3567	0.44
H3-TD05OVWB-M001	132.07	20.09	0.011	3567	0.51
H3-TD05OVWB-F005	132.07	25.79	0.028	3567	0.26
H3-TD07OVWB-F002	130.07	31.59	0.02	1708	0.92
H3-TD07OVWB-M001	130.07	6.63	0.007	1708	0.55
H3-TD07OVWB-M003	130.07	4.35	0.002	1708	1.27
H3-TD07OVWB-M004	130.07	9.67	0.014	1708	0.40
H3-TD07OVWB-M006	130.07	14.84	0.012	1708	0.72
H3-TD07OVWB-M007	130.07	20.40	0.012	1708	1.00
H3-TD07OVWB-M008	130.07	7.40	0.014	1708	0.31
H3-TD07OVWB-M011	130.07	13.67	0.008	1708	1.00
H3-TD07OVWB-M014	130.07	6.81	0.008	1708	0.50
H3-TD07OVWB-M021	130.07	7.47	0.008	1708	0.55
H3-TD11OVWB-F004	126.07	7.22	0.014	1127	0.46
H3-TD11OVWB-F013	126.07	7.51	0.015	1127	0.44
H3-TD11OVWB-F023	126.07	8.08	0.012	1127	0.60
H3-TD11OVWB-F026	126.07	12.68	0.013	1127	0.87
H3-TD11OVWB-F027	126.07	14.73	0.018	1127	0.73
H3-TD11OVWB-M001	126.07	8.64	0.003	1127	2.56
H3-TD11OVWB-M003	126.07	6.83	0.006	1127	1.01
H3-TD11OVWB-M005	126.07	8.21	0.006	1127	1.21
H3-TD11OVWB-M014	126.07	2.59	0.004	1127	0.57
H3-TD11OVWB-M024	126.07	5.75	0.007	1127	0.73
Reach 5C/5D/6					
H3-TD12OVWB-M018	125.07	5.45	0.005	602	1.81
H3-TD12OVWB-M017	125.07	5.65	0.005	602	1.88
H3-TD12OVWB-M015	125.07	5.98	0.008	602	1.24
H3-TD12OVWB-M014	125.07	3.95	0.004	602	1.64
H3-TD12OVWB-M013	125.07	8.51	0.007	602	2.02
H3-TD12OVWB-M011	125.07	6.63	0.008	602	1.38
H3-TD12OVWB-M010	125.07	4.59	0.003	602	2.54
H3-TD12OVWB-F009	125.07	15.84	0.020	602	1.32
H3-TD12OVWB-F007	125.07	6.74	0.009	602	1.25
H3-TD12OVWB-F006	125.07	4.64	0.007	602	1.10

Notes:

1. Data from RFI Report (BBL and QEA, 2003)
2. The average tissue PCB concentration for Reach 5A/5B is 16.98 mg /kg and for Reach 5C/5D/6 is 7.51 mg/kg.
3. The geometric mean of the individual BSAFs is 0.56 in Reach 5A/5B and 1.12 in Reach 5C/5D/6. The median of individual BSAFs is 0.53 in Reach 5A/5B and 1.23 in Reach 5C/5D/6. The higher of the geometric mean or median for the averaging area was used as $BSAF_i$ in the target soil equation (see Table E-1).

Table E-3 – Fish PCB Tissue Concentration, Lipid Fraction, and $BSAF_f$ Predicted from the Food Chain Model (FCM)

Tissue PCB (mg/kg)	Lipid fraction	Sediment PCB (mg/kg)	Sediment FOC	$BSAF_f$
Reach 5A/5B				
33.5	0.030	12.1	0.025	1.32
Reach 5C/5D/6				
39.7	0.030	23.2	0.089	1.33

Note:

1. $BSAF_f$ was derived from the slope of regressions of lipid-normalized PCB concentrations against OC-normalized sediment PCB concentrations obtained from 26 years of estimates produced by the FCM as described in Section E.3. Other data shown are averages of 26 years of inputs and outputs from the FCM.

Table E-4 – Data Used to Calculate $BSAF_a$ and Average Lipid Content of Amphibians

Field Sample ID	Location (Pond ID or State Plane coordinates)	Tissue PCB (mg/kg)	Lipid Fraction	Sediment PCB (mg/kg)	Sediment FOC	Individual $BSAF_a$
Leopard Frog						
Reach 5A/5B						
H3-TO04RP32-0-F003*	W-9A	2.96	0.030	7.5	0.0169	0.22
H3-TA03RP31-0-F001*	E-5	1.31	0.006	19.6	0.0492	0.55
H3-TA04RP32-0-C001	W-9A	3.59	0.016	7.5	0.0169	0.51
H3-TA04RP33-0-C001	W-8	5.39	0.016	43.5	0.0938	0.73
H3-TO04RP32-0-F006*	W-9A	1.18	0.004	7.5	0.0169	0.69
H3-TO08RP35-0-F003*	W-6	0.81	0.019	21.0	0.0505	0.10
H3-TA08RP35-0-C001	W-6	1.76	0.013	21.0	0.0505	0.32
H3-TA08RP34-0-C001	W-7A	2.11	0.019	27.6	0.0492	0.20
H3-TO08RP34-0-F005*	W-7A	0.53	0.018	27.6	0.0492	0.05
H3-TO08RP34-0-F006*	W-7A	7.74	0.015	27.6	0.0492	0.94
Reach 5C/5D/6						
H3-TO12RP39-0-F008*	W-1	0.04	0.007	0.4	0.2630	3.29
H3-TA12RP39-0-C001	W-1	0.15	0.004	0.4	0.2630	25.38
H3-TA10RP36-0-C001	W-4	0.34	0.010	0.4	0.0670	5.75
H3-TA12RP38-0-C001	E-1	3.09	0.013	26.6	0.1110	0.99
H3-TO12RP39-0-F001*	W-1	0.05	0.014	0.4	0.2630	2.23
Wood Frog						
Reach 5A/5B						
H3-TA04RS27-0-C001	18-VP-2	2.92	0.039	4.9	0.0476	0.73
H3-TA05RS28-0-C001	23B-VP-1	0.30	0.018	0.2	0.0763	6.14
H3-TA05RS29-0-C001	23B-VP-2	1.22	0.020	0.3	0.0887	17.98
H3-TA08RS30-0-C001	38-VP-1	1.60	0.008	28.5	0.0023	0.02
H3-TA08RS21-0-C001	38-VP-2	5.34	0.011	32.3	0.0919	1.38
Reach 5C/5D/6						
H3-TA08RS32-0-C001	46-VP-1	0.13	0.015	0.8	0.1196	1.38
H3-TA10RS22-0-C001	46-VP-5	0.59	0.010	1.4	0.0303	1.32
Bullfrog						
Reach 5C/5D/6						
H3-TA12BFTO-0-M004*	56693N,902875E	7.25	0.009	6.1	0.0078	1.05
H3-TA12BFTO-0-M001*	56644N,902903E	6.13	0.011	16.4	0.1031	3.63
H3-TA12BFTO-0-F002*	56634N,903109E	3.48	0.011	2.9	0.0713	7.87
H3-TA12BFTO-0-F003*	56659N,903175E	5.09	0.011	79.2	0.1274	0.78
H3-TA12BFTO-0-F009*	56598N,903768E	5.37	0.018	39.7	0.2671	2.04
H3-TA12BFTO-0-M011*	56557N,903833E	7.56	0.012	0.4	0.0199	28.19
H3-TA12BFTO-0-M010*	56611N,903445E	9.22	0.010	6.7	0.0339	4.82
H3-TA12BFTO-0-M007*	56729N,903326E	2.44	0.006	10.6	0.0295	1.10
H3-TA12BFTO-0-F005*	56675N,903040E	4.49	0.008	68.6	0.0536	0.46
H3-TA12BFTO-0-F008*	56557N,902085E	4.25	0.011	0.4	0.0260	28.81
H4-TA13BFTO-0-M004*	56584N,901272E	6.01	0.007	0.5	0.0254	44.06
H4-TA13BFTO-0-F001*	56576N,901644E	4.27	0.011	54.0	0.0798	0.57
H4-TA13BFTO-0-M003*	56576N,901664E	5.55	0.008	40.0	0.0559	0.99
H4-TA13BFTO-0-M002*	56543N,901693E	5.25	0.007	76.0	0.0820	0.83
H4-TA13BFTO-0-F006*	56751N,901711E	1.48	0.007	205.0	0.1447	0.15
H4-TA13BFTO-0-M011*	56353N,901531E	3.04	0.005	37.9	0.1100	1.62
H4-TA13BFTO-0-F009*	56370N,901448E	3.89	0.016	70.3	0.0751	0.25
H4-TA13BFTO-0-M010*	56254N,901251E	4.35	0.022	11.8	0.0836	1.42
H4-TA13BFTO-0-M008*	56558N,901321E	5.45	0.018	0.5	0.0252	15.65

Notes:

1. * Estimated whole-body PCB and lipid concentrations came from two body part samples of one frog (ovary + offal for leopard frog and leg + offal for bullfrog). All other samples are whole-body composites of more than one individual. For reconstituted whole body samples, field sample ID shown is chain of custody ID for offal. Data are from EPA database for ERA.
2. Sediment PCB and FOC data are spatially weighted by pond for all but bullfrogs (many bullfrogs were from Woods Pond and large backwaters). PCB and FOC values for bullfrogs came from the co-located or nearest sediment sample.
3. The average tissue PCB concentration for Reach 5A/5B is 2.58 mg/kg and 3.81 mg/kg for Reach 5C/5D/6.
4. The geometric mean of the individual BSAFs is 0.48 in Reach 5A/5B and 2.36 in Reach 5C/5D/6. The median of individual BSAFs is 0.55 in Reach5A/5B and 1.52 in Reach 5C/5D/6. The higher of the geometric mean or median for the averaging area was used as $BSAF_a$ in the soil target equation (see Table E-1).

Table E-5 – Data Used to Calculate the $BSAF_{ab}$, BAF_{ab} and Average Lipid Content of Aquatic Birds (Wood Duck)

Appendix L Location ID	Tissue PCB (mg/kg)	Lipid Fraction	Sediment Spatially-Weighted PCB (mg/kg)	Sediment Spatially-Weighted FOC	Soil Spatially-Weighted PCB (mg/kg)	Soil Spatially-Weighted FOC	$BSAF_{ab}$	BAF_{ab}
Reach 5								
TS002	5.12	0.014	17.1	0.064	17.58	0.084		
TS004	7.16	0.010	17.1	0.064	17.58	0.084		
TS005	6.81	0.008	17.1	0.064	17.58	0.084		
TS007	6.87	0.007	17.1	0.064	17.58	0.084		
TS008	11.16	0.024	17.1	0.064	17.58	0.084		
TS003	4.79	0.024	17.1	0.064	17.58	0.084		
TS001	12.26	0.024	17.1	0.064	17.58	0.084		
TS006	4.87	0.025	17.1	0.064	17.58	0.084		
Average	7.38	0.017	17.1	0.064	17.58	0.084	1.72	0.348
Reach 6								
TS044	1.04	0.023	28.4	0.083	25.04	0.095		
TS039	3.18	0.092	28.4	0.083	25.04	0.095		
TS037	6.09	0.053	28.4	0.083	25.04	0.095		
TS038	17.51	0.073	28.4	0.083	25.04	0.095		
TS041	10.38	0.071	28.4	0.083	25.04	0.095		
TS042	8.70	0.089	28.4	0.083	25.04	0.095		
TS040	5.81	0.131	28.4	0.083	25.04	0.095		
TS010	5.28	0.003	28.4	0.083	25.04	0.095		
TS009	3.89	0.003	28.4	0.083	25.04	0.095		
TS036	3.05	0.044	28.4	0.083	25.04	0.095		
TS043	3.62	0.161	28.4	0.083	25.04	0.095		
TS011	7.75	0.003	28.4	0.083	25.04	0.095		
Average	6.36	0.062	28.4	0.083	25.04	0.095	0.318	0.208

Notes:

1. Data are from EPA database for ERA, which only identifies location for tissue samples as Reach 5 or 6. Thus, for aquatic birds only, the BSAF and the BAF were each calculated for Reach 5 and Reach 6, instead of for reach 5A/5B and 5C/5D/6.
2. Reconstituted whole body lipid and PCBs are from GC (gas chromatograph) values in Appendix L in ERA.
3. The estimate of FOC and PCBs in soil and sediment for each tissue sample is the spatially weighted average for Reach 5 or 6 (excluding unsuitable duck habitat for floodplain soil) and assumes each duck has a large foraging area that encompasses the entire reach.
4. BSAFs for individual ducks were not calculated but rather an average $BSAF_{ab}$ was calculated by entering the average concentration of tissue PCBs (C_{ab}) and lipids ($LIPID_{ab}$) and sediment PCBs (C_{sed}) and FOC (FOC_{sed}) for each reach into the equation: $BSAF_{ab} = C_{ab} / \{LIPID_{ab} \times [(P_{aba} \times C_{sed} / FOC_{sed}) + (P_{abt} \times C_{soil} / FOC_{soil})]\}$. BAF_{ab} was calculated by entering the average concentration of tissue PCBs (C_{ab}) and lipids ($LIPID_{ab}$) and soil PCBs (C_{soil}) and FOC (FOC_{soil}) for each reach into the equation: $BAF_{ab} = BSAF \times (LIPID_{ab} / FOC_{soil})$. See text for derivation of equations.
5. The PCB concentration in duck tissue from aquatic prey (C_{aba}) in Reach 5 averaged 5.79 mg/kg (calculated using equation 13 in text) and from terrestrial prey (C_{abt}) averaged 1.59 mg/kg (calculated using equation 14 in text), which sums to the measured average PCB concentration in the tissue (C_{ab}) of 7.38 mg/kg. Similarly for Reach 6, the PCB concentration from aquatic prey averaged 4.99 mg/kg and from terrestrial prey averaged 1.37 mg/kg, which sums to the measured average PCB concentration (C_{ab}) in the tissue of 6.36 mg/kg.

Table E-6 – Kalamazoo River Data (Trowbridge Area) Used to Calculate the $BSAF_{am}$ and Average Lipid Content of Aquatic Mammals (Muskrat)

Field Sample ID	Tissue PCB (mg/kg)	Lipid Fraction	Sediment Average PCB (mg/kg)	Sediment Average FOC	Individual $BSAF_{am}$
MT0018	0.082	0.020	2.177	0.055	0.10
MT0020	0.036	0.007	2.502	0.069	0.14
MT0021	0.059	0.026	0.011	0.057	11.48
MT0024	0.076	0.019	2.177	0.055	0.10
MT0025	0.014	0.013	2.502	0.069	0.03
MT0026	0.112	0.044	0.017	0.057	8.62
MT0027	0.079	0.043	0.017	0.039	4.24

Notes:

1. Data are from Kalamazoo River PCB database.
2. The geometric mean of the individual BSAFs is 0.14. The median of individual BSAFs is 0.57. The higher of the geometric mean or median was used as $BSAF_{tm}$ for both averaging areas when applied to the target soil equation (see Table E-1).

Table E-7 – Data Used to Calculate the BAF_{tb} for Terrestrial Birds

Field Sample ID	Location (Site or State Plane Coordinate)	Egg Tissue PCB (mg/kg)	Estimated Adult Tissue PCB (mg/kg) [2]	Soil Average PCB (mg/kg)[3]	Individual BAF_{tb}
House Wren					
Reach 5A/5B					
MCM812-E	Canoe Meadows	57.57	29.36	13.8	2.13
MCM815-E	Canoe Meadows	149.44	76.21	13.8	5.52
MCM828-E	Canoe Meadows	45.94	23.43	13.8	1.70
MCM809-E	Canoe Meadows	63.16	32.21	13.8	2.33
MCM816-E	Canoe Meadows	43.30	22.08	13.8	1.60
Black-Capped Chickadee					
Reach 5A/5B					
MCM830-E	Canoe Meadows	17.58	8.97	13.8	0.65
MLR881-P	New Lennox Road	18.18	9.27	24.2	0.38
Reach 5C/5D/6					
MRB842-P	Roaring Brook Road	24.98	12.74	27.6	0.46
American Robin					
Reach 5A/5B					
043-E	56295N, 905724E	162.00	82.62	37.8	2.19
069-E	56261N, 905926E	51.40	26.21	15.0	1.75
009-E	56261N, 905956E	37.50	19.13	0.4	49.80
108-E	56412N, 905970E	86.30	44.01	10.0	4.40
056-E	56497N, 906053E	103.00	52.53	17.0	3.09
110-E	56434N, 906115E	170.00	86.70	40.8	2.13
Reach 5C/5D/6					
022-E	56354N, 903376E	6.70	3.42	0.7	4.88
023-E	56539N, 903474E	18.40	9.38	49.0	0.19
012-E	56215N, 904242E	7.38	3.76	3.7	1.03
049-E	56487N, 905410E	150.00	76.50	18.4	4.16

Notes:

1. Wren and chickadee data from EPA database for ERA. Robin tissue data from GE database for robin productivity study (ARCADIS G&M, Inc., 2002).
2. Soil data were spatially-weighted for wrens and chickadees**.**
3. The estimated average tissue PCB concentration for adult tissue in Reach 5A/5B is 39.44 mg/kg and for Reach 5C/5D/6 is 18.06 mg/kg (assuming adult concentrations are 0.51 of egg concentrations, Neigh et al., 2006).
4. The geometric mean of the individual BAFs is 2.43 in Reach 5A/5B and 1.13 in Reach 5C/5D/6. The median of individual BAFs is 2.13 in Reach 5A/5B and 1.03 in Reach 5C/5D/6. The higher of the geometric mean or median for the averaging area was used as BAF_{tb} in the target soil equation (see Table E-1).

Table E-8 – Data Used to Calculate the BAF_{tm} for Terrestrial Mammals

Field Sample ID	Location (State Plane coordinates)	Tissue PCB (mg/kg)	Soil Spatially-Weighted Average PCB (mg/kg)	Individual BAF_{tm}
Short-Tailed Shrew				
Reach 5A/5B				
H3-TM05SS13-0-F001	57072N, 909134E	135.77	26.07	5.21
H3-TM05SS13-0-F002	57061N, 909173E	102.25	28.78	3.55
H3-TM05SS13-0-F003	57024N, 909166E	59.41	37.65	1.58
H3-TM05SS13-0-F004	57090N, 909185E	93.37	24.60	3.80
H3-TM05SS13-0-M001	57099N, 909188E	127.60	23.56	5.42
H3-TM05SS13-0-M002	57099N, 909188E	91.93	23.56	3.90
H3-TM05SS13-0-M003	57064N, 909172E	139.27	28.32	4.92
H3-TM05SS13-0-M004	57039N, 909168E	117.67	32.59	3.61
H3-TM05SS13-0-M005	57057N, 909172E	131.95	29.23	4.51
H3-TM05SS13-0-M006	57087N, 909183E	130.78	24.98	5.24
H3-TM07SS14-0-F001	56803N, 907074E	19.82	36.58	0.54
H3-TM07SS14-0-F002	56802N, 907070E	87.13	37.38	2.33
H3-TM07SS14-0-F004	56802N, 907084E	80.15	33.92	2.36
H3-TM07SS14-0-F005	56848N, 907068E	49.47	31.36	1.58
H3-TM07SS14-0-F009	56797N, 907087E	80.46	33.05	2.43
H3-TM07SS14-0-M001	56810N, 907079E	147.93	35.24	4.20
H3-TM07SS14-0-M003	56802N, 907070E	54.40	37.38	1.46
H3-TM07SS14-0-M004	56769N, 907014E	14.81	27.98	0.53
H3-TM07SS14-0-M005	56807N, 907083E	99.47	34.33	2.90
H3-TM07SS14-0-M006	56821N, 907076E	85.54	35.47	2.41
Reach 5C/5D/6				
H3-TM15SS15-0-F001	56256N, 904032E	7.45	1.25	5.94
H3-TM15SS15-0-F002	56294N, 904065E	4.45	1.27	3.52
H3-TM15SS15-0-M001	56322N, 904094E	5.46	1.12	4.88
H3-TM15SS15-0-M002	56297N, 904140E	10.68	0.71	15.13
White-Footed Mouse				
Reach 5A/5B				
H3-TM05WO13-0-F001	57035N, 909232E	19.98	28.43	0.70
H3-TM05WO13-0-F002	57005N, 909160E	2.44	45.27	0.05
H3-TM05WO13-0-F003	57031N, 909167E	10.10	35.62	0.28
H3-TM05WO13-0-F004	57106N, 909191E	27.39	23.14	1.18
H3-TM05WO13-0-F005	57030N, 909254E	12.43	24.56	0.51
H3-TM05WO13-0-F006	57010N, 909161E	1.63	42.92	0.04
H3-TM05WO13-0-F007	57080N, 909180E	1.92	25.92	0.07
H3-TM05WO13-0-F008	57065N, 909164E	2.10	27.86	0.08
H3-TM05WO13-0-F009	57043N, 909168E	2.15	31.60	0.07
H3-TM05WO13-0-F010	56999N, 909158E	2.00	47.47	0.04
H3-TM05WO13-0-M001	57029N, 909260E	6.02	23.37	0.26
H3-TM05WO13-0-M002	57031N, 909251E	6.76	25.14	0.27
H3-TM05WO13-0-M003	57043N, 909168E	15.38	31.60	0.49
H3-TM05WO13-0-M004	57070N, 909148E	2.38	26.50	0.09
H3-TM05WO13-0-M005	57031N, 909251E	15.98	25.14	0.64
H3-TM05WO13-0-M007	57106N, 909191E	4.50	23.14	0.19
H3-TM05WO13-0-M008	57072N, 909134E	2.42	26.07	0.09
H3-TM05WO13-0-M009	57031N, 909251E	7.94	25.14	0.32
H3-TM05WO13-0-M011	57019N, 909164E	3.61	39.48	0.09
H3-TM05WO13-0-M012	57067N, 909157E	16.72	27.35	0.61
H3-TM07WO14-0-F002	56860N, 907064E	5.56	33.48	0.17
H3-TM07WO14-0-F003	56769N, 907014E	3.72	27.98	0.13

Field Sample ID	Location (State Plane coordinates)	Tissue PCB (mg/kg)	Soil Spatially-Weighted Average PCB (mg/kg)	Individual BAF_{tm}
H3-TM07WO14-0-F004	56812N, 907080E	34.98	35.13	1.00
H3-TM07WO14-0-F005	56764N, 907002E	3.94	20.83	0.19
H3-TM07WO14-0-F007	56830N, 907068E	4.64	35.50	0.13
H3-TM07WO14-0-F010	56808N, 907078E	2.49	35.54	0.07
H3-TM07WO14-0-F011	56794N, 907089E	1.13	32.72	0.03
H3-TM07WO14-0-F013	56830N, 907068E	1.03	35.50	0.03
H3-TM07WO14-0-F014	56803N, 907074E	1.07	36.58	0.03
H3-TM07WO14-0-F018	56860N, 907022E	5.33	50.35	0.11
H3-TM07WO14-0-M003	56846N, 907069E	0.15	31.38	0.00
H3-TM07WO14-0-M004	56920N, 907017E	5.60	34.62	0.16
H3-TM07WO14-0-M005	56846N, 907069E	2.17	31.38	0.07
H3-TM07WO14-0-M006	56821N, 907076E	1.72	35.47	0.05
H3-TM07WO14-0-M007	56921N, 907014E	8.78	33.27	0.26
H3-TM07WO14-0-M009	56800N, 907062E	2.36	38.73	0.06
H3-TM07WO14-0-M010	56851N, 907069E	1.62	31.09	0.05
H3-TM07WO14-0-M011	56855N, 907015E	3.19	52.80	0.06
H3-TM07WO14-0-M017	56906N, 907036E	1.51	40.28	0.04
H3-TM07WO14-0-M018	56765N, 907004E	4.02	22.16	0.18
Reach 5C/5D/6				
H3-TM15WO15-0-F001	56300N, 904144E	0.35	0.69	0.51
H3-TM15WO15-0-F002	56320N, 904088E	0.45	1.18	0.38
H3-TM15WO15-0-F003	56291N, 904155E	1.01	0.66	1.53
H3-TM15WO15-0-F004	56342N, 904064E	0.54	1.96	0.27
H3-TM15WO15-0-F005	56339N, 904064E	0.19	1.97	0.10
H3-TM15WO15-0-F006	56272N, 904045E	0.40	1.33	0.30
H3-TM15WO15-0-M001	56256N, 904032E	1.81	1.25	1.44
H3-TM15WO15-0-M002	56297N, 904140E	0.61	0.71	0.86
H3-TM15WO15-0-M003	56291N, 904155E	0.44	0.66	0.67
H3-TM15WO15-0-M004	56287N, 904059E	0.21	1.29	0.16
H3-TM15WO15-0-M005	56333N, 904075E	1.61	1.73	0.93
H3-TM15WO15-0-M006	56305N, 904136E	0.38	0.71	0.54

Notes:

1. Data from EPA database for ERA.
2. The average tissue PCB concentration for Reach 5A/5B is 35.13 mg/kg and for Reach 5C/5D/6 is 2.25 mg /kg.
3. The geometric mean of the individual BAFs is 0.34 in Reach 5A/5B and 0.92 in Reach 5C/5D/6. The median of individual BAFs is 0.27 in Reach 5A/5B and 0.16 in Reach 5C/5D/6. The higher of the geometric mean or median for the averaging area was used as BAF_{tm} in the target soil equation (see Table E-1).

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Appendix F

Evaluation of Shear Stress and Need for Over-Excavation for SED 9

APPENDIX F

Evaluation of Shear Stress and Need for Over-Excavation for SED 9

As discussed in the main text of this Revised CMS Report, alternative SED 9, as defined by EPA, differs from the other sediment remediation alternatives in a number of ways. Two of them are as follows:

1. The spatial delineation of SED 9 remediation areas in the Reach 7 impoundments (i.e., Reaches 7B, 7C, 7E, and 7G) and Reach 8 (Rising Pond) was required to be based on the bottom shear stress within those reaches (as opposed to defining remediation areas based on a single technology over an entire reach or based on depth and/or PCB concentration, as has been done for the other alternatives). For these reaches, EPA specified the following approach:

   - In areas having lower shear stress, sediments would be removed to a depth of 1 foot followed by placement of a cap back to grade. The cap in these lower shear stress areas would consist of a 6-inch active layer (assumed to consist of material containing a sorptive amendment) overlain by a 6-inch habitat/bioturbation layer (assumed to consist of sand or gravel material).

   - In areas with higher shear stress, sediments would be removed to a depth of 1.5 feet followed by placement of a cap back to grade. The cap in higher shear stress areas would be the same as that in lower shear stress areas except that it would also include a 6-inch armor layer (designed to resist erosion) at the surface.

2. EPA specified a different sequencing of construction activities for SED 9 than for the other sediment alternatives. Specifically, EPA specified that, under SED 9, sediment removal in the Reach 5 backwaters and in Reaches 6, 7, and 8 would be performed concurrently with removal activities in the Reach 5 channel (i.e., Reaches 5A, 5B, and 5C), and that placement of the caps in these backwaters and downstream reaches would be delayed until after all the removal and capping activities in the Reach 5 channel have been completed. Under this approach, the sediments exposed by removal in the reaches where the capping would be delayed would be "uncovered" for some period of time after sediment removal is complete. As a result of this sequencing, EPA directed GE to evaluate the need for additional removal, in terms of an increased removal depth, to account for any sedimentation that would occur during the period between completion of removal and initiation of capping in the subject reaches.

This Appendix describes model-based analyses that were developed to address these two aspects of the development of SED 9. Specifically, these analyses were developed to:

- Evaluate the distribution of bed shear stress and delineate regions of high and low shear stress within the Reach 7 impoundments and Reach 8; and

- Estimate the thickness of deposition that could occur during the "uncovered" periods (i.e., the time between completion of removal activities and initiation of capping activities) in the reaches where capping would be delayed, and determine what additional removal depth, if any, would be needed to account for that deposition.

The results of these analyses are presented in the following sections.

F.1 DELINEATION OF HIGH AND LOW SHEAR STRESS AREAS

Delineation of high and low shear stress areas in the Reach 7 impoundments and Reach 8 under SED 9 was based on the premise that areas subject to relatively higher shear stress would require a cap that includes an armor layer because the shear stress in these areas would be sufficiently high, such that a habitat layer nominally consisting of sand or gravel would be eroded during conditions of elevated current velocity. In general, erosion of sediment depends on both shear stress in the river bed, which is related to flow conditions, and the critical shear stress of the bed materials (e.g., particle size). As river flow increases, the river bed shear stress increases, and once that shear stress exceeds the critical shear stress for the bed material, resuspension is expected to occur. Therefore, for the purposes of this modeling analysis, "low shear stress" conditions were defined as those in which the bed shear stress is less than the critical shear stress of a sediment cap's habitat layer such that the material would be largely stable. The modeling approach used to identify the portions of the Reach 7 impoundments and Reach 8 that meet this low shear stress condition was as follows:

- The assessment was conservatively focused on the extreme flow event used in Year 26 of the CMS model projection period. The peak flow rate from this event corresponds to the largest flood on record for the Housatonic River, and is the largest simulated flow used in all CMS-related modeling (see Section 3.2.2.1 of the main body of this report).

- Since a gravel or sand habitat layer would likely be used in areas with low shear stress (as discussed above), a range of critical shear stresses associated with such material was developed from the literature (van Rijn, 1993). Based on the values in Table F-1, a conservative value of 1.9 Pascal (Pa), which is the critical shear stress for coarse sand, was selected for this analysis.

Table F-1 – Summary of Critical Shear Stress Associated with Different Size Classes of Solids (van Rijn, 1993).

Description	D 50 (mm)	Critical Shear Stress (Pa)
Medium Sand	0.5	0.5
Coarse Sand	1	1.9
Very Coarse Sand	2	4.9
Gravel	4	11

- An area was considered to have high shear stress if the bed shear stress predicted by EPA's Downstream Model exceeded the 1.9 Pa threshold value for a sustained period of time (defined as > 12 hours for this analysis) during the extreme event. Otherwise, the area was considered to have low shear stress since either the threshold value was never met or it was only exceeded for a short period of time (< 12 hours). The 12-hour criterion was used in this definition to avoid delineating areas that exceed the threshold shear stress for only a short period of time and hence would not experience substantial erosion as compared to areas where the threshold value is exceeded during a significant portion of the extreme event.

Figures F-1a through F-1e show the spatial distribution of model-calculated bed shear stress in the Reach 7 impoundments and Reach 8, as well as the changes in bed shear stress associated with river flow rate over the course of the extreme event (a time period of 5 days). It can be seen from these plots that the magnitude of model-calculated bed shear stress, as well as the spatial extent of high bed shear stress (e.g., grid cells with about 2 Pa and above), increases with increasing flow. Figure F-2 shows the frequency at which model grid cells exceeded 1.9 Pa during the extreme event. As expected, the narrow portions of the impoundments, such as the entry channels, had a greater frequency of high shear stress than the wider portions of the impoundments, where the river also generally becomes deeper. Generally, a grid cell that exceeded 1.9 Pa for greater than 12 hours (0.5 day) was defined as a high shear stress area. The following portions of the Reach 7 and 8 impoundments were identified as having high or low shear stress based on the approach described above:

- Reach 7B (Columbia Mill Dam Impoundment): The entry channel and area just above the dam were defined as having high shear stress, while the middle deeper portion of the impoundment was defined as a low shear stress area.

- Reach 7C (Former Lee/Eagle Mill Impoundment): The entire reach was defined as a high shear stress area.

- Reach 7E (Willow Mill Dam Impoundment): The entire reach was defined as a high shear stress area.

- Reach 7G (Glendale Dam Impoundment): The upper portion of this reach was defined as having high shear stress, while the deeper portion over the lower half of this reach leading up to and immediately adjacent to the dam was defined as a low shear stress area.

- Reach 8 (Rising Pond): The majority of Rising Pond was defined as a low shear stress area, with the exception of the narrow entry channel of the impoundment.

Based on the model predictions at the grid cell level described above, contiguous areas within each impoundment were delineated as having high or low shear stress, as shown in Figure F-3. This analysis resulted in approximately 34 acres of these impoundments being defined as having high shear stress, and 45 acres being defined as having low shear stress. This delineation would be revisited in design (if SED 9 were selected), particularly since a habitat layer could likely be sized to withstand the selected critical shear stress (1.9 Pa), as well as potentially higher shear stresses. However, it should be noted that the identification of high and low shear stress areas shown in Figure F-3 is generally consistent with two other observations:

- Review of the available surface sediment grain size data collected by EPA indicates that relatively coarser sediments are located in the areas of predicted higher bed shear stress (such as the narrow entry cannel to Reach 7B), and that relatively finer grain size sediment were found in the deeper slower moving portions of the impoundments. It is reasonable to expect that the present grain size distribution at the sediment surface reflects an equilibration condition with the bed shear stress.

- Based on the analyses conducted in the original CMS to evaluate the level of erosion experienced by thin-layer caps, it was found that the limited areas where erosion of thin-layer caps was predicted within the Reach 7 impoundments and Reach 8 generally matched the areas delineated as high shear stress areas in this analysis.

The results of the model simulation of SED 9 confirmed that the areas delineated as having low shear stress (based on the approach described above) are not predicted to experience significant erosion. For example, within the low shear stress areas, only a limited number of model grid cells (5 of the 16 grid cells in Reach 7B, 2 of the 18 grid cells in Reach 7G, and 2 of the 73 grid cells in Rising Pond) are predicted to experience complete erosion of the upper six inches of the cap (which corresponds to the habitat/bioturbation layer as specified by EPA).

F.2 ESTIMATION OF SEDIMENTATION DURING "UNCOVERED" PERIODS

As discussed above, the construction sequencing specified by EPA for SED 9 would result in a time delay between the completion of sediment removal and the placement of the caps in the Reach 5 backwaters, Reach 6 (Woods Pond), Reach 7 impoundments, and Reach 8 (Rising Pond). During this "uncovered" period, deposition of solids would occur. In this situation, EPA stated that GE should evaluate the increase in removal depths (over-dredging) in those areas that would be necessary to offset the sediment deposition that would occur during the "uncovered" period.

To evaluate this issue, a modeling analysis was performed to estimate the depth of sediment accumulation in these areas during this period, based on the annual deposition rate (predicted by EPA's model) and the duration of the "uncovered" period under the construction timeline developed for SED 9. The remediation schedule developed by GE for SED 9 was presented in Figure 6-25 in the main body of this report and is repeated as Figure F-4 in this Appendix. That schedule indicates that the backwater remediation, including placement of cap material, would be completed at the same time as the remediation in Reach 5C. Since the backwater remediation would be completed concurrently with remediation in the Reach 5 channel (with no increase in the overall time to complete Reach 5), there would be no time delay between the completion of sediment removal and the placement of the caps in the Reach 5 backwaters. Therefore, there was no need to include the Reach 5 backwaters in this analysis. For the impoundments (i.e., Woods Pond, the Reach 7 impoundments, and Rising Pond), this analysis was conducted as follows:

- Based on the assumed sequencing of work under the remediation schedule developed for SED 9 (see Figure F-4), the number of years in which each reach would be "uncovered" between dredging and capping is between 3 and 4 years for these impoundments.

- Based on yearly changes in bed elevation computed by EPA's model under the no-action alternative (SED 1), reach-averaged annual deposition rates were calculated over the 52-year model projection period in each of the subject reaches. Rolling averages of annual deposition rates for each reach were then calculated based on the duration of each reach's "uncovered period". Since the annual deposition rate is affected by the flow conditions for a given year, the rolling-average approach considered a combination of flow conditions in the future. This approach is more conservative than using a long-term average deposition rate and more realistic than using the maximum deposition rate.

- Based on these durations and rolling averages of annual deposition rates derived above, the total thickness of deposited sediment in a given reach was estimated based on the time it would be uncovered and the maximum rolling average deposition rate predicted by the model for that reach.

The resulting thickness of sediment accumulation by reach is presented in Table F-2 below.

Table F-2 – Total Deposition by Reach during the Uncovered Period

Reach	"Uncovered" Duration (years)	Deposition Rate (cm/yr)[1]	Total Deposition (inches)
Reach 6	3.3	0.5	0.8
Reach 7B	3.7	0.2	0.4
Reach 7C	3.7	0.02	0.1
Reach 7E	3.7	0.2	0.3
Reach 7G	3.7	1.0	1.5
Reach 8	3.9	0.2	0.3

[1] Maximum 3-year (Reach 6) or 4-year (Reaches 7-8) rolling average from the 52-year model simulation of SED 1.

The model-predicted thicknesses of sediment deposited in these areas during the 3- to 4-year uncovered periods under SED 9 are small. Total estimated deposition in five of these six impoundments is less than one inch, and the estimated deposition in the remaining impoundment (the Glendale Dam Impoundment) is approximately 1.5 inches (Table F-2). These thicknesses are within the anticipated accuracy and allowable dredge depth tolerances for current environmental dredging equipment. Moreover, it is likely that the accumulated sediments would consolidate once the relatively dense capping material (typically sand and gravel, or large sized materials in the case of armor stone) is placed on the river bottom. This would further offset any additional accumulation of sediments during the uncovered period.

This analysis indicates that it is not necessary to increase the base removal depths in these areas under SED 9 to account for deposition of sediment between the time removal is completed and the time capping begins.

References

van Rijn, L.C. 1993. *Principles of Sediment Transport in Rivers, Estuaries and Coastal Seas,* Aqua Publications.

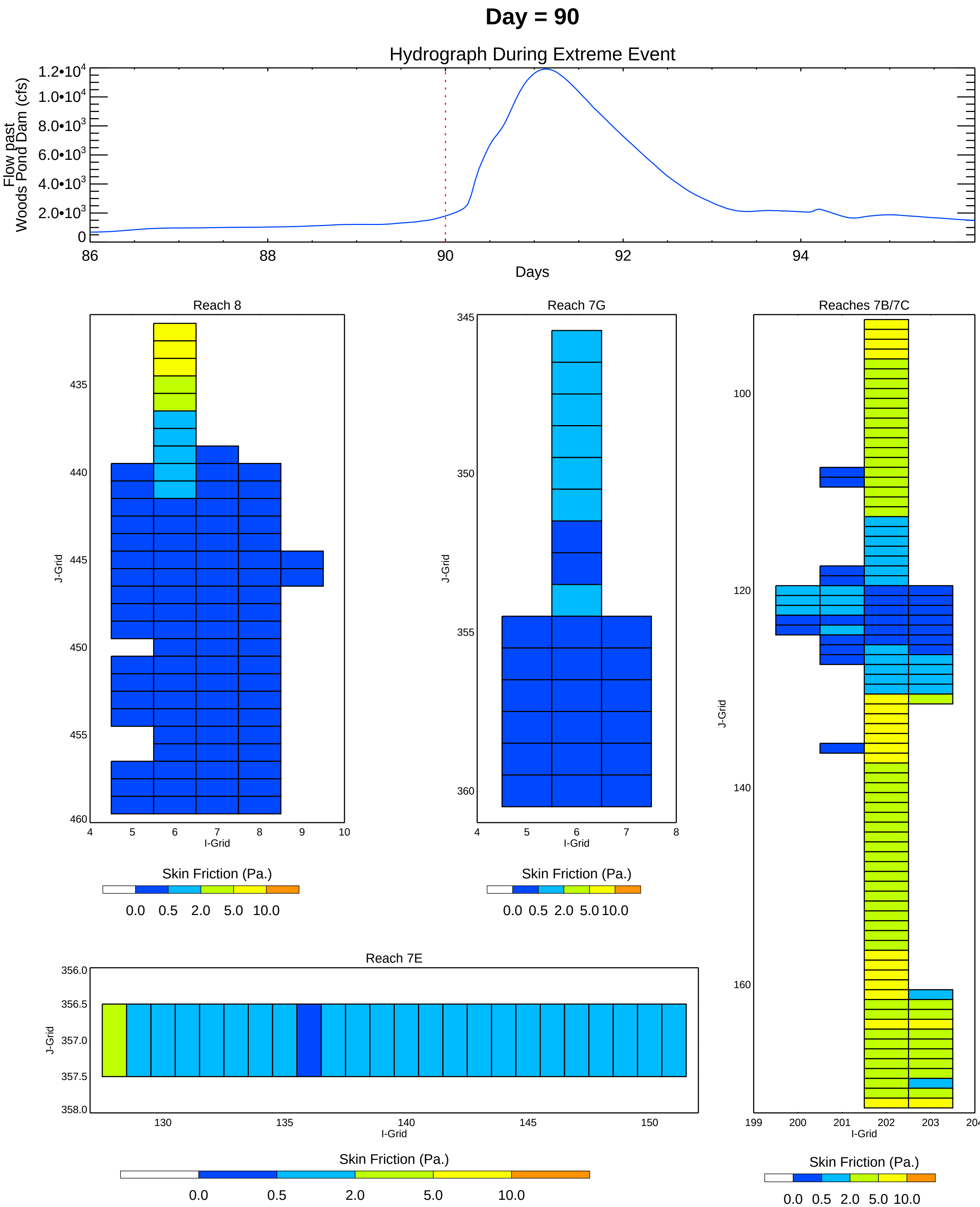

Figure F-1a. Model Calculated Skin Friction During the Extreme Event (Day 90)

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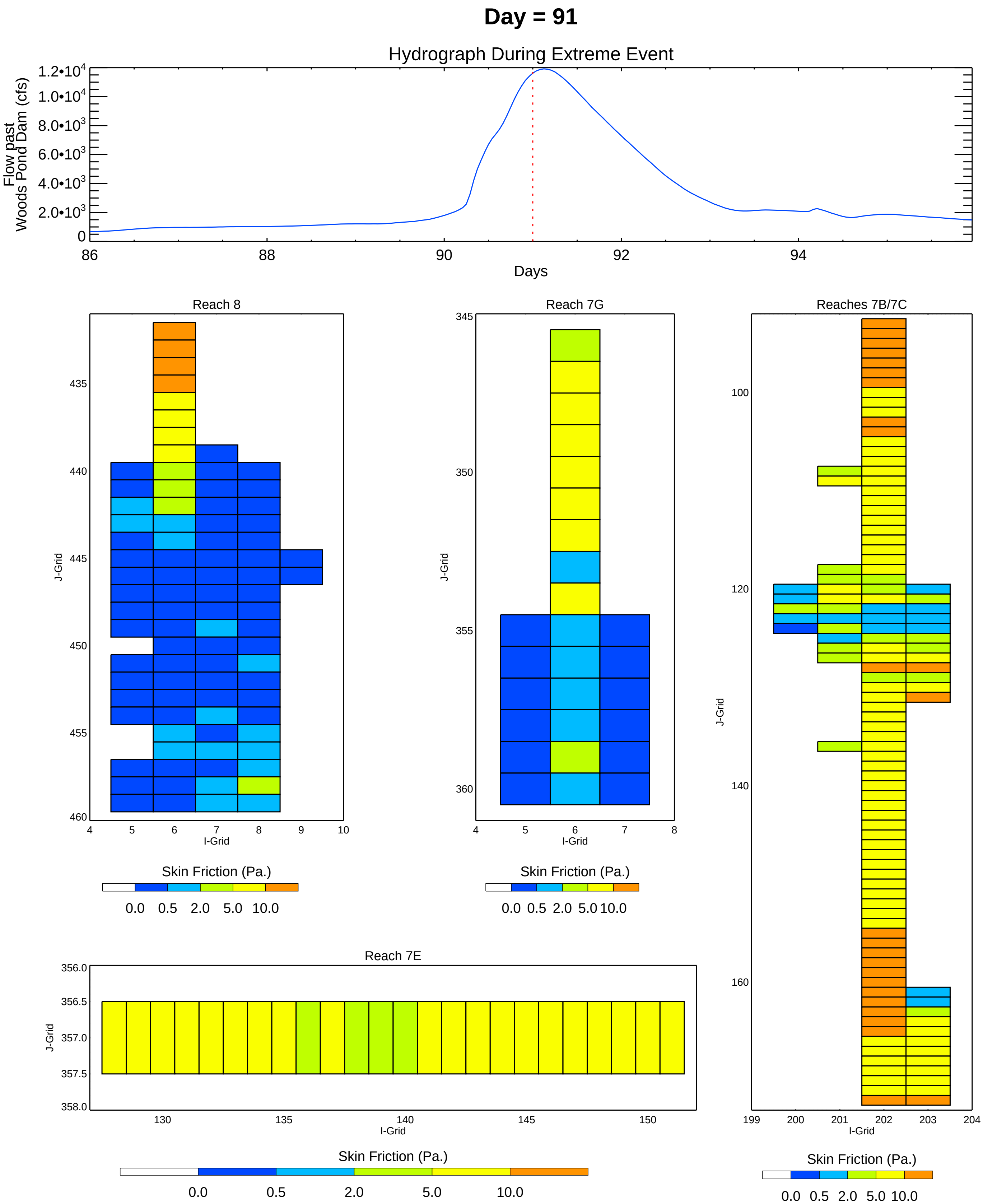

Figure F-1b. Model Calculated Skin Friction During the Extreme Event (Day 91)

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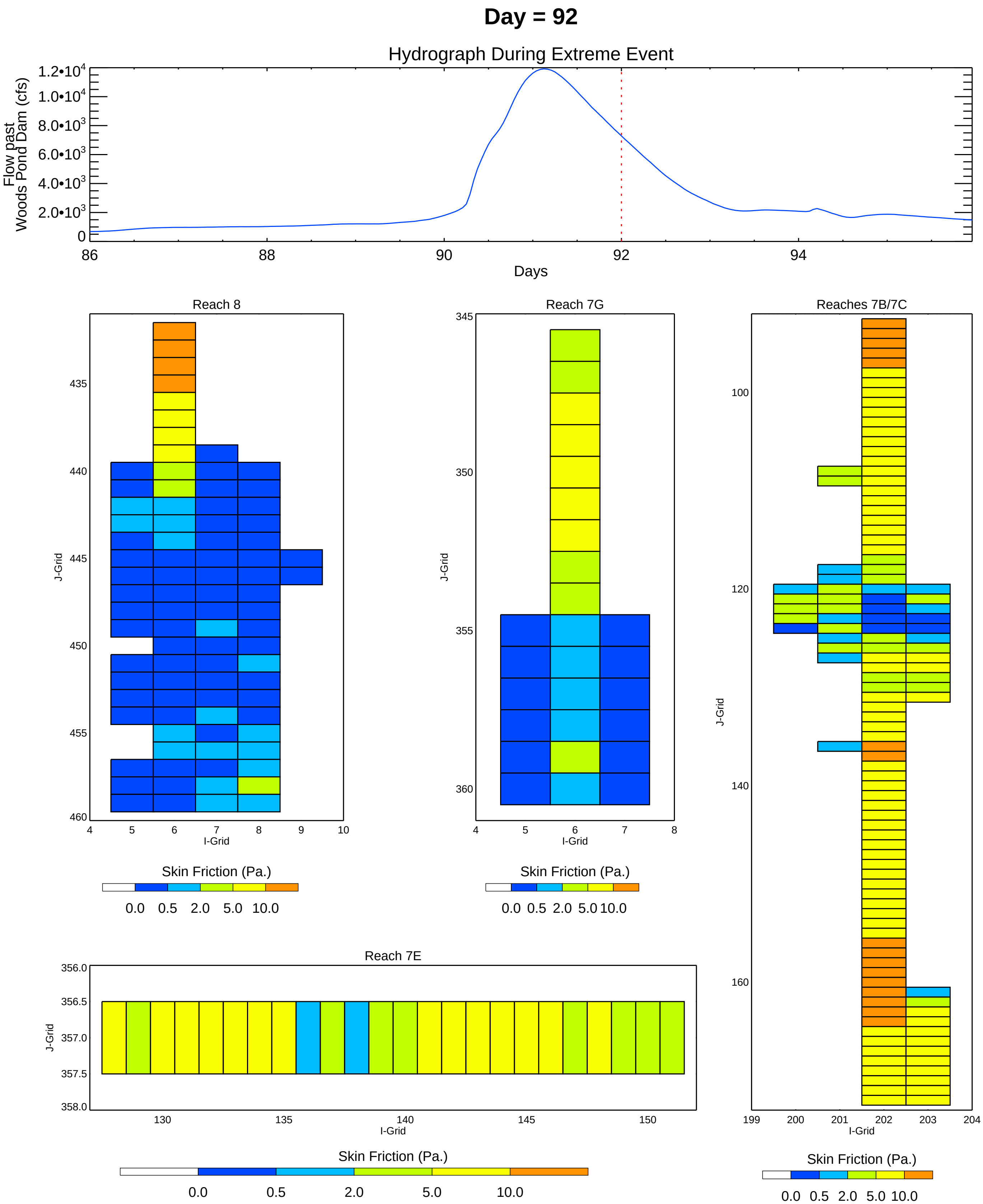

Figure F-1c. Model Calculated Skin Friction During the Extreme Event (Day 92)

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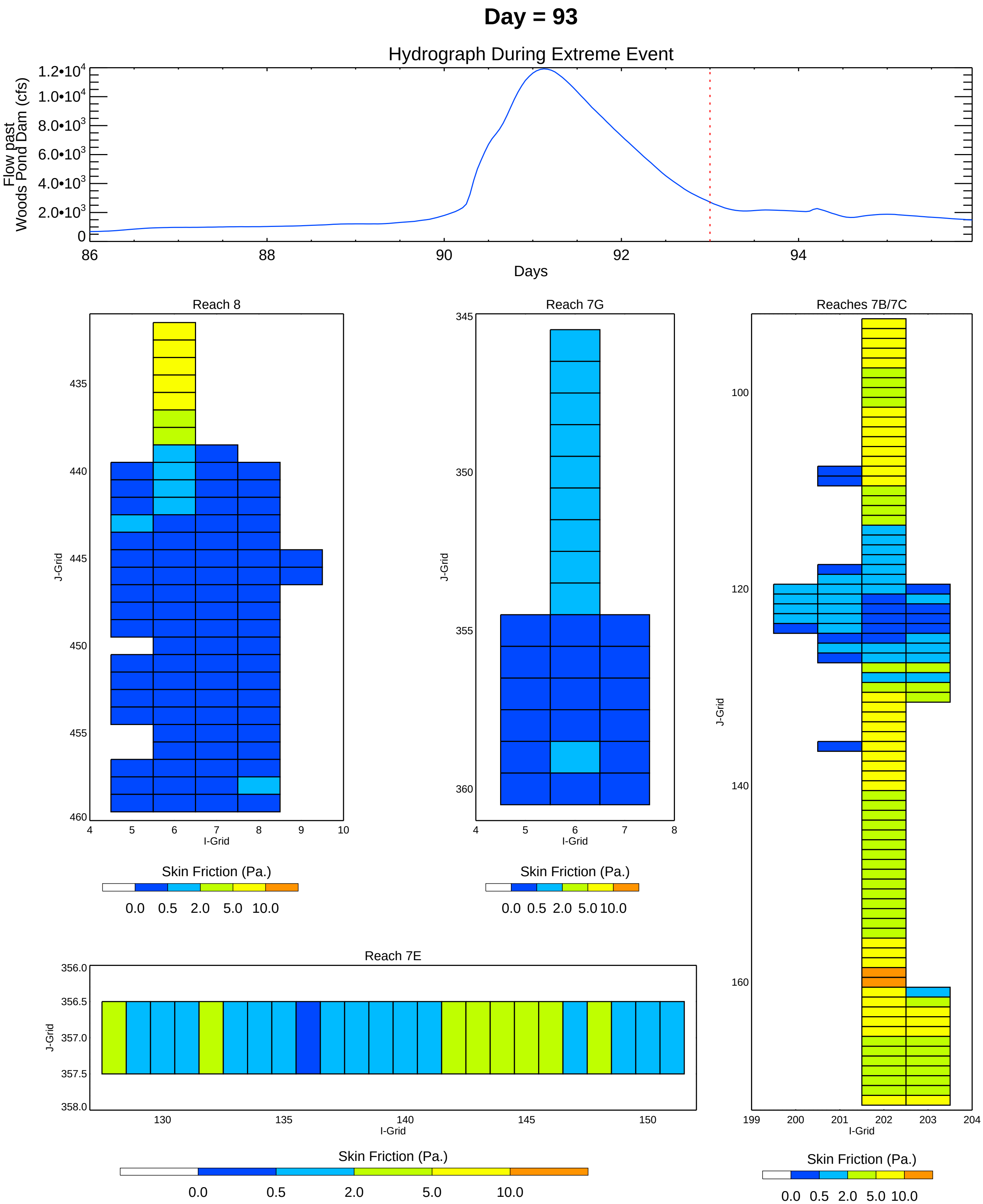

Figure F-1d. Model Calculated Skin Friction During the Extreme Event (Day 93)

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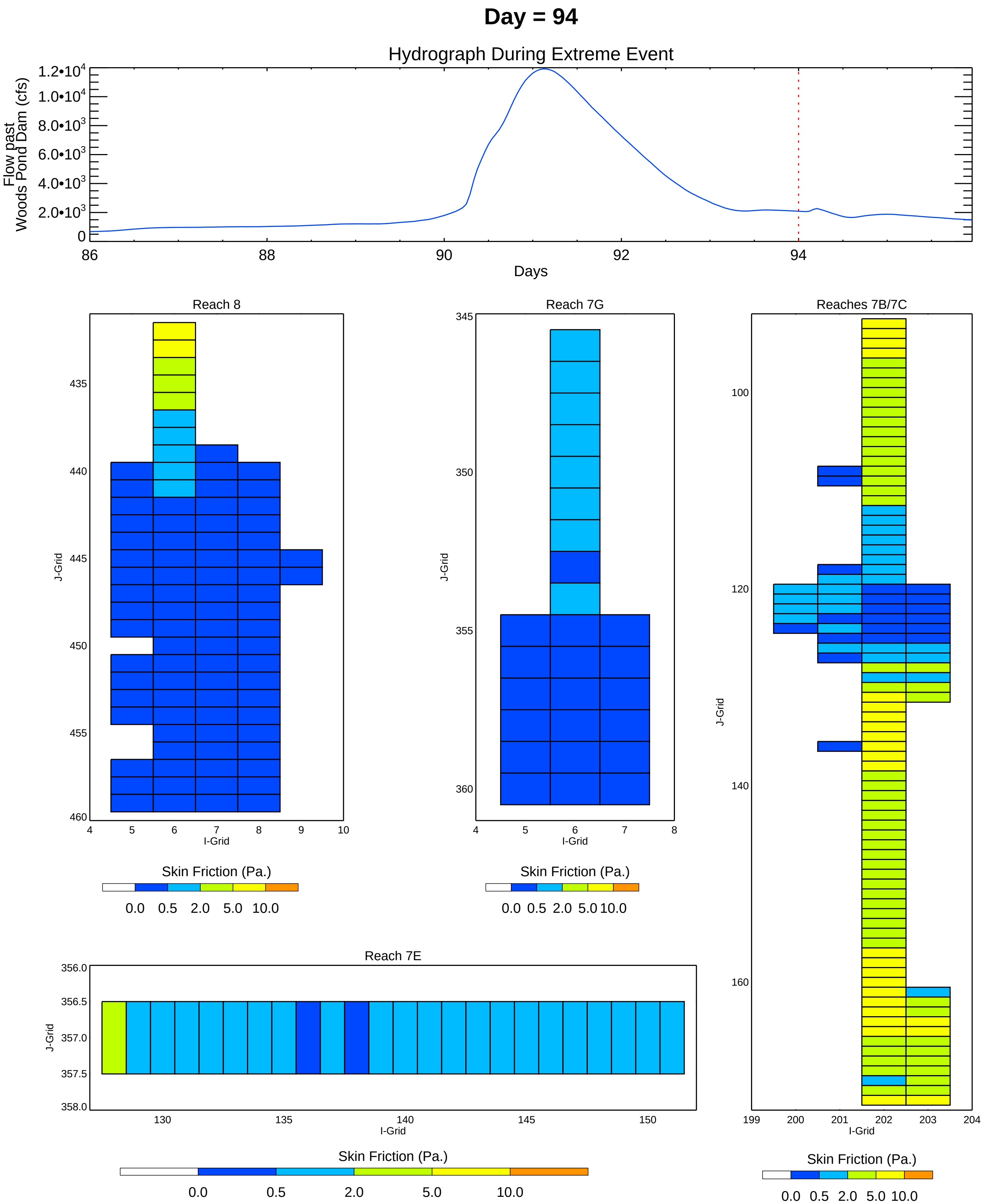

Figure F-1e. Model Calculated Skin Friction During the Extreme Event (Day 94)

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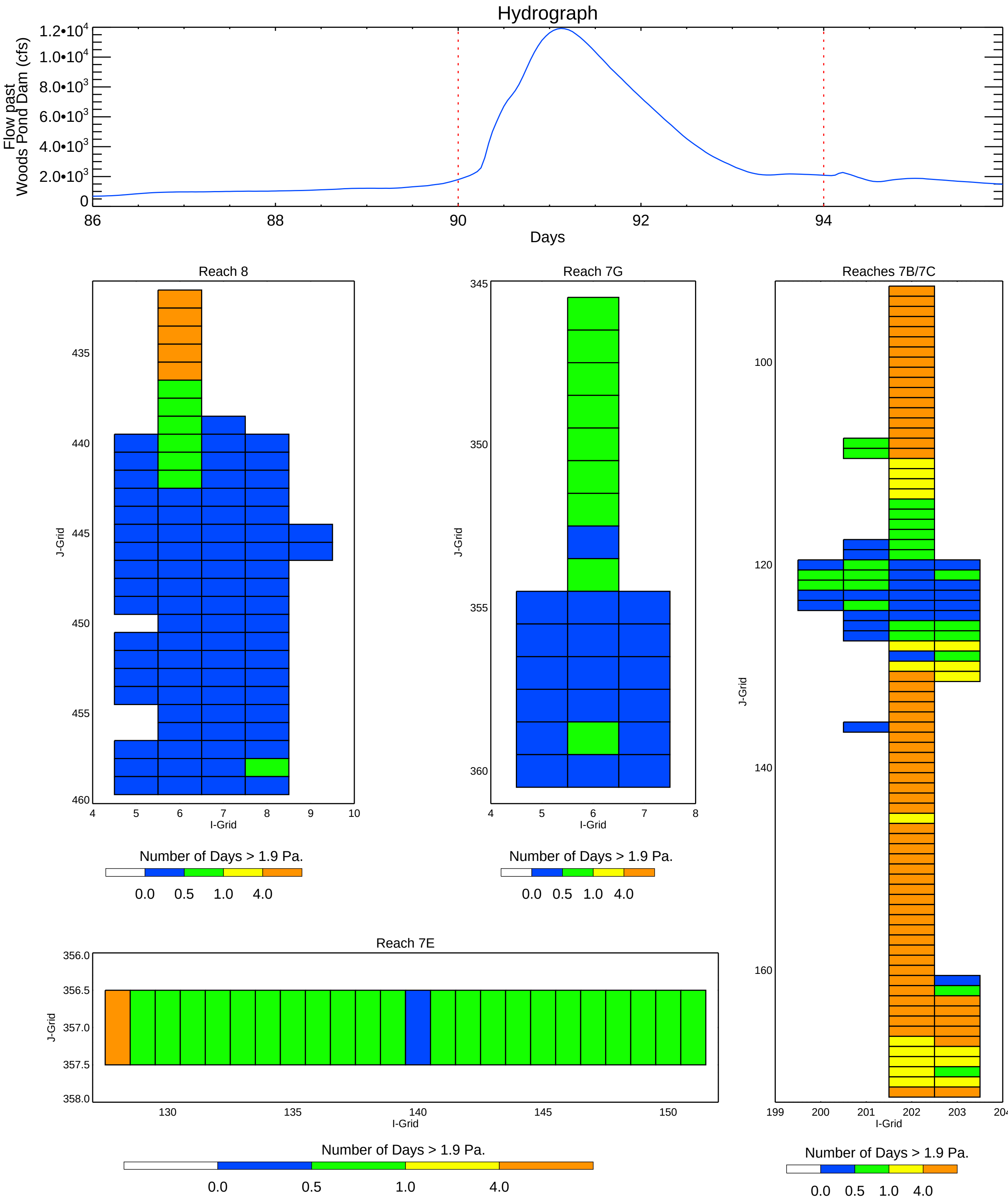

Figure F-2. Frequency of Model Calculated Bed Shear Stress Exceeding 1.9 Pa

Source: Z:\GENcms\MODEL\EPA_EFDC\Results\R78\Proj_R78_SED1CMSBS_0712-28\OUTEXPL\TAUVECH_2030_hourlyOutput.out

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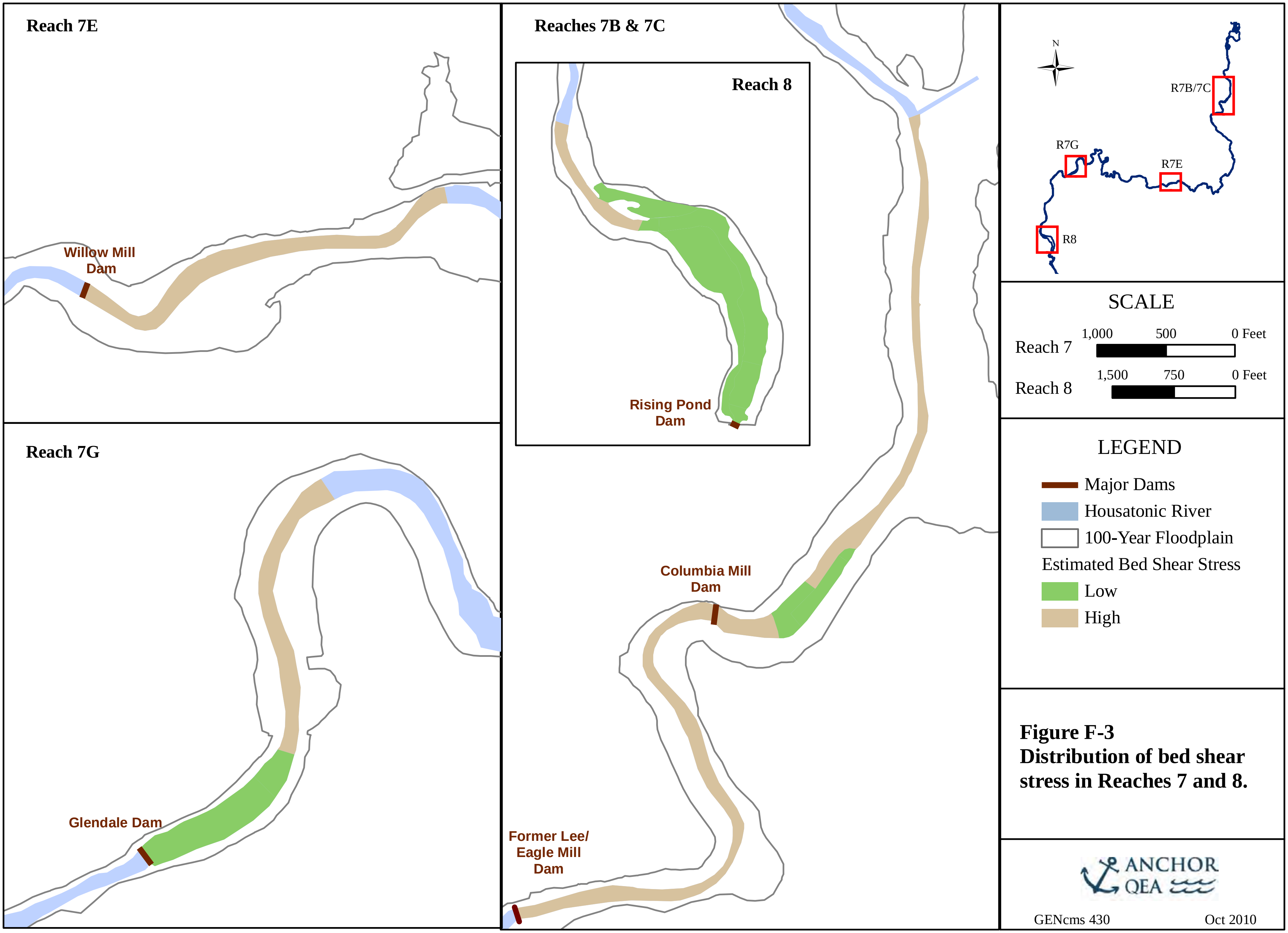

Figure F-3
Distribution of bed shear stress in Reaches 7 and 8.

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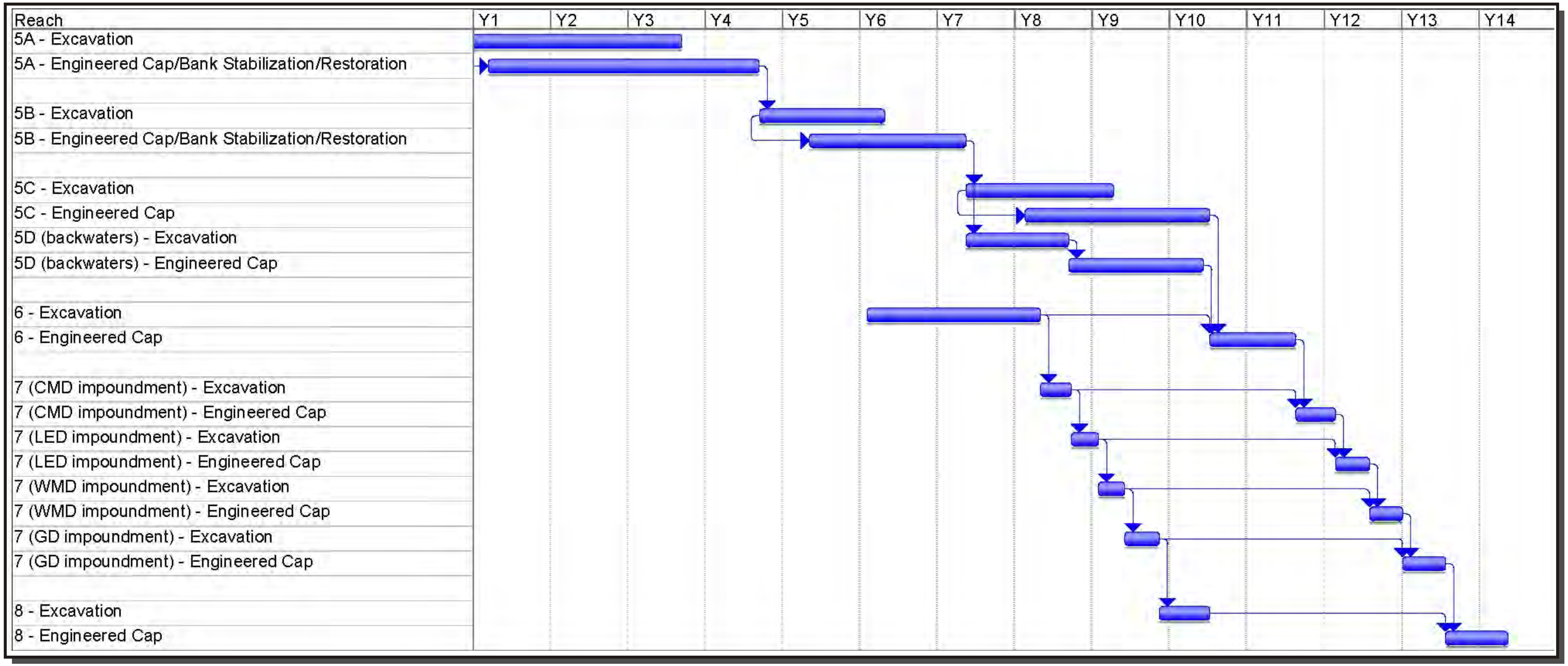

NOTE:
1. CMD = Columbia Mill Dam; LED = Lee/Eagle Dam; WMD = Willow Mill Dam; GD = Glendale Dam.

2. Y = year

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

REVISED CMS REPORT

SED 9 CONSTRUCTION SCHEDULE

ARCADIS

FIGURE
F-4

Appendix G

Riverbank Stabilization Techniques

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APPENDIX G

RIVERBANK STABILIZATION TECHNIQUES

Under Remedial Alternatives

Housatonic River
Rest of River

October 12, 2010

Prepared for:
General Electric
Pittsfield, MA

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Westford, MA

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Appendix G: Riverbank Stabilization Techniques

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Appendix G: Riverbank Stabilization Techniques

1. Introduction

The SED 3 through SED 10 sediment remedial alternatives include stabilization of all or portions of the riverbanks in Reaches 5A and 5B of the Housatonic River. As discussed in the text of this Revised Corrective Measures Study (CMS) Report, GE has re-evaluated the bank stabilization techniques described in the original CMS Report for SED 3 through SED 8 and has also evaluated such techniques for SED 9 and SED 10. The objective of this evaluation was to identify, in conceptual terms, potential techniques that would stabilize banks and reduce erosion on a long-term basis while reducing the adverse ecological and aesthetic impacts of bank stabilization to the extent consistent with effective stabilization. As such, this evaluation focused on incorporation of a variety of bioengineering measures, to the extent practical and appropriate based on river conditions, in addition to traditional bank hardening methods. It thus resulted in the identification of various combinations of bioengineering and traditional bank stabilization techniques that could be applied to the riverbanks in Reaches 5A and 5B.

This Appendix G identifies the conceptual bank stabilization measures identified for Reaches 5A and 5B under SED 3 through SED 10 based on an initial visual assessment of bank conditions, as well as review of other existing information (e.g. aerial photographs, EPA transect data), to evaluate geomorphic characteristics and hydraulics affecting particular bank sections. Given that a detailed survey of the riverbanks in Reaches 5A and 5B has not been conducted, the selection of bank stabilization measures is necessarily preliminary. Detailed studies of river fluvial geomorphology, hydrologic conditions, and bank conditions would be needed to specify appropriate bank stabilization measures during final design for the selected remedial alternative. This Appendix provides additional details on the conceptual bank stabilization plans described generally in Section 3.1.4 and is divided into eight sections. Section 1 is a general introduction. Section 2 provides a brief description of geomorphic considerations affecting bank stabilization in Reaches 5A and 5B. Section 3 describes a range of potential bank stabilization techniques considered for application to the banks in these sub-reaches, while Section 4 discusses the process used in selecting stabilization techniques for application to varying bank conditions. Sections 5, 6, 7 and 8 of this Appendix present the resulting conceptual bank stabilization plans included as part of alternatives SEDs 5-8, SEDs 3 and 4, SED 9, and SED 10, respectively.[1]

2. Geomorphic Considerations and General Approach

Rivers are natural open systems that adjust their morphology to transmit the flow and sediment load delivered from their watershed. Over periods of thousands of years, the supply of sediment from upstream is balanced by a river's ability to transport it. However, over shorter time periods, natural and man-made changes in a river's flow and sediment transport regime can induce erosion or deposition and associated changes in the river channel form, as the river adjusts to increased or decreased sediment loads or flows.

The physical appearance and character of the river (or geomorphology) is a product of channel boundary and slope adjustment to the present flow and sediment regime. River form and fluvial processes evolve simultaneously and operate through mutual adjustments toward self-stabilization.

Because river systems are dynamic, their pattern, dimension, and profile are a function of numerous process variables,[2] with the result that a change in one variable sets up a mutual adjustment in others (Leopold *et al.*, 1964). Channel stabilization methods must address these observable relationships to prevent the negative feed-back mechanisms from the river from undermining the stabilization measures. In bank stabilization design, this is accomplished by comparing the observed morphological features of a river to those of known stable systems in order to account for the natural tendency of a particular river system or segment to adjust to a more stable channel form.

The effects of changes in the Housatonic River's flow and sediment transport regime on the river channel can be seen in Reach 5 of the Housatonic River (from the Confluence of the river's East and West Branches to Woods Pond) in the form of tight

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[1] A discussion of bank stabilization methods and their application as part of these remedial alternatives was previously presented in the *Supplement to Response to EPA's Interim Comments on CMS Report: Evaluation of Example Areas, Housatonic River – Rest of River* dated February 2010 (the Supplemental Interim Response). In that document, the discussion of bank stabilization measures was limited to just three "Example Areas" identified by EPA. The discussion included in this report addresses the full length of Reaches 5A and 5B as applicable for the sediment remedial alternatives.

[2] These variables include river width, depth, slope, velocity, flow resistance, sediment size, sediment load, and discharge.

meander bends, oxbows, and recent shoot cutoffs (Photograph G-1). In Reaches 5A and 5B, these changes have caused erosion on outer banks of meander bends, formation of mid-channel bars that redirect flows causing bank erosion, and poor point bar development[3] in a number of locations.

Photograph G-1. Tight meander bends and other features of the Housatonic River indicating current and historical instability.

Other indications that the river is undergoing morphological changes in Reaches 5A and 5B include portions of the channel that are very wide and have developed side bars, atypical flow geometry and thalweg location, longitudinal position of the pools with respect to the channel pattern, and occurrence of depositional areas on the outside banks leading into the meander.

The sediment remedial alternatives involve stabilization of all or portions of the existing banks in Reaches 5A and 5B to reduce bank soil erosion. The identification of stabilization techniques applicable to the particular riverbanks in Reaches 5A and 5B, described in Sections 3 and 4 of this Appendix, takes into account, to the extent possible, the natural geomorphological factors affecting the river in this area (e.g., channel geometry and velocity, sediment transport, and hydrodynamics).

A river segment's channel-forming flow, also known as "bankfull" discharge or flow, is the flow that transports the majority of a river's sediment load over time and thereby forms and maintains the river channel. In many rivers, the bankfull stage (when the river is at bankfull elevation) is the point at which water begins to overflow onto the floodplain. However, if a river downcuts (that is, erodes more deeply into the bottom of the channel), the bankfull stage is often at an elevation that is lower than the top of the river's banks. Such a river is considered incised. If incision continues to a point at which water does not overflow onto the floodplain at twice the river's bankfull depth, it is considered entrenched. Bankfull stage can be observed and determined within incised and entrenched rivers by using a series of common indicators such as a bench

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[3] Point bars develop when sand and gravel is deposited on the inside of meander bends. When the river hydrologic environment is stable, the point bar will typically take on a characteristic crescent shape. However, in an unstable hydrologic environment, point bars often change shape (slope and size) dramatically during bankfull flow events and do not maintain a consistent geometry over time. Such point bars are described as poorly developed.

or scour line. An illustration of bankfull stage relative to a river channel and other floodplain features is shown in Figure G-1.

Preliminary observations indicate that the Housatonic River in Reaches 5A and 5B is incised to a degree, but not entrenched. This incision was taken into account when developing the bank stabilization measures described in this Appendix.

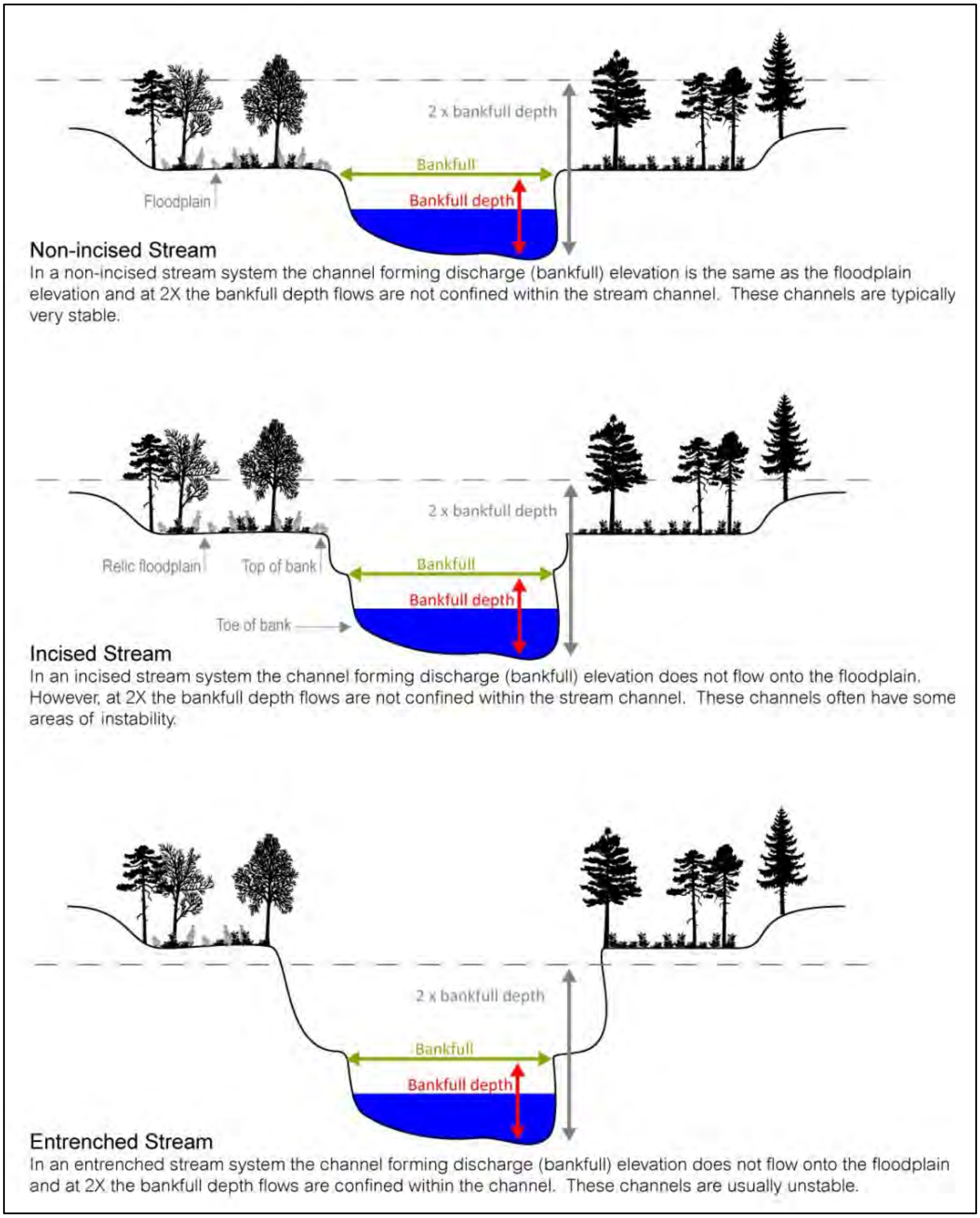


Figure G-1. Illustration of bankfull elevation, incision and entrenchment

3. Description of Potential Stabilization Techniques

Bioengineering techniques include use of natural materials and certain riparian vegetation as a strategy to control bank erosion and promote longer-term stability of the river channel and banks, while attempting to minimize the adverse effects of stabilization when possible. Such techniques can be grouped into two basic categories: those that reduce the force of water against a riverbank, and those that increase a bank's resistance to the force of water (NRCS, 2002). Both categories of bioengineering techniques employ riparian vegetation as a means of erosion control. Vegetative growth reduces local velocities against the bank, thereby reducing near bank shear stress. After time, as the vegetation grows and matures, the hard mass provided by plant roots can provide protection from erosion and collapse and increase internal bank strength (Rosgen, 2006; Wynn *et al.,* 2004).

Many of the techniques that are designed to reduce the force of water against a riverbank do so by directing flow away from banks. The structures used to direct flow away from a bank, such as vanes and bank spurs, are made of materials such as logs or native rock. These structures can also be used to deliberately create scour areas such as pools within the bed of a river channel. Such scour areas can increase the overall stability of the river profile by providing energy dissipation. Other examples of techniques to reduce the force of water against a bank include reshaping a bank to reduce its angle or constructing a bench which can reduce the shear stress affecting the lower portion of the bank.

Techniques designed to increase a bank's resistance to the force of water function in much the same way as traditional hardening techniques, such as gabions, riprap and concrete, by "armoring" a riverbank with materials that are more resistant to the force of water than native, in situ soil. Natural materials, such as coir fiber, provide flow resistance while also serving as a substrate for plant growth, or incorporate interstitial space to provide ground contact for rooting plants.

In areas that are subject to greater instability, such as where shear stress and channel velocities are particularly severe, bioengineering techniques are unlikely to succeed (at least by themselves), and thus traditional hardening methods (e.g., use of concrete, riprap, and gabion baskets) are necessary to prevent bank soil erosion. Bioengineering techniques and traditional hardening methods are not exclusive of each other, however. In areas where shear stress and channel velocities are relatively severe, bioengineering can be used in conjunction with traditional hardening methods to provide the most effective strategy for bank stability (VDCR, 2004).

It should be noted, however, that any technique for bank stabilization would be intended, by design, to prevent any significant bank soil erosion and lateral channel migration, which are two key geomorphic processes that produce a heterogeneous mix of riverbank types, including vertical and undercut banks, that are critically important to many of the plants and animals that use the banks. Thus, while efforts can be made to reduce ecological impacts, it must be recognized that any bank stabilization techniques, including bioengineering techniques, would have long-term or permanent adverse ecological consequences. These impacts are described in the text of this Revised CMS Report (e.g., Section 5.2.3).

In some cases, bank stabilization methods are applied to only discrete portions of the banks along a given stretch of a river, which reduces the adverse ecological impacts compared to stabilizing the banks throughout the entire stretch of a river. This partial or intermittent bank stabilization approach focuses on the areas with the greatest need for stabilization. Since many bioengineering techniques are specifically designed to reduce flow velocities, dissipate energy, and reduce erosional forces along the banks on which they are applied rather than simply deflecting the river's energy upstream or downstream, they are consistent with intermittent bank stabilization because they mean that the stabilization design for particular sections of riverbank can minimize energy displacement that could affect nearby riverbank segments. This approach is discussed further in Section 8 of this Appendix in connection with the stabilization techniques for SED 10, which would involve this type of intermittent bank stabilization in Reaches 5A and 5B. As discussed there, various guidance documents recognize that this is a workable approach to controlling erosion and stabilizing banks, provided that any potential impacts of such partial bank stabilization measures on the portions of the banks that would not be stabilized are considered and any necessary steps are taken to prevent those measures from increasing erosion in other areas. As further discussed in Section 8, such an evaluation has been made, on a preliminary basis, for the bank stabilization under SED 10.

A range of bank stabilization techniques, including bioengineering options, that have been considered for use on the banks in Reaches 5A and 5B are described in more detail below along with a general description of the types of conditions typically present in Reaches 5A and 5B for which each technique may be applicable.

3.1 Vegetative Plantings

The planting of herbaceous and woody vegetation is one of the simplest forms of stabilizing a riverbank. The plant roots help stabilize the soil and control shallow mass movement by binding soil particles and by removing moisture from the soil. The above-ground portion of the plant provides some protection of the soil surface and reduces water velocity. While vegetative plantings are incorporated into a number of bioengineering techniques, the techniques that primarily rely on the establishment and growth of vegetation are described in this section.

Plugs consist of individual rooted stems of grasses, sedges, and rushes. They are often planted along the lower portion of the bank approximately one foot below the ordinary high water level,[4] where they form clumps to help prevent scour in low stress areas. Plugs can be used in conjunction with other techniques, such as coir matting, compartmentalized placed fill, and vegetated geogrids.

Live stakes are dormant (but live) cuttings or branches typically 2 to 3 feet in length that are inserted into the soil at or below bankfull elevation (Photograph G-2). If correctly prepared, handled, and placed, the live stake will, under suitable conditions, root and grow. Only a few species will grow well from live stakes. Those species include willows, dogwoods, and elderberry. Live stakes can be used in conjunction with other techniques, including erosion control matting.

Photograph G-2. Live stakes.

Live fascines are long bundles of live woody vegetation buried in a riverbank in shallow trenches placed parallel to the flow of the river. The plant bundles sprout and develop a root mass that will hold the soil in place and protect the bank from erosion. These cuttings are bound together in bundles that are typically 6-8 inches in diameter and 4-20 feet in length.

A brush mattress (Photograph G-3) is a layer of live branch cuttings, placed perpendicular to the flow of the river on the bank, and held down in place with poultry netting or light gauge wire mesh to form a "mattress" of woody material. Live stakes are often placed in between the layers of brush, and a live fascine is often placed at the toe of the bank for

Photograph G-3. Newly installed brush mattress.

4 The ordinary high water level or line is that line on the bank established by the routine fluctuations of flow in the stream channel and indicated by physical characteristics such as a clear natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas. The ordinary high water level is lower than the bankfull elevation.

added protection. The mattress covers the bank and provides high resistance to shear stress and increased roughness, thereby reducing flow velocities. For this reason, a brush mattress is one of several techniques appropriate for outer meander bends where near-bank shear stress tends to be moderate to high and/or where space for excavation is limited by high banks or relatively deep pools near the banks. The live cuttings and live stakes that make up the mattress propagate riparian vegetation. Moreover, the irregular surface of the numerous branches that make up the brush mattress tends to capture sediment during flood conditions, thereby creating a substrate suitable for colonization of some native vegetation.

Regardless of the technique employed, any trees and other vegetation on the banks would need to be removed to implement the remediation/stabilization. In addition, because any future windthrow and overtopping of trees would destabilize those banks and cause severe bank erosion, only herbaceous plants and shrubs, and not trees, would be planted in connection with any bioengineering technique, and an ongoing program to prevent the growth of trees on the stabilized banks would be essential.

3.2 Coir Fabric Techniques

Coir fabric or coir matting is erosion control matting constructed of coconut fibers (Photograph G-4). The matting protects the banks while vegetation is established and biodegrades in about 5 years. Coir fabric is also used to construct a number of other bioengineering systems, including prevegetated mats, pre-planted coir pillow, and vegetated geogrid, each of which is described below.

Photograph G-4. Coir matting with vegetation beginning to grow through.

Pre-vegetated mats are coir mats that are pre-planted with sprigs or seeds and grown in a nursery to establish vegetation in the matting prior to use. The mats are placed on the bank soil in a manner similar to the placement of a sod mat. A variation of this is a pre-planted coir pillow, which is an approximately 3 foot by 8 foot by 4 inches thick coir fiber log. Because coir pillows are pre-planted, vegetation tends to become established more quickly.

Coir matting is applicable in a variety of conditions in Reaches 5A and 5B to protect banks while vegetation becomes established. This treatment can be used alone in depositional areas or on banks with low near-bank shear stress. This would include the inside of broad mender bends, straight reaches where the thalweg is in the center of the channel, or downstream of stable point bars. In such conditions, the bank would be graded to a low slope of 3:1 or less, covered in coir matting, and replanted with herbaceous and shrub vegetation. Coir matting may also be used on the upper bank slopes (above bankfull elevation) on banks undergoing stabilization with riprap or compartmentalized placed fill. Bank soil removal would be performed as necessary to allow implementation of these measures.

The most sophisticated use of coir matting is to construct vegetated geogrids. A vegetated geogrid consists of a wall composed of 1-foot “lifts” of compacted soil wrapped in coir fabric or geotextile (typically synthetic) fabric, with plugs, live stakes, or other plantings placed between each lift (Photograph G-5). This technique essentially replaces the riverbank with a newly constructed, reinforced wall that provides resistance to shear stress, while at the same time providing vegetative growth. The irregular surface created by the lifts helps to trap sediment during flood events, which in turn encourages further vegetative growth and colonization of vegetation. Because the vegetated geogrid is a wall, it can be constructed on steep slopes, thereby providing a suitable solution where it is not feasible to decrease the slope of a bank. It can also be used to protect fill slopes, which are generally more susceptible to erosion than slopes cut into in-situ soil. Some bank soil removal would be performed in association with using vegetated geogrids where vertical banks are sloped to 1:1 or greater. As an alternative to the lifts, a product known as “BioD-Blocks” can be used. This product is composed of coir fiber “blocks” tied into the bank with coir fiber matting (with layers of compacted soil placed between each course of blocks). Unlike conventional soil layer lifts, the coir block forms the face of the soil lift, which provides enhanced resistance to shear stress.

Photograph G-5. Vegetated geogrid with established vegetation.

3.3 Constructed Bankfull Bench

Photograph G-6. Bankfull bench along small stream.

The bankfull bench is a nearly flat area of variable width (but usually a minimum of 4 feet wide) constructed on a riverbank either by excavation or by the placement of fill (Photograph G-6). The bench is constructed at the bankfull elevation. The bankfull bench is designed not only to stabilize the riverbank, but also to improve the overall stability of the channel. Rivers such as the Housatonic, which are incised systems, have bankfull flows that do not reach the floodplain; flows greater than bankfull have increased velocities until reaching the top of bank elevation. For such incised systems, conditions of bed and bank instability can lead to bank erosion. A bankfull bench attempts to address this by modifying the channel geometry into a stable form that possesses the width and depth necessary to transport the river's sediment load over time without aggrading or degrading. The overall sediment transport capacity of the channel is increased while shear stress to the bank is decreased.

The bankfull bench can function as a stand-alone measure, but it can also be used where any excavation, reshaping, or armoring of a riverbank occurs. It is also usually accompanied by vegetative plantings to provide added stability, particularly if fill soils are used; typically, shrubs and herbaceous vegetation would be planted on and above the bench, while only herbaceous vegetation would be planted below the bench. Vegetation on the bench increases roughness which in turn reduces flow velocities along the bank and allows for deposition of sediment.

Bankfull benches would be used on straight reaches between meander bends to help further reduce moderate shear stress. Benches would either be excavated into the existing bank (requiring bank soil removal) or, where the channel is "over-wide" (i.e. wider than necessary to carry its sediment load) built out into the channel. The bank would be graded to a 2:1 slope from the toe of the bank to the bankfull elevation, the bench would be constructed, and the bank would continue at a 2:1 slope or less to the top of the bank. The bank and the bench would be covered in coir matting and planted with vegetation. Bankfull benches would also be incorporated into the reconstruction of the inside of meander bends. For example, when a point bar is rebuilt, a short bankfull bench could be constructed toward the downstream end to assist with the transition between the point bar and the downstream riffle.

3.4 Rootwad Revetments

Rootwad revetments are composed of "rootwads," which are downed trees that are buried in a riverbank with the root mass portion exposed towards the flow, and the stem or bole of the tree buried in the bank (Photograph G-7). Generally, the root system of the trees used as rootwads would be at least 3 feet in diameter. Rootwads are often placed in clusters along the outer meander bends of a river to form a protective layer against high shear stress impacting the riverbanks.

Photograph G-7. Rootwads along an outer meander bend.

Rootwads are usually used in conjunction with logs or boulders to create an integrated revetment, whereby the rootwad tree is laid on top of a footer log, to provide stability and achieve the desired angle that is necessary to maximize resistance to flow. Boulders are often placed between the rootwads to minimize erosion or scour around the rootwad, and to anchor the rootwads to increase their tolerance to shear stress. Since rootwad revetments have the potential for scour around the structure, particularly on the upper bank above the rootwad, the placement of the rootwad clusters is usually accompanied by vegetative plantings, brush layers, or matting to help stabilize the upper bank (Harman, 2004).

When properly installed and given measures to minimize scour around the structure, rootwads can provide a high level of stability in or near high stress bends. They would be used in conjunction with other bank treatments in areas of high to moderate near bank stress. Root wads would be particularly useful on the outside of meander bends, past the areas of highest near-bank stress, to provide a transition from harder treatments such as riprap and log vanes to a bank treatment that is softer in nature such as a bankfull bench.

3.5 Compartmentalized Placed Fill

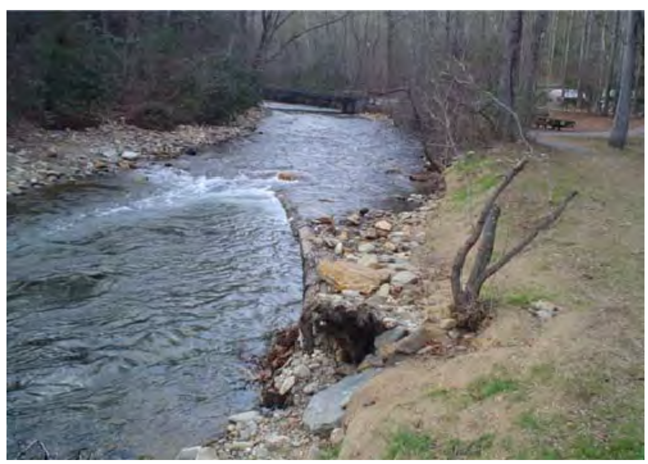
This technique consists of placing filled bags or tubes of organic material and stone on the riverbank to armor slopes. Envirolok™ is a trade name for a particular brand of bag. The bags are typically built into a wall unit using either straps or a locking spike to create a stable surface. The bags are composed of a synthetic material that is filled with a planting medium. Native plants are planted between the layers or lifts of bags to promote vegetation growth (Photograph G-8). The bags break down under UV exposure and can last from 10 years to over 50 years depending upon the amount of exposure.

Photograph G-8. Newly planted Envirolok™ bags.

Compartmentalized placed fill can be used on moderately steep banks or in areas of moderate to high shear stress. These areas occur in a variety of geomorphic positions, including the outside of broad meander bends, straight reaches where the thalweg is near the bank, and downstream of tight meander bends. The banks undergoing such treatment would be graded to a 2:1 slope or less, with bank soil removal as necessary. The compartmentalized placed fill would be placed from the toe of the bank to bankfull elevation. Above bankfull, the bank would be stabilized with a vegetative technique, including planting of herbaceous and shrub species.

3.6 Log Vane/Rock Vane

A vane is an in-stream structure that is used to deflect near-bank erosional forces away from unstable riverbanks. A log vane involves placement of a log with a rootwad anchored into the bank, facing upstream, and angled on a downward slope from bankfull elevation at the bank to the channel bed elevation at the end of the log (Photograph G-9). A footer consisting of a second log or boulders is placed beneath the log. Filter fabric is often placed along the footer, and the area between the log and the bank is backfilled to prevent undercutting of the vane. A rock vane is of similar geometry but constructed of large boulder sized rock.



Photograph G-9. Log vane.

Vanes are typically installed at the upstream end of an outer meander bend or other unstable area of moderate to high near bank stress to deflect flow away from the bank and dissipate energy. Typically, in Reaches 5A and 5B, vanes would be used in series on the outside of meander bends in conjunction with other techniques such as riprap or compartmentalized placed fill. For the most part, log and rock vanes can be used interchangeably. There are some circumstances in which it is difficult to install a log vane such as when the water is too deep or the bank is too low to adequately bury and anchor the log. There may be other situations where banks are too high or steep to be suitable for use of log vanes. In these instances, rock vanes may be used rather than log vanes.

Variations of the vane are barbs or bank spurs. These are small low rock or log structures oriented upstream, extending into the stream thalweg (i.e., the deepest portion of the river) to divert flow away from an eroding bank by helping to maintain the thalweg towards the center of the channel. (Photograph G-10). Usually a number of stream barbs are installed in series along the outside of a meander bend They differ from log vanes in that they typically do not protrude more than a third of the way into the river channel. Barbs transfer erosive velocity away from the stream bank through interruption of currents and cross-stream flow that develop within the meander bend. Barbs have been shown to be effective at redirecting flows and inducing deposition. They are typically used on meander bends with a larger radius of curvature that do not have extremely high sheer stress, and/or in sections of the river channel that are over-wide to help maintain sediment transport.

Photograph G-10. Bank spurs.

3.7 Articulated Concrete

Articulated concrete structures, of which A-Jacks are the most common brand, are pre-cast concrete blocks consisting of three perpendicular arms that are rigidly fixed at the center (Photograph G-11). These structures are placed along a toe of slope of bank to dissipate the energy of the water against the bank and therefore reduce erosion, and increase sedimentation. Voids in the matrix are often filled with soil and stone. The spacing of the

Photograph G-11. A-jacks along toe of bank.

articulated concrete/A-Jacks allows for the establishment of vegetation between the blocks. The blocks will often collect coarse and fine sediment when functioning properly so treated banks naturally revegetate as the systems become embedded in the stream bank. Tree management would be required as described in Section 3.1.

Articulated concrete may be used as an alternative to riprap in circumstances where it would not be possible to fully implement other types of bank treatment below the water line, such as when stabilization work is being performed while water is flowing in the channel. In these circumstances, a treatment incorporating articulated concrete may be used to protect the toe of the bank and prevent scour and undercutting of the bank.

3.8 Rock Riprap

Stone has long been used to provide immediate and permanent riverbank protection. One use of stone is riprap which consists of large angular rocks placed on the bank to reduce bank shear stress and erosion (Photograph G-12). Riprap is one of the most effective measures at the toe of a slope or unstable bank for preventing erosion. A primary advantage of riprap over vegetation is its immediate effectiveness with little to no establishment period. Riprap is typically placed on banks at a 2:1 slope but may be used on steeper bank slopes of up to 1.5:1. Stone size, shape, gradation, and density are all important design considerations.

Photograph G-12. Riprap placed along entire bank.

In some situations, joint planting is combined with riprap to provide some vegetation. Joint planting refers to the insertion of plugs and/or live stakes between the rocks to encourage the growth of riparian vegetation. The planting of cuttings in riprap helps to provide longer-term stability once the vegetation becomes established.

In Reaches 5A and 5B, riprap would be used on banks that are under high near-bank shear stress. The bank would be graded to the selected slope (with bank soil removal as necessary) and riprap would then be placed from the toe of the bank to a maximum of bankfull elevation. Above bankfull elevation, other applicable bank treatments would be used, such as coir matting and joint plantings (where appropriate), to revegetate the banks with herbaceous and shrub vegetation.

3.9 Articulated Concrete Block Revetment

An articulated concrete block (ACB) revetment system is a matrix of interconnected concrete block units installed to provide an erosion resistant revetment. An ACB revetment system consists of concrete block units that are typically connected by geometric interlock, cables, ropes, geotextiles, or geogrids to form a mattress. The concrete mattress overlays a geotextile fabric for subsoil retention.

A variety of proprietary ACB revetment systems are available. The thickness of the blocks typically ranges from 4 to 9 inches. The blocks are cast into interlocking or non-interlocking shapes and usually are cabled into mats but can be non-cabled. The blocks may be open cell or closed cell. Open-cell blocks allow for a greater space for soil to be placed into them or for sediment to fill in the open areas and to eventually become vegetated.

Articulated concrete block revetments are applicable in high-risk applications where no additional bank or grade movement is desired, particularly in areas of very high velocities and shear stresses. Its use is also advantageous in areas where reshaping of the banks is not desirable or possible. This stabilization measure was used selectively on the 1½ Mile Reach of the Housatonic (Photograph G-13).

Photograph G-13. Articulated concrete block revetment on 1½ Mile Reach.

4. Application of Stabilization Techniques to Housatonic Riverbank in Reaches 5A and 5B

This section describes the process used to analyze banks in Reaches 5A and 5B and the methods and assumptions used to identify bank stabilization techniques suited for application to the particular geomorphic conditions observed in those sub-reaches. Based on the bank conditions in these sub-reaches, stabilization techniques generally suitable to each type of condition were identified, as further described below. Sections 5 through 8 of this Appendix G present the resulting conceptual bank stabilization plans that would apply to remedial alternatives SEDs 5-8, SEDs 3 and 4, SED 9, and SED 10, respectively.

4.1 Approach and Assumptions

The first step in selecting an appropriate stabilization technique is to understand the physical characteristics and condition of the different bank segments along the 7 miles of river (14 miles of riverbank) in Reaches 5A and 5B. Bank conditions were estimated by evaluating aerial photographs, EPA-surveyed cross-sections and bank heights, and field observations.

Aerial photographs were used to identify the geomorphic position (i.e., inside or outside meander bends) of riverbanks within Reaches 5A and 5B as well as to characterize the meander bends as either tight or broad. Bank heights and bank angles were calculated from cross-sectional data collected by EPA in 1999, when EPA measured and quantified the channel cross-sectional geometry at 286 locations between the Confluence and Woods Pond. Using these cross-sectional data, bank height was calculated by measuring from the water level, as shown on the cross-section, to the top of bank. An approximate bank angle was also determined from these cross-sections. This information was used to help identify potential treatments by looking at bank height, bank angle, and water depth. Preliminary field observations were used to check bank conditions indicated by EPA, as well as to confirm initial characterization of bank steepness.

For purposes of this identification process, "tight" meander bends have been defined as those with a Radius of Curvature (Rc) of 200 feet or less. Rosgen (2006) uses a 2.2:1 ratio of Rc/bankfull width to calculate moderate or higher near bank shear stress. Based on field observations, bankfull widths in Reaches 5A and 5B appear to be around 70 to 80 feet, which would indicate a high shear stress for meander bends with an Rc of 154 to 176 feet or less. For this evaluation, a conservative Rc of 200 feet was used to differentiate between "tight" and "broad" meander bends; this ensured that all outer meanders with high shear stress would be identified and grouped together.

Based upon the range of conditions found along the Housatonic River in Reaches 5A and 5B, eight typical bank conditions were identified:

1) Outside of tight meander bends, banks > 4 feet in height;
2) Outside of tight meander bends, banks > 4 feet in height, with adjacent deep pools;
3) Outside of tight meander bends, banks < 4 feet in height;
4) Outside of broad meander bends, banks > 4 feet in height;

5) Inside of tight meander bends, typically with point bar formation;[5]

6) Straight reaches, banks > 4 feet in height, and under moderate shear stress;

7) Straight reaches, banks < 4 feet in height, and under moderate near-bank shear stress with deep runs;

8) Depositional banks and banks under low shear stress (variety of heights and locations) (see footnote 5 regarding Item 5 above).

As noted above, the assessment of riverbank conditions using the methods described above is necessarily preliminary. A detailed field assessment of bank conditions is not appropriate or feasible to support the evaluation of remedial alternatives. Further detailed field documentation and evaluation of bank conditions would be completed during the design phase once a remedial alternative has been selected.

For purposes of the current analysis, the following assumptions were made:

- Outside meander bends are typically areas of high shear stress. As discussed above, meanders with an Rc of 200 feet or less were considered to have high near-bank shear stress on the outer bank.
- The insides of meander bends are typically depositional and/or areas of low shear stress unless field observations indicated otherwise. (Field observations indicate that a few inside meander bends are under moderate shear stress due to an extremely tight radius of curvature.)
- If erosional areas are observed in a given bank, then that bank is deemed to be under high to moderate shear stress.
- The river channel should be no more than approximately 70 to 80 feet in width in riffles/runs to properly transport sediment. Straight reaches in the 80 to 100 foot range were observed to have excessive deposition as evidenced by mid and side channel bar formation. Where the channel was over 80 feet in width it was considered “over-wide”.
- Banks that are currently depositional will be depositional following remedial activities.
- In the absence of implementing stabilization measures that redirect flow, the thalweg of the channel will not vary greatly from pre- to post-remediation condition.

[5] There is some overlap between this category and category 8, since the insides of many tight meander bends are depositional areas. However, this category has been identified as a separate bank condition because of the presence of point bars.

- Bank heights were determined using EPA's cross-sectional data collected in 1999 (unpublished information that EPA provided to GE) at numerous locations in Reaches 5A and 5B, and measuring bank height, as shown on each cross-section, to the top of bank. However, specific data regarding bank height are not available for the entirety of Reaches 5A and 5B. Actual bank heights may differ from those estimated for this analysis. Selected measures would be modified as needed in final design to account for differences in bank height from those assumed.

Suitable bank stabilization techniques were then identified for each of the eight typical bank conditions in Reaches 5A and 5B.

4.2 Application of Bank Stabilization Techniques to Particular Riverbank Conditions

For the purposes of development of conceptual bank stabilization plans for the sediment remedial alternatives, the banks were grouped into the eight specific types listed above, based on each type's predominant characteristics or conditions that would affect the selection of stabilization techniques. The following describes each of these eight different riverbank (and associated river) conditions and the stabilization technique(s) that would be appropriate for implementation on that type of riverbank.

1) Outside of tight meander bends with banks over 4 feet in height

Banks greater than 4 feet in height on the outside of tight meander bends occur at many locations in the 5 miles of Reach 5A and are characterized by high near-bank shear stress, typically resulting in a steep erosional face and often lacking vegetation. Stabilization would consist of the removal of bank soil as necessary to grade the bank to a 2:1 slope. Riprap would be placed from the toe of the bank to bankfull elevation. Joint plantings of the riprap to augment vegetation and help reduce current velocities would occur. Above the bankfull elevation, the bank would be covered in coir matting and replanted with herbaceous vegetation and shrubs.

Rock or log vanes would be placed either singly or in series extending from the point of curvature through the meander bend to the point of tangency. The vanes would be spaced at varying intervals dependent upon the radius of the meander. In some locations, rootwads would be used toward the downstream end of the meander as a transition between the meander bend and the riffle to reduce shear stress. Rootwads typically would be used where, based on channel conditions, the thalweg remains along one of the banks as it comes out of the meander bend, creating higher shear stress and causing erosion.

In limited circumstances where there is a steep slope and an adjacent land use near the top of the bank that necessitates stable bank conditions, and where sloping the bank is not practicable, concrete block revetments can be used to prevent erosion and avoid harm to the adjacent structure(s) or land use**.** Currently this stabilization treatment is prescribed in only one location in Reaches 5A and 5B – on the outside meander bend located at River Mile 133.16, where there is a steep slope and a residential area near the top of bank.

2) Outside of tight meander bends with banks greater than 4 feet in height and deep pools

Banks greater than 4 feet in height and having deep pools on the outside of tight meander bends are found in several locations below New Lenox Road in the lower portion of Reach 5B, where the outside meander bend is adjacent to former agricultural fields that are higher than the surrounding floodplain. The maximum pool depth per meander bend ranges from 10 to 18 feet, and the pool extends for a distance around each meander bend. Therefore, the use of flow diversion structures such as vanes or spurs as stabilization methods would likely be infeasible. In this area, flow velocities are lower than in upstream areas due to the backwater effects of Woods Pond Dam, but the high banks prevent overbank flooding into the floodplain that would release shear stress during flood events. The upper portions of these banks are vegetated with herbaceous vegetation in most places.

These banks would be stabilized by placing riprap from the toe of the bank to the ordinary high water line (see footnote 4 above for definition). Above the ordinary high water line, soil would be removed as necessary to form a 2:1 slope, and a brush mattress would be installed on the bank. The ordinary high water line is used in the downstream portion of Reach 5B to define the extent of work because bankfull indicators are lacking due to the backwater effect of Woods Pond Dam.

3) Outside of tight meander bends with banks less than 4 feet in height

Tight meander bends with bank heights less than 4 feet are found in Reach 5B. Above New Lenox Road, in the upper portion of Reach 5B, the backwater effects of Woods Pond Dam, while minor, can be observed. Many of the banks are around 4 feet in height and the adjacent pools are 6 to 8 feet deep. Because the banks are lower than typically observed in Reach 5A, shear stress is not as high. However, the banks are still erosional and often vertical and lacking vegetation. These outside meander bend banks would be stabilized by removing soil and rebuilding the bank at a 2:1 slope with compartmentalized placed fill. Vegetation would be planted in the compartmentalized placed fill. Log or rock vanes and root wads would also be used to redirect flow.

Below New Lenox Road, the pools in the meander bends with banks less than 4 feet in height have maximum depths of 10 to 18 feet and extend for a distance around each meander bend. Therefore, the use of flow diversion structures such as vanes or spurs as stabilization methods would likely be infeasible. In this area, flow velocities are lower than in upstream areas, the banks are not as high, and the river more readily reaches the adjacent floodplain during flood events. However, as with the previously-described similar banks above New Lenox Road, these outside meander bends are typically under moderate shear stress, are steep to moderately steep and erosional, and are mostly vegetated in their upper portions. These banks would be stabilized by placing riprap from the toe of the bank to the ordinary high water line. Above the ordinary high water line, soil would be removed and a vegetated geogrid would be used to reconstruct and stabilize the bank. The vegetated geogrid would be planted with shrubs and herbaceous vegetation.

4) Outside of broad meander bends

The outside banks of broad meander bends are under less shear stress than the tight meanders described above. These banks are of varying heights, slopes, and vegetative condition. There are often short erosional areas followed by well-vegetated stretches.

In most cases, these banks can be stabilized with compartmentalized placed fill in combination with log/rock vanes. In a few areas, the banks would need protecting only with coir matting, with log/rock vanes used to redirect flows away from the bank. A key objective would be to re-establish the vegetation to provide stability. The strategic use of prevegetated coir mats would assist in reestablishing vegetation in areas where shear stress is slightly higher. Installation of the compartmentalized placed fill would require the removal of soil, while areas stabilized with coir matting would not unless bank slopes were greater than 2:1.

5) Inside of tight meander bends

Some insides of tight meander bends are stable, while others are unstable. Those that are stable are characterized by low shear stress and are depositional, with a point bar developing. In such areas, the flow coming around the tight meander bend primarily affects the outside bank, resulting in low shear stress, deposition, and the formation of a point bar on the insides of the bend. The bank angle in these areas is typically very low (4:1 or less). While the point bar is often considered a river bed feature, the upper portion of the bar is actually part of the bank and can be either sparsely or heavily vegetated. These banks are similar to those in Category 8 described below in that they are depositional areas. What sets them apart is that they contain a stable point bar.

On these banks, the point bar would be rebuilt following sediment remediation and the bank would be graded as necessary to a stable geometry. The upper slopes of the point bar would be covered in coir matting and planted with herbaceous vegetation and shrubs. Pre-vegetated mats could be used on the upper slope of the point bar to help initiate vegetative growth. Downstream of the point bar, a short bankfull bench would be built or the bank reconstructed at a gentle slope to help reduce stress on the point bar during flood events. Construction of the bankfull bench would require removal of bank soil.

Because of existing channel geometry, not all inside meander bends are stable or contain well-developed point bars. Those inside meander bends that are unstable are characterized by moderate shear stress. The bank angle in these areas is typically steeper than those observed on stable point bar systems. It is unlikely that a stable point bar could be constructed in these meander bends. These banks would be graded to the degree necessary to stabilize them (with bank soil removal as appropriate), covered with coir matting, and revegetated with shrubs and herbaceous vegetation.

6) *Straight reaches with banks greater than 4 feet in height and under moderate shear stress*

Straight reaches with bank heights greater than 4 feet under moderate shear stress occur in several geomorphic locations on the river. The first are the short straight reaches between meander bends. Typically, as flow comes around the outside of the meander bend, the thalweg remains close to that bank, creating slightly higher shear stress along that bank than along the opposite bank. In some other locations, these banks may be susceptible to avulsions[6] or shoot cutoffs.

These banks would receive one of three treatments depending upon the anticipated amount of shear stress, which is dependent upon the tightness of the meander bend (radius of curvature). Banks that are subject to moderate to high shear stress would be stabilized with compartmentalized placed fill. Banks that are under moderate shear stress would have a bankfull bench constructed and covered in coir matting. In some locations where it is determined that the shear stress along the bank may be low, the bank would be graded to a degree necessary to be stable and covered with coir matting and revegetated. The treatments involving compartmentalized placed fill and bankfull bench construction would require removal of bank soil.

Other banks greater than 4 feet in height occur along lengthy, relatively straight reaches that are often "over-wide," which leads to the development of the side channel bars. These banks are characterized by periodic undercutting or areas of erosion resulting from the thalweg "wandering" from one side of the channel to the other as side channel

[6] An avulsion is the rapid abandonment of a river channel and the formation of a new river channel. The term meander cutoff is often used to describe this process as well.

bars are formed. The bank with the side channel bar is under low shear stress while the opposite bank is under moderate shear stress.

Such banks would receive several treatments depending upon bank height, length of reach, and channel conditions (width, slope). Banks with low shear stress would be graded as necessary, covered with coir matting, and revegetated. Those that are under moderate shear stress would receive a bankfull bench. In segments that are over-wide, the bankfull bench would be constructed into the channel as opposed to being excavated from the existing bank. Banks where the bankfull bench is built into the existing bank would require removal of bank soil. In many of these segments, alternating bank spurs would be installed to direct and maintain the thalweg toward the center of the channel.

7) Straight reaches with banks less than 4 feet in height and under moderate shear stress

The lower portion of Reach 5B is influenced by the backwater effects of Woods Pond Dam. In this portion of the river, there are no riffles, and the river channel between the meander bends consists of deep (5 to 8 feet) runs. In some portions of this river segment, the thalweg runs along one edge of the channel. Typically, this occurs on the bank downstream of the outside meander bend. While vegetated, this bank often shows signs of periodic erosion, indicating moderate shear stress on the bank.

These banks would be stabilized by placing riprap from the toe of the bank to the ordinary high water line. Above the ordinary high water line, the bank would be graded to a 2:1 slope, covered in coir matting, and revegetated with herbaceous vegetation and shrubs. Grading the slope would require removal of bank soil where the existing slope exceeds 2:1.

8) Depositional banks and banks under low shear stress

Depositional banks and banks under low shear stress occur throughout Reaches 5A and 5B in a variety of geomorphic positions. They are most commonly found in the short straight reaches downstream of a point bar on the inside of a tight meander bend. Typically, as flow comes around the tight meander bend, the thalweg and main current velocities are closer to the opposite bank. These areas downstream of the point bar are initially under little near-bank stress and are often depositional. There is not a sharp demarcation between these banks and those described in Category 5 above. Often the point bar feature transitions into these depositional banks.

These banks also occur on the inside of broad meander bends, and they can occur on either bank on long straight reaches. In this latter situation, the opposite bank is often under moderate shear stress. These banks typically have a gentle slope and are usually well vegetated with herbaceous and shrub vegetation.

These banks would be graded as necessary to maintain stability, covered in coir matting, and revegetated with herbaceous vegetation and shrubs. In segments that are determined to have slightly higher near-bank stress, a bankfull bench would be constructed to reduce shear stress along the bank during periods of higher flow. While it may be necessary to remove bank soil in a few locations to implement this approach, for the most part removal of bank soil is not anticipated.

* * *

Table G-1 summarizes the bank stabilization techniques or combination of techniques that have been identified for potential use and lists for each the associated bank conditions where such measures have been preliminarily identified for application to Reaches 5A and 5B under the sediment remedial alternatives.

Table G-1 Application of Bank Stabilization Techniques to Bank Conditions

Stabilization Technique	Geomorphic Position of Bank	Meander Bend Radius	Bank Height	Shear Stress Condition
Concrete Block Revetment	Outside meanders	< 200 ft	> 4 ft	Very High
Riprap with Joint Planting	Outside meanders	< 200 ft	> 4 ft	High
Root Wads	Outside meanders	< 200 ft	> 4 ft	High
Log or Rock Vane	Outside meanders	NA	> 4 ft	High
Bankfull Bench	Straight reaches	NA	> 4 ft	Moderate
Compartmentalized Placed Fill	Outside meanders and straight reaches	> 200 ft	> 4 ft	Moderate
	Outside meanders	< 200 ft	< 4 ft	Moderate
Vegetated Geogrid with Riprap	Outside meanders	< 200 ft	< 4 ft	Moderate
Bank Spurs	Straight reaches	NA	> 4 ft	Moderate
Brush Mattress	Outside meanders	NA	> 4 ft	Moderate
Coir Matting with Riprap	Straight reaches	NA	< 4 ft	Moderate to Low
Grade Bank/Coir Matting	Inside broad meanders and straight reaches	> 200 ft	All heights	Low
Reshape Point Bars	Inside meanders	Low	< 4 ft	Low
Live Stakes	Used in conjunction with other techniques under varying bank conditions			

Note: Articulated concrete may be used as an alternate to riprap, in conjunction with certain techniques, to stabilize the toe of the bank under alternatives in which the stabilization work would be performed while water is flowing in the channel.

5. Stabilization Approach for SED 5 through SED 8

In applying the guidelines discussed above, we have first considered the bank stabilization techniques for SED 5 through SED 8, since all bank stabilization work in Reaches 5A and 5B under those alternatives would be performed in the dry, in conjunction with sediment removal, with the river diverted through the use of sheetpiles. This section describes the bank stabilization techniques identified for those alternatives. These stabilization techniques would be subject to modification or revision during remedial design. Under these sediment alternatives, all banks in Reaches 5A and 5B (7 miles of river; 14 miles of riverbank) would be stabilized. The conceptual bank stabilization techniques identified for these sub-reaches are depicted on Figures G-2 through G-9.

Selection of the various bank stabilization techniques shown on these figures was based on application of the guidelines presented in Table G-1. However, in certain locations, the technique selected deviated from those guidelines based upon observed site conditions and use of professional judgment that a different treatment was necessary due to in-stream conditions. These deviations are as follows:

Reach 5A

- Mile 135.04 to 135.00 - Left bank – This bank is under high shear stress. The upstream confluence of the West Branch of the Housatonic is forcing the thalweg against the left bank. Riprap and joint plantings would be used to stabilize this bank.
- Mile 134.97 to 134.93 - Left bank – This inside meander bend is very tight and lacks a point bar. A rebuilt point bar would likely be unstable and not remain in place. The bank would be graded as necessary to maintain stability and protected with coir matting to allow vegetation to redevelop.
- Mile 134.30 to 134.18 – Right bank – This bank is very high (30+ feet) and composed of native soils. It is in a long straight reach that normally would be graded. Due to the height of the bank, grading is not practicable. The toe of the bank would be stabilized with riprap and the upper bank would remain vegetated.
- Mile 134.15 to 134.09 – Right bank – Grading and covering with coir would normally be prescribed for this location. However, the entire right bank in this location is under moderate to high shear stress. Compartmentalized placed fill would be used to stabilize this bank from the bridge to almost the apex of the meander bend.
- Mile 134.01 to 133.98 – Both banks downstream from the bridge would be stabilized with riprap to prevent erosion associated with the bridge during high flow events.

- Mile 133.07 to 133.04 – Left bank – This bank is erosional and appears to be under high shear stress due to in-channel geometry. The bank would be stabilized with riprap and joint plantings as opposed to grading and covering with coir matting or building a bankfull bench.
- Mile 133.04 to 133.02 – Right bank – The bank is relatively low at this location of a former avulsion (defined in note 6 above). The outer bank at this meander bend is currently building up, and therefore, does not require as rigorous armoring. This bank would be stabilized with compartmentalized placed fill instead of riprap and joint plantings.
- Mile 132.87 to 132.83 – Right bank – The bank is relatively low at this former avulsion location. The outer bank at this meander bend is currently building up. This bank would be stabilized with compartmentalized placed fill instead of riprap and joint plantings.
- Mile 131.35 to 131.29 – Right bank – The right bank is under only moderate shear stress. However, due to the presence of the wastewater treatment plant next to the river, riprap placed from toe of the bank to bankfull elevation would be used to protect this critical infrastructure.

<u>Reach 5B</u>

- Mile 128.88 to 128.81 – Right bank – This inside meander bend is relatively high and vertical and lacks a stable point bar. The bank would be graded and covered with coir matting to stabilize the bank while vegetation redevelops.
- Mile 128.78 to 128.70 – Left bank – This inside meander bend is relatively high and vertical and lacks a stable point bar. The bank would be graded and covered with coir matting to stabilize the bank while vegetation redevelops.
- Mile 128.17 to 128.12 – Right bank – This outside meander bend is under only low shear stress because of backwater effects. Only the lower portion of bank would be stabilized with coir matting following remediation. Along a portion of this bank, the upper bank consists of native soils (not fluvial deposits) and would not be disturbed if possible. If disturbance is necessary, the coir matting stabilization would occur on the upper bank as well.
- Mile 128.12 to 128.05– Left bank – This outside meander bend is quite low and is under low shear stress due to the backwater effects of Woods Pond. The bank would be stabilized with coir matting. This treatment would be sufficient to prevent erosion while vegetation develops following remedial activities.

Under the bank stabilization approach identified for SED 5 through SED 8 (as shown on Figures G-2 through G-9), the relative amount of each stabilization technique over the entirety of Reaches 5A and 5B is as follows:

- Concrete block revetment – 0.3%
- Riprap and joint planting– 18.4%
- Compartmentalized placed fill – 16.2%
- Bankfull bench – 7.9%
- Coir fabric with riprap (Reach 5B only) – 2.0%
- Vegetated geogrid with riprap (Reach 5B only) – 2.8%
- Grade bank and cover with coir matting – 37.3%
- Reshape point bar and cover with coir matting – 14.3%
- Brush mattress – 0.8%

Application of these bank stabilization techniques would involve or be accompanied by removal of riverbank soil in a number of locations in Reaches 5A and 5B. In total, SED 5 through SED 8 would involve removal of 35,000 cubic yards (cy) of bank soil in those sub-reaches. Riverbank soil removal would be required for the following treatments:

- Placement of riprap;
- Compartmentalized placed fill;
- Bankfull benches cut into the bank;
- Vegetated geogrids; and
- Coir with riprap.

For the most part, soil removal would not be required when banks are graded and covered with coir matting, as grading would result in a stable slope for most of those banks. Grading and soil removal may be necessary in areas where the banks are under low shear stress but are relatively steep, in order to achieve a less steep slope.

The volume of soil removal was calculated using EPA's cross-sectional data collected in 1999 (mentioned above). As noted above, using these cross-sectional data, bank height was determined by measuring from the water level, as shown on the cross-section,[7] to the top of bank; and an approximate bank angle was also determined for these cross-sections. A bank height and a bank angle were then assigned to each treatment bank. Soil volumes were estimated by determining the difference between existing bank angle and the proposed angle.

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[7] It is not known what stage this water level represents, but is assumed to be around base flow elevation, which is approximately a foot below the ordinary high water elevation.

Assumptions used in estimating the removal volumes included the following:

- All banks with riprap and joint planting would be sloped to 2:1.
- Bankfull benches would be 5 feet wide and sloped from 2:1 from the toe of the bank to the bench and then 2:1 from the bench to top of bank.
- Bank height was determined as described above (by measuring from the water level shown on the EPA cross-section to the top of bank).
- Compartmentalized placed fill banks would be sloped to 2:1.
- Vegetated geogrid banks would be sloped to 2:1.
- Coir matting with riprap would be sloped to 2:1.
- Rebuilding point bars would not require removal of bank soil.
- Grading banks in depositional or low shear stress areas would not require removal of bank soil.

6. Stabilization Approach for SED 3 and SED 4

This section presents the conceptual bank stabilization techniques identified for SED 3 and SED 4, subject to modification or revision during remedial design. Like SED 5 through SED 8, SED 3 and SED 4 would involve stabilization of all riverbanks in Reaches 5A and 5B.

In Reach 5A, the bank stabilization activities under both of these alternatives would be conducted in the dry in conjunction with the removal of river sediments. As a result, the conceptual bank stabilization techniques identified for that sub-reach under SED 3 and SED 4 are the same as those identified for Reach 5A under SED 5 through SED 8, as described in Section 5 above.

In Reach 5B, however, SED 3 would involve monitored natural recovery for the sediments in all of Reach 5B, and SED 4 would involve sediment removal through dry excavation in the upstream part of that sub-reach and thin-layer capping (to be performed in the wet) in the downstream part of that sub-reach (generally downstream of New Lenox Road). Therefore, bank stabilization activities in all of Reach 5B under SED 3 and in the downstream part of Reach 5B under SED 4 would be performed from the riverbank while water is present in the river. In these circumstances, some of the riverbank stabilization techniques for those areas would be modified from those described above, because implementation of some of the techniques identified for SED 5 through SED 8 would be impractical or dangerous while flowing water is present. As a result, the stabilization techniques identified for Reach 5B under SED 3 and for the downstream portion of Reach 5B under SED 4 would need to be modified. Those modifications include the following:

- Use of vanes to reduce near-bank shear stress and modify flow in outer meander bends would be limited by water depth. Construction of log vanes would not be practical in pools exceeding 4 feet in depth, as it would be difficult to anchor the end of such vanes in the river channel; and construction of vanes from rock or riprap would not be practical in pools with a depth of 6 feet or greater. Thus, rock vanes or riprap (extending from toe of the bank to a maximum of bankfull elevation) would be used in place of log vanes in areas with depths of 4 to 6 feet, and vanes could not be used at all in pools with a depth of 6 feet or greater.

- Rebuilding point bars in Reach 5B would not be necessary as no sediment removal would be performed. All inside meander bends would be subject to grading and covering with coir matting.

- Use of compartmentalized placed fill would be limited. Compartmentalized placed fill could be placed above the ordinary high water level, but constructing a solid foundation for the bags might not be possible in all areas. At a minimum, it would be necessary to armor the toe of the bank below the bags with riprap or A-jacks to prevent undercutting. In areas where use of compartmentalized placed fill is determined to be infeasible due to soil/sediment conditions (e.g., very wet or lacking sufficient strength), it would be necessary to use riprap with joint plantings to stabilize the banks.

- Placement of coir matting below the ordinary high water level would not be practicable. In some areas, the matting would be placed to about 1 foot above that level and the remaining portion of the bank and the bank below the ordinary high water level would be stabilized with riprap or A-jacks. Banks that are considered depositional would not need treatment below the ordinary high water level.

- Similarly, in constructing bankfull benches, coir matting on the lower portion of the bench would be anchored with riprap or A-jacks.

Bank treatments of riprap with joint plantings, brush mattresses, vegetated geogrid, and coir matting with riprap, would not require modification.

For SED 3, the conceptual bank stabilization techniques identified for Reaches 5A and 5B – which are the same as those for SED 5 though 8 in Reach 5A and include modifications in Reach 5B – are depicted on Figures G-10 through G-17. Under this approach, the relative amount of each stabilization technique over the entirety of Reaches 5A and 5B under SED 3 is as follows:

- Concrete block revetment – 0.3%
- Riprap and joint planting – 18.4%

- Compartmentalized placed fill – 8.2%
- Compartmentalized placed fill with riprap (Reach 5B only) – 8.0%
- Bankfull bench – 7.0%
- Bankfull bench with riprap (Reach 5B only) – 0.9%
- Coir fabric with riprap (Reach 5B only) – 2.0%
- Vegetated geogrid with riprap (Reach 5B only) – 2.8%
- Grade bank and cover with coir matting – 42.9%
- Reshape point bar and cover with coir matting – 8.7%
- Brush mattress – 0.8%

For SED 4, the conceptual bank stabilization techniques identified for Reaches 5A and 5B – which are the same as those for SED 5 though 8 in Reach 5A and the upstream portion of Reach 5B and include modifications (as described above) in the downstream portion of Reach 5B – are depicted on Figures G-18 through G-25. Under this approach, the relative amount of each stabilization technique over the entirety of Reaches 5A and 5B under SED 4 is listed below. (These relative amounts are the same as those identified for SED 3 except for compartmentalized placed fill and such fill with riprap.)

- Concrete block revetment – 0.3%
- Riprap and joint planting – 18.4%
- Compartmentalized placed fill – 15.2%
- Compartmentalized placed fill with riprap (downstream part of Reach 5B only) – 1.0%
- Bankfull bench – 7.0%
- Bankfull bench with riprap (downstream part of Reach 5B only) – 0.9%
- Coir fabric with riprap (Reach 5B only) – 2.0%
- Vegetated geogrid with riprap (Reach 5B only) – 2.8%
- Grade bank and cover with coir matting – 42.9%
- Reshape point bar and cover with coir matting – 8.7%
- Brush mattress – 0.8%

Under both SED 3 and SED 4 (as with SED 5 through SED 8), application of these bank stabilization techniques would involve or be accompanied by removal of riverbank soil in a number of locations in Reaches 5A and 5B. For these alternatives, the total volume of bank soil removal, the stabilization treatments with which such soil removal would be associated, and the methods for and assumptions used in calculating the volume of soil removal are the same as those described in Section 5 for SED 5 through SED 8. Like those alternatives, SED 3 and SED 4 would each involve removal of a total of 35,000 cy of bank soil.

7. Stabilization Approach for SED 9

SED 9 would likewise involve stabilization of the riverbanks in Reaches 5A and 5B, including removal of 35,000 cy of bank soils. However, SED 9 would differ from the sediment alternatives discussed above in that it would involve performance of the bank stabilization and bank soil removal work in both Reaches 5A and 5B in the wet while water is flowing in the channel, using equipment operating from the river bottom in Reach 5A and barge-mounted equipment in Reach 5B.

In these circumstances, some of the riverbank stabilization techniques have been modified for SED 9, because (as noted above for SED 3 and SED 4 in Reach 5B) implementation of some of the techniques identified for SED 5 through SED 8 is impractical while water is flowing in the channel. The presence of flowing water decreases visibility and is inherently more dangerous. Additionally, shaping of sands and fine sediments (such as in constructing a point bar) is not practical in the wet, as the substrate will not hold form and will wash away. Most of the modifications necessary for SED 9 are the same as those described in Section 6 for the SED 3 and SED 4 bank stabilization work in Reach 5B areas where the work would be performed in the wet. In addition, the bank stabilization under SED 9 would require additional modifications for techniques not used in Reach 5B under SED 3 or SED 4. Those additional modifications are as follows:

- Fine shaping and grading of the lower portion of the point bars would not be possible in the wet. To help promote point bar development, the general shape of the lower point bar would be constructed using coarse gravel or larger material.

- While concrete block revetment matting would still be used, the revetment mat would only extend to the ordinary high water level. Riprap would be used to stabilize the bank below the concrete revetment mat to the toe of the bank.

Bank treatments of riprap, brush mattresses, vegetated geogrid, and coir matting with riprap would not require modification for SED 9.

Figures G-26 through **G-33** show the stabilization treatments that would be used under SED 9. Under this approach, the relative amount of each stabilization technique over the entirety of Reaches 5A and 5B under SED 9 is as follows:

- Concrete block revetment with riprap – 0.3%

- Riprap and joint planting– 21.0%
- Compartmentalized placed fill with riprap – 13.4%
- Bankfull bench with riprap – 7.8%
- Coir fabric with riprap (Reach 5B only) – 14.4%
- Vegetated geogrid with riprap (Reach 5B only) – 2.8%
- Grade bank and cover with coir matting – 25.2%
- Reshape point bar and cover with coir matting – 14.3%
- Brush mattress – 0.8%

Again, as with the alternatives discussed above, application of these bank stabilization techniques in SED 9 would involve or be accompanied by removal of riverbank soil in a number of locations in Reaches 5A and 5B, with a total removal of 35,000 cy. The stabilization treatments with which such bank soil removal would be associated, as well as the methods for and assumptions used in calculating the volume of soil removal, are the same as those described in Section 5 for SED 5 through SED 8.

8. Stabilization Approach for SED 10

Under SED 10, riverbank stabilization and associated bank soil removal would occur only in selected riverbank areas in Reaches 5A and 5B, based on criteria described in the text of this Revised CMS Report. The areas subject to stabilization under SED 10 total 1.6 miles and represent approximately 12**%** of the overall length of the riverbanks in Reaches 5A and 5B. The bank stabilization in Reach 5A would be performed in the dry, in conjunction with sediment remediation, while the river is diverted by sheetpiles; and the bank stabilization in Reach 5B would be performed in the wet from the top of the bank since SED 10 would not involve any sediment remediation in Reach 5B.

This partial or intermittent approach to stabilizing riverbanks is a standard practice. A review of river stabilization projects constructed in the past 15 years reveals that riverbank stabilization is often undertaken on discrete or intermittent portions of banks along a given river stretch, as would occur under SED 10. Such projects are undertaken at a wide range of scales ranging from <100 feet to thousands of feet, may include one or both banks, and may include one or multiple stabilized areas. Various guidance documents recognize this approach and incorporate, explicitly or implicitly, the associated need to consider in design the potential impacts of the stabilization measures on non-stabilized areas of the riverbank both upstream and downstream of the stabilized banks (e.g., Federal Interagency Stream Restoration Working Group (FISWRG), 2001; VDCR, 2004; Fischenich, 2001; USACE, 1997).

Where upstream and downstream impacts of the stabilization measures on non-stabilized banks occur, they appear to be most often associated with traditional stabilization measures such as bank armoring with concrete and other smooth materials. These "hard" techniques tend to transfer scouring and erosion problems downstream by reducing bank roughness and increasing velocity (Li and Eddleman, 2002). Even traditional armoring techniques such as riprap, however, rarely affect the channel more than a few feet upstream and downstream (Fischenich, 2001). Moreover, bioengineering techniques are typically used in intermittent bank stabilization applications. Those techniques use vegetation, rocks, and vanes, all of which serve to reduce flow velocity, dissipate and redistribute energy, and reduce erosional forces in the stabilized area (USACE, 1997; Li and Eddleman, 2002). Vegetation on the banks tends to increase channel roughness, thus lowering velocity. Vanes and spurs dissipate flow velocity and direct flow away from the banks towards the center of the channel. As a result, these techniques prevent or minimize energy displacement that could affect adjacent or nearby bank segments.

There are a number of examples where stabilization of intermittent bank segments along a longer stretch of river has been successfully implemented with the involvement and/or funding of resource agencies. In the New England region, for example, the Franklin Regional Council of Governments (FRCOG) sponsored the Turners Falls/Northfield Mountain project to stabilize 13 bank segments on the Connecticut River, totaling approximately 11,470 linear feet of riverbank. FRCOG's evaluation of this project indicated that the use of bioengineering stabilization methods in these locations successfully stabilized eroding banks and slopes while protecting the integrity of non-stabilized sections of the river (FRCOG, 2003 and 2010). Another example is a project performed by the White River Partnership (a partnership among the U.S. Forest Service, Natural Resource Conservation Service, U.S. Fish and Wildlife Service, and Vermont Agency of Natural Resources) to stabilize three bank segments on the White River ranging in length from 300 to 800 feet to address specific erosion problems. EPA has identified the White River project, among other Case Study Watersheds, as illustrative of successful bank restoration (USEPA, 2006).

To develop conceptual bank stabilization techniques for SED 10, we first selected conceptual stabilization measures for the bank segments that were identified for remediation/stabilization under SED 10 in the August 2009 *Work Plan for Evaluation of Additional Remedial Alternatives*. Selection of those measures was based on application of the same guidelines used for the other alternatives (as they would pertain to the identified bank segments), with the modifications for Reach 5B to include bank treatments that can be implemented while water is present in the river. A preliminary analysis was then performed, consistent with the guidance referenced above, to evaluate the potential impacts of the stabilization measures in those bank areas on the proximate upstream and downstream banks that would not be stabilized. This evaluation included an analysis of each of the 25 bank segments identified for remediation/stabilization in the August 2009 Work Plan. For 18 of those segments, it was determined that additional stabilization would not be necessary to address potential impacts to upstream or downstream non-stabilized banks. The preliminary analysis showed that, in most cases, the identified stabilization treatments, while stabilizing erodible banks, started and ended on stable banks that were under low to moderate shear stress, and that the identified stabilization methods would not shift erosive forces to upstream or downstream banks.

However, this preliminary analysis indicated the need to extend the bank stabilization identified in the 2009 Work Plan at seven locations, to avoid or minimize adverse impacts on non-stabilized banks. These extensions were necessary to allow for the placement of vanes, to prevent undercutting of stabilization measures, and to stabilize adjacent erosional banks. The resulting bank stabilization areas and measures for SED 10, including those extensions, are shown on Figures G-34 through G-40.

The seven areas in which the originally proposed bank stabilization for SED 10 has been extended to address potential impacts on proximate banks are as follows:

- Mile 133.85 to 133.84, Left bank – A small bend in the bank is functioning as a meander bend and the thalweg is running along this bank creating bank erosion. Extending the stabilization upstream to a point where the thalweg is further from the bank and the bank is under lower shear stress would prevent undermining of the SED 10 stabilization in this meander bend.
- Mile 133.51 to 133.48, Left bank – This outside meander bend is under high shear stress. The stabilization would be extended upstream to encompass the entire meander bend to prevent undermining of the SED 10 stabilization and to allow for placement of a log/rock vane. The left bank downstream is also erosional and stabilization measures would be extended downstream to the beginning of the next meander bend where the near bank stress is low.
- Mile 133.20 to 133.16, Right bank – This outside meander bend is under high shear stress. Stabilization measures would be extended upstream to encompass most of the meander bend to prevent undermining of the SED 10 stabilization on this bank.
- Mile 133.12 to 133.10, Right bank – Erosion along this bank extends downstream to Mile 133.07. Stabilization measures would be extended downstream to encompass this existing erosion.
- Mile 131.51 to 131.48, Left bank – The entire outside meander is under high shear stress. Stabilization measures would be extended upstream to allow for the placement of a log/rock vane to reduce shear stress on this bank and to prevent undermining of the SED 10 stabilization at this location.

- Mile 129.71 to 129.66. Left bank - The entire outside meander is under high shear stress. Stabilization measures would be extended upstream to allow for the placement of log/rock vanes to reduce shear stress on this bank and to prevent undermining of the SED 10 stabilization in this meander bend.
- Mile 129.2 to 129.17, Left bank – This outside meander bend is under high shear stress. Stabilization measures would be extended upstream to allow for placement of a log/rock vane and to prevent undermining of the SED 10 stabilization in this meander bend.

Under the bank stabilization approach identified for SED 10, the relative amount of each stabilization technique over the limited portions of Reaches 5A and 5B subject to stabilization (including the above-described extensions) is as follows, with the total length of Reaches 5A and 5B subject to each technique shown in parentheses:[8]

- Concrete block revetment – 2.5% of stabilized area (0.3% of Reaches 5A and 5B)
- Riprap and joint planting – 46.6% of stabilized area (5.4% of Reaches 5A and 5B)
- Compartmentalized placed fill – 11.9% of stabilized area (1.4% of Reaches 5A and 5B)
- Compartmentalized placed fill with riprap – 20.8% of stabilized area (2.4% of Reaches 5A and 5B)
- Bankfull bench – 5.3% of stabilized area (0.6% of Reaches 5A and 5B)
- Grade bank and cover with coir matting – 12.9% of stabilized area (1.5% of Reaches 5A and 5B)

Application of these bank stabilization techniques would involve or be accompanied by removal of riverbank soil at the selected locations in Reaches 5A and 5B. The amount of sediment removal was calculated as described in Section 5. In total, SED 10 would involve removal of 6,700 cy of bank soil in Reaches 5A and 5B.

During final remedial design, a more detailed evaluation would be made of the potential impacts of the identified bank stabilization measures for SED 10, via energy displacement, on non-stabilized areas of the riverbank immediately upstream and downstream of the stabilized banks. If it is determined that negative impacts on stability would occur in any additional areas, further adjustments incorporating

[8] As noted above, bank stabilization under SED 10 would be performed on a total of only approximately 12% of the riverbanks in Reaches 5A and 5B.

appropriate bioengineering practices would be implemented at those locations to address the impacts.

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135.1
135
134.9
1
134.8
134.7
134.6
134.5
134.4
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill
Bankfull Bench
Vegetated Geogrid with Riprap
Brush Mattress
Coir with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 5 Through SED 8
Conceptual Bank Stabilization
AECOM
Figure
G-2


134.1
134.2
134.3
134.4
134
133.9
133.8
133.7
Apply riprap along toe of slope only do not apply on upper slope
Build bankfull bench into channel
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill
Bankfull Bench
Vegetated Geogrid with Riprap
Brush Mattress
Coir with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 5 Through SED 8
Conceptual Bank Stabilization
AECOM
Figure
G-3


133.7
133.6
133.4
133.3
133.2
133.1
133
132.9
132.8
132.7
132.6
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill
Bankfull Bench
Vegetated Geogrid with Riprap
Brush Mattress
Coir with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 5 Through SED 8
Conceptual Bank Stabilization
AECOM
Figure
G-4

SED 5 Through SED 8

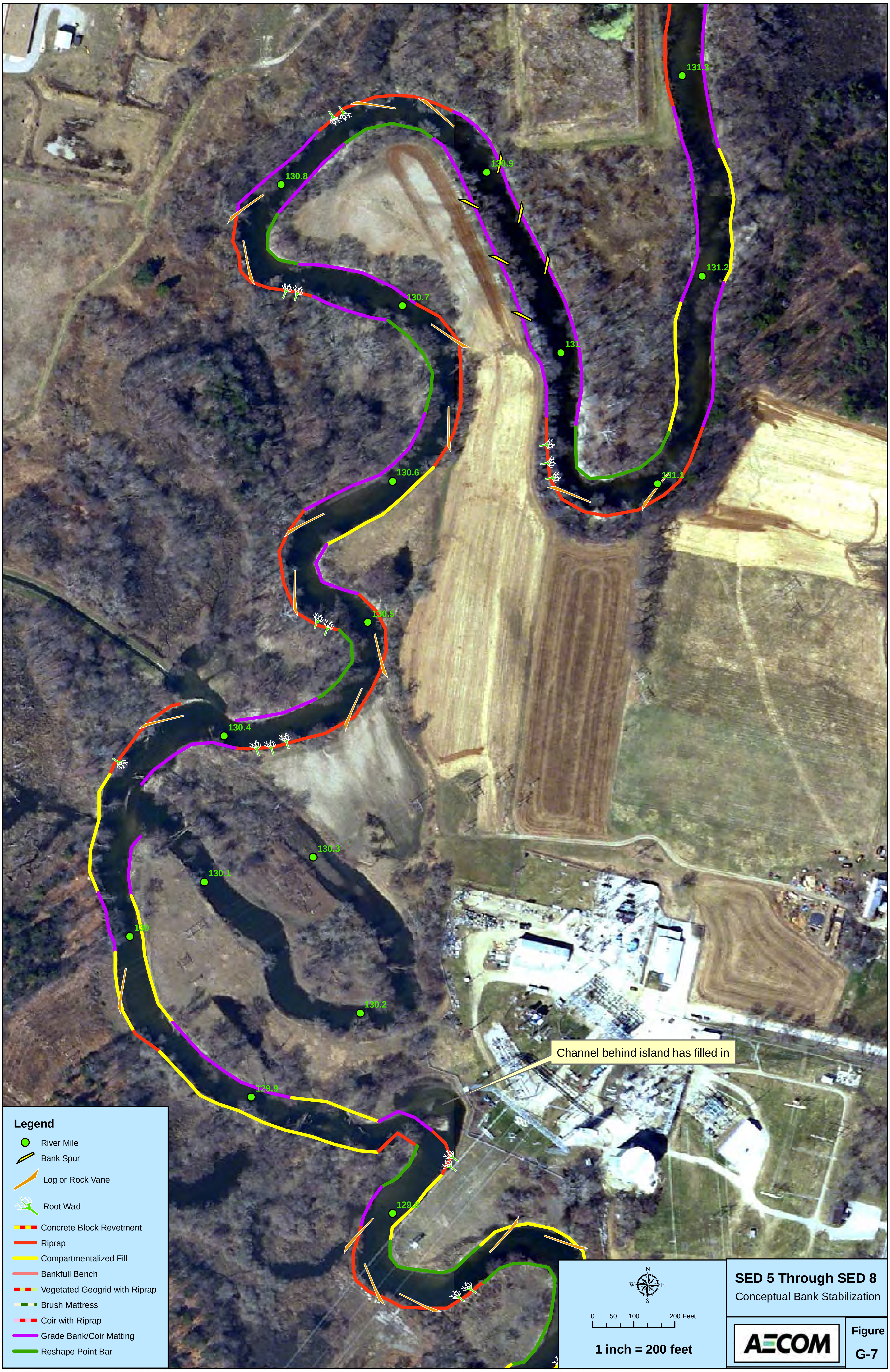
Conceptual Bank Stabilization

AECOM

Figure

G-5


132.1
131.9
131.8
131.7
131.6
Build bankfull bench into channel
131.5
131.4
131.3
131.2
131
30.9
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill
Bankfull Bench
Vegetated Geogrid with Riprap
Brush Mattress
Coir with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 5 Through SED 8
Conceptual Bank Stabilization
AECOM
Figure
G-6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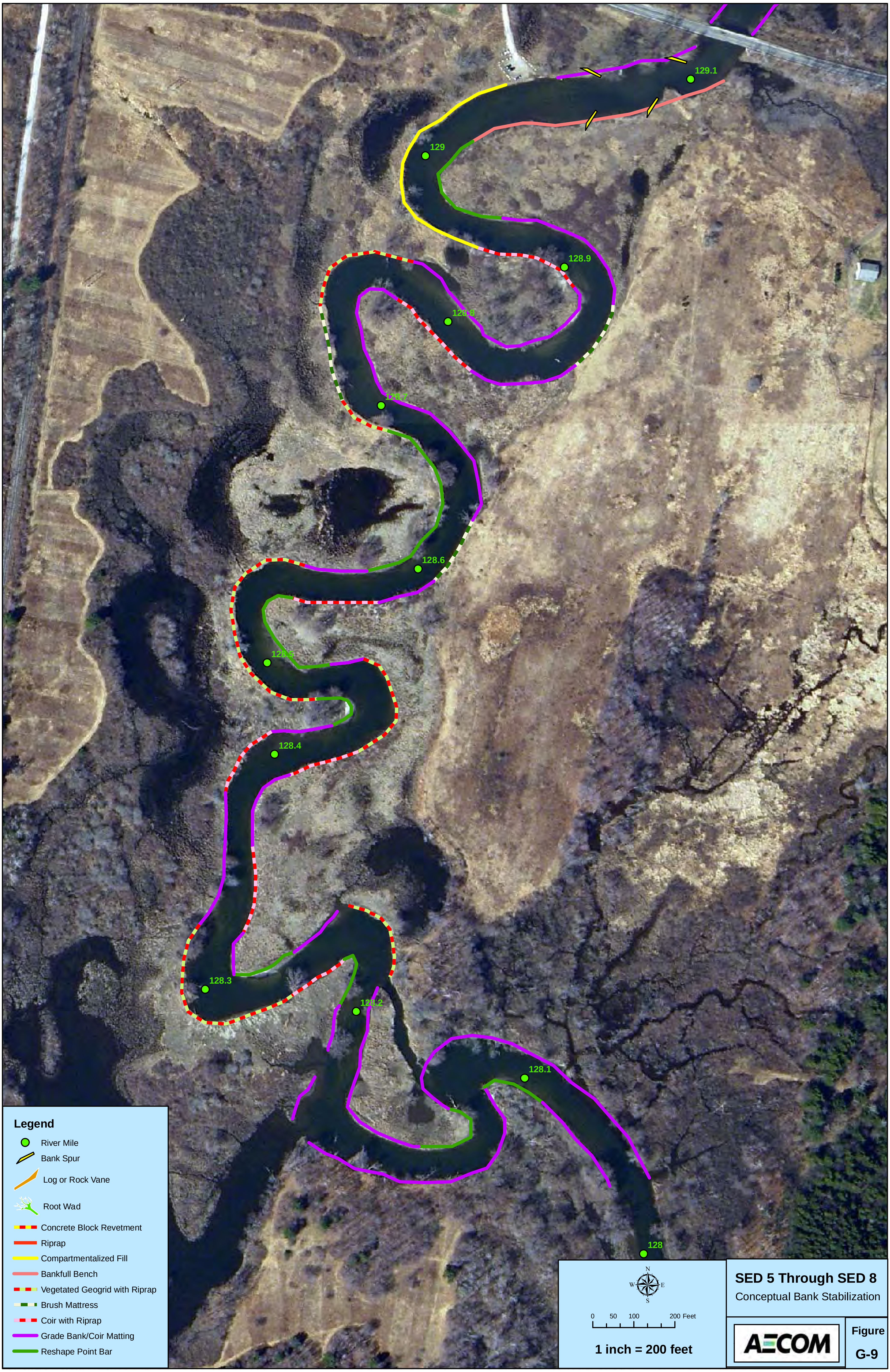
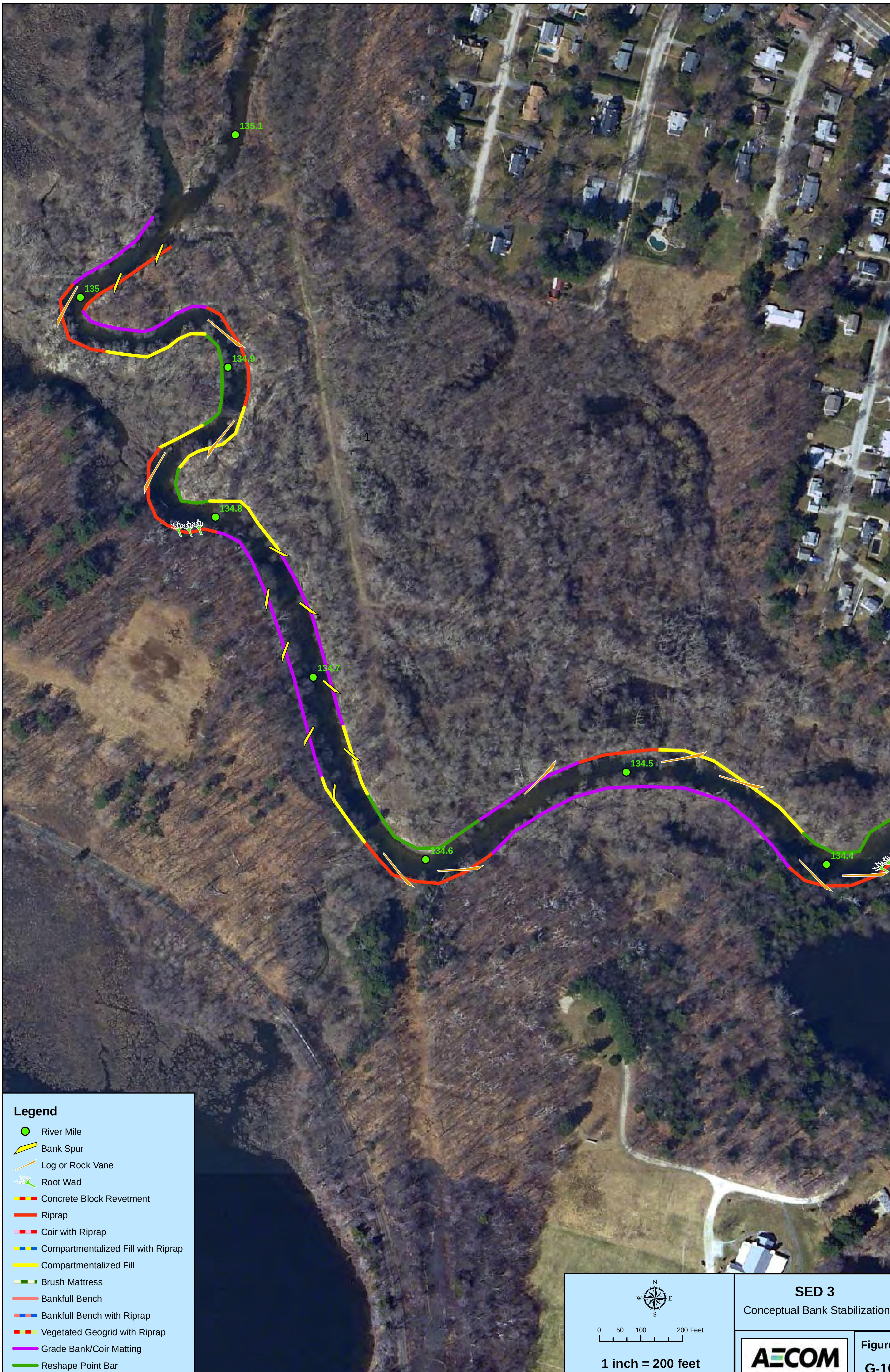
130.9
130.8
131.2
130.7
131
131.1
130.6
130.5
130.4
130.3
130.1
130
130.2
129.9
Channel behind island has filled in
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill
Bankfull Bench
Vegetated Geogrid with Riprap
Brush Mattress
Coir with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 5 Through SED 8
Conceptual Bank Stabilization
AECOM
Figure
G-7


129.8
129.7
129.6
129.5
129.4
129.3
129.2
129.1
129
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill
Bankfull Bench
Vegetated Geogrid with Riprap
Brush Mattress
Coir with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 5 Through SED 8
Conceptual Bank Stabilization
AECOM
Figure
G-8


129.1
129
128.9
128.8
128.7
128.6
128.5
128.4
128.3
128.2
128.1
128
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill
Bankfull Bench
Vegetated Geogrid with Riprap
Brush Mattress
Coir with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 5 Through SED 8
Conceptual Bank Stabilization
AECOM
Figure
G-9



Legend

- River Mile
- Bank Spur
- Log or Rock Vane
- Root Wad
- Concrete Block Revetment
- Riprap
- Coir with Riprap
- Compartmentalized Fill with Riprap
- Compartmentalized Fill
- Brush Mattress
- Bankfull Bench
- Bankfull Bench with Riprap
- Vegetated Geogrid with Riprap
- Grade Bank/Coir Matting
- Reshape Point Bar

N W E S

0 50 100 200 Feet

1 inch = 200 feet

SED 3

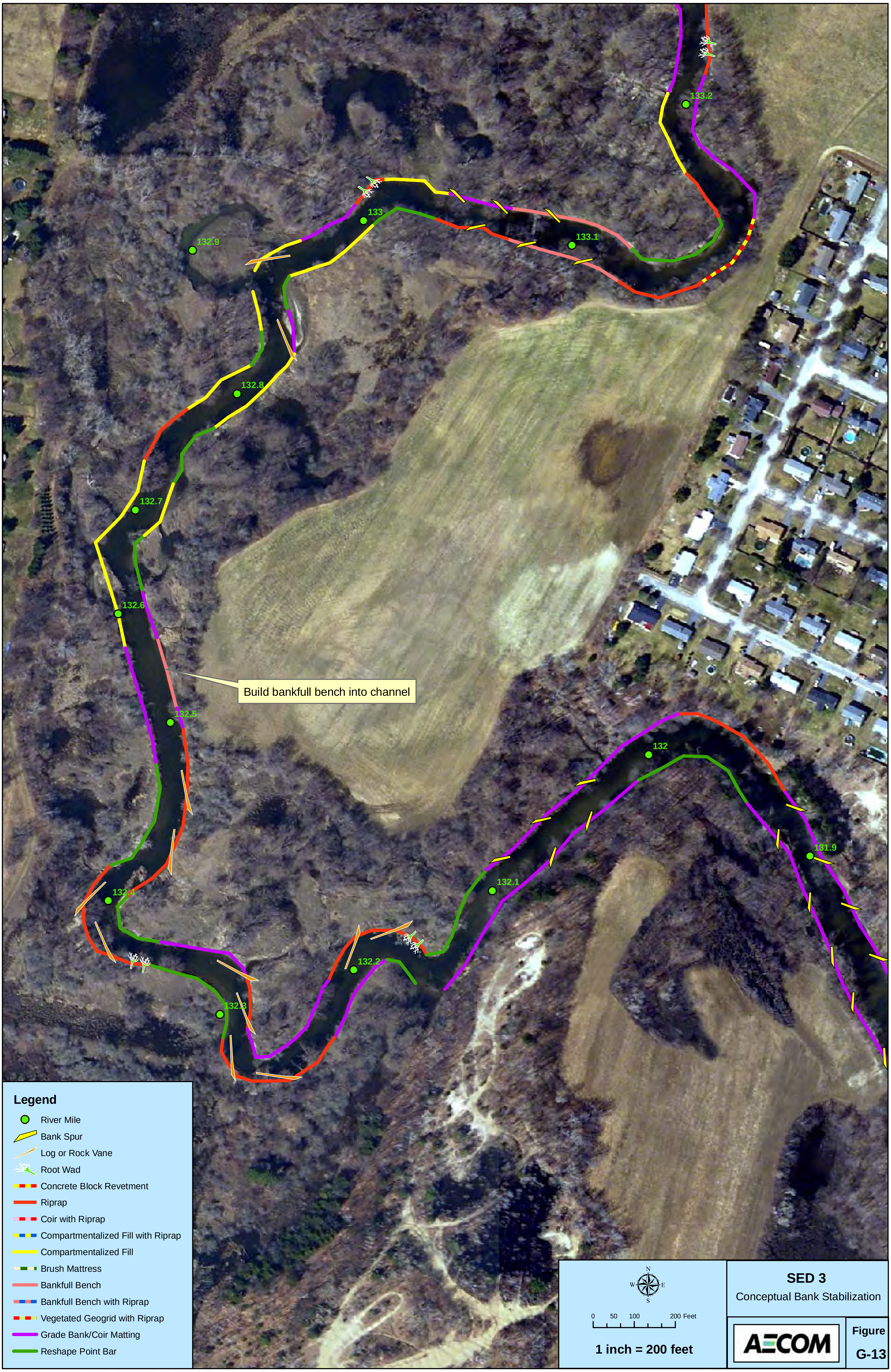
Conceptual Bank Stabilization

AECOM

Figure G-10

134.4
134.3
134.2
134.1
134
133.9
Apply riprap along toe of slope only
do not apply on upper slope
Build bankfull bench into channel
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 3
Conceptual Bank Stabilization
AECOM
Figure
G-11

133.7
133.6
133.4
133.3
133.2
133.1
133
132.9
132.8
132.7
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 3
Conceptual Bank Stabilization
AECOM
Figure
G-12



SED 3

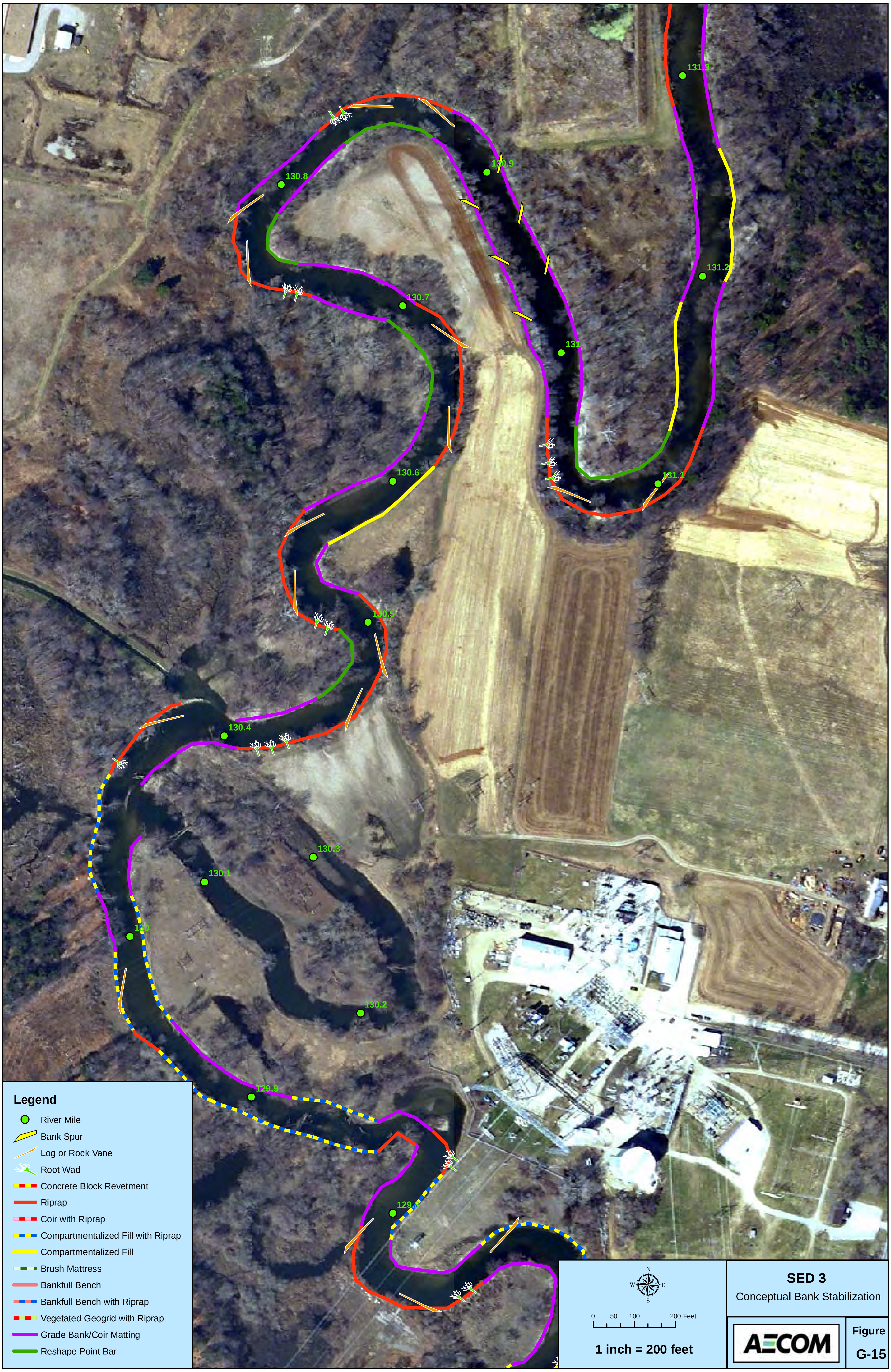
Conceptual Bank Stabilization

AECOM

Figure

G-13

132.1
131.9
131.8
131.7
131.6
131.5
131.4
131.3
131.2
131
Build bankfull bench into channel
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 3
Conceptual Bank Stabilization
AECOM
Figure
G-14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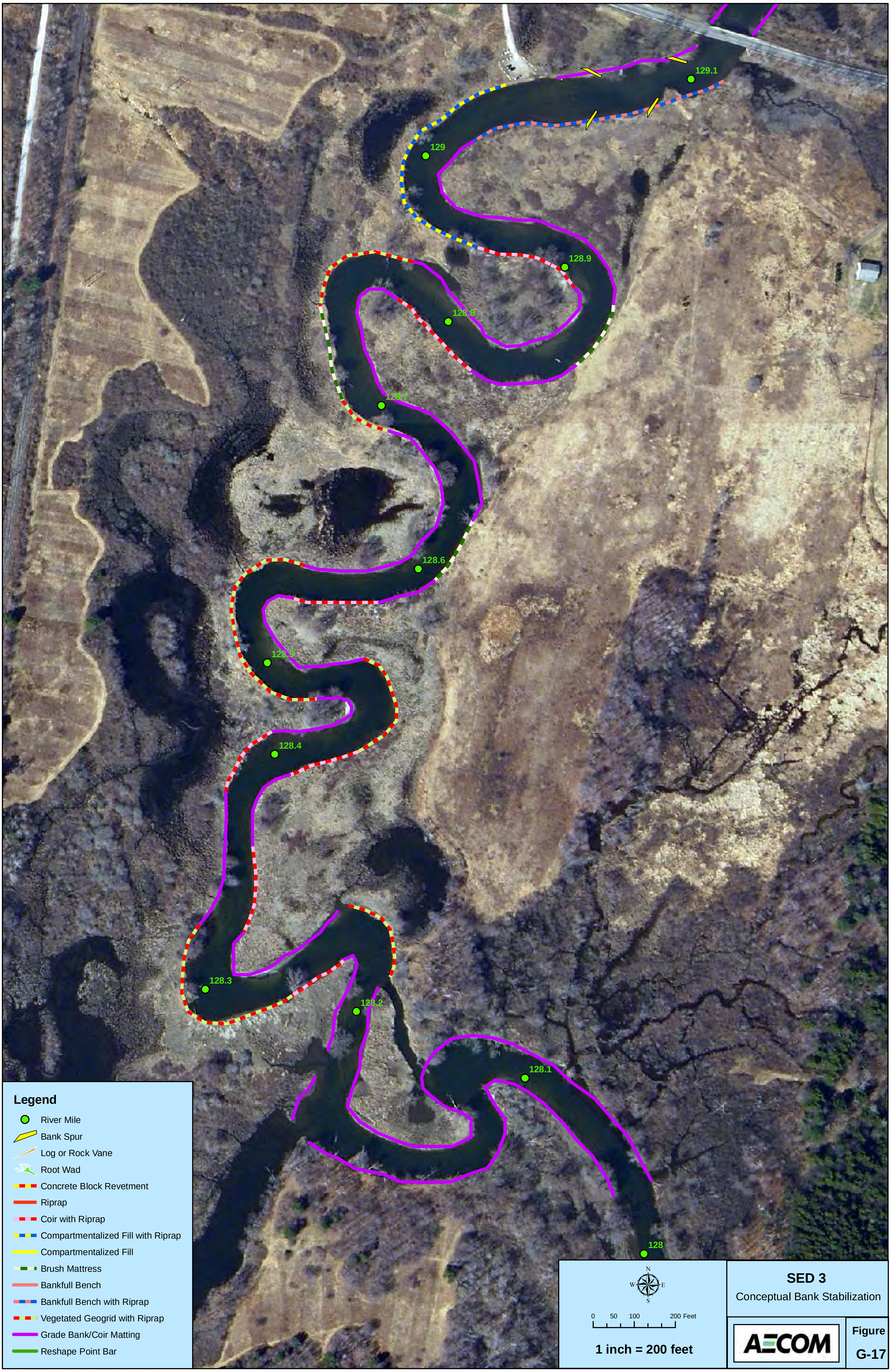
130.9
130.8
131.2
130.7
131
131.1
130.6
130.5
130.4
130.3
130.1
130
130.2
129.9
129.8
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 3
Conceptual Bank Stabilization
AECOM
Figure
G-15

129.1
129.2
129.3
129.4
129.5
129.6
129.7
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 3
Conceptual Bank Stabilization
AECOM
Figure
G-16

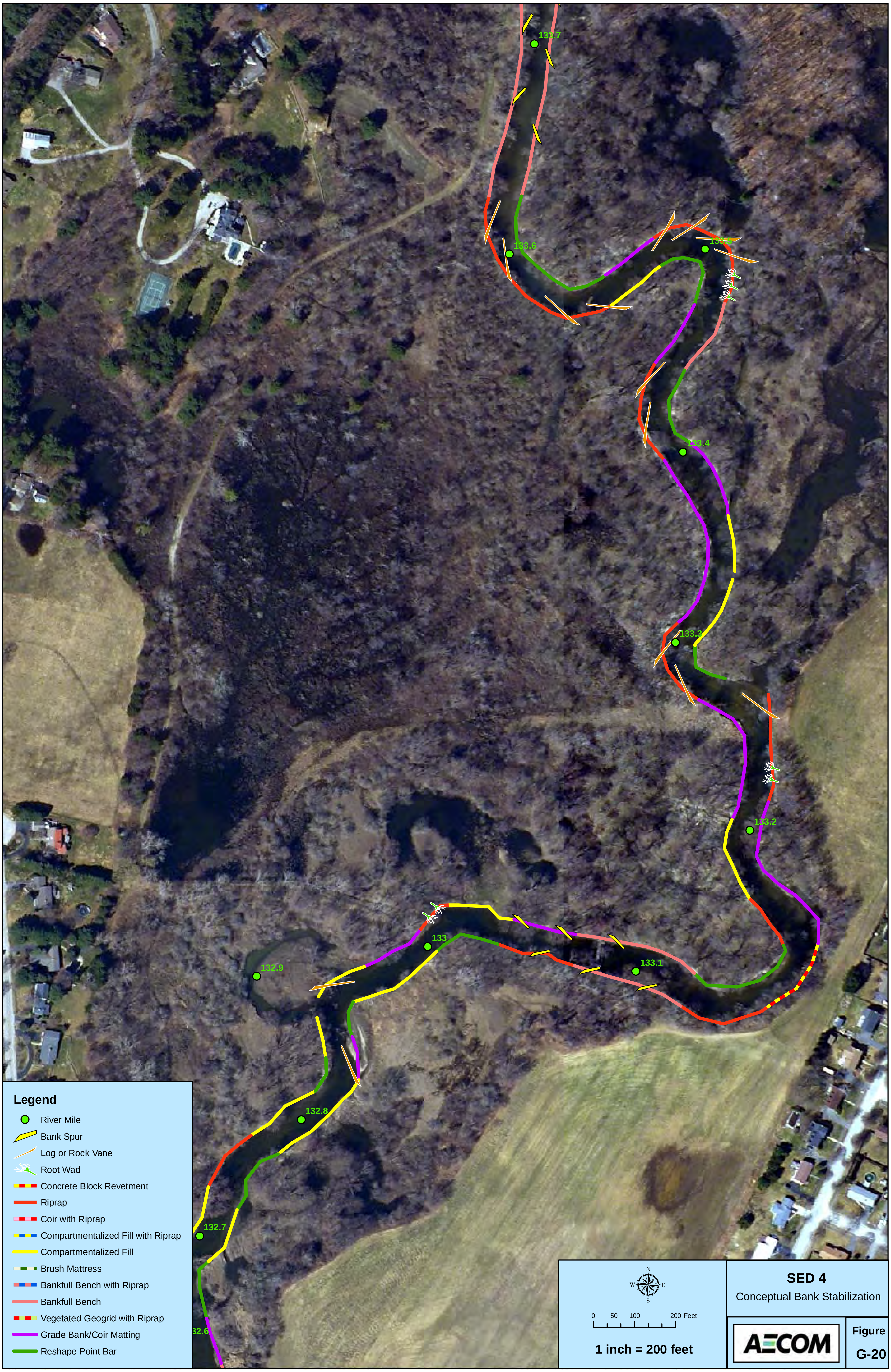

129.1
129
128.9
128.8
128.7
128.6
128.5
128.4
128.3
128.2
128.1
128
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 3
Conceptual Bank Stabilization
AECOM
Figure
G-17

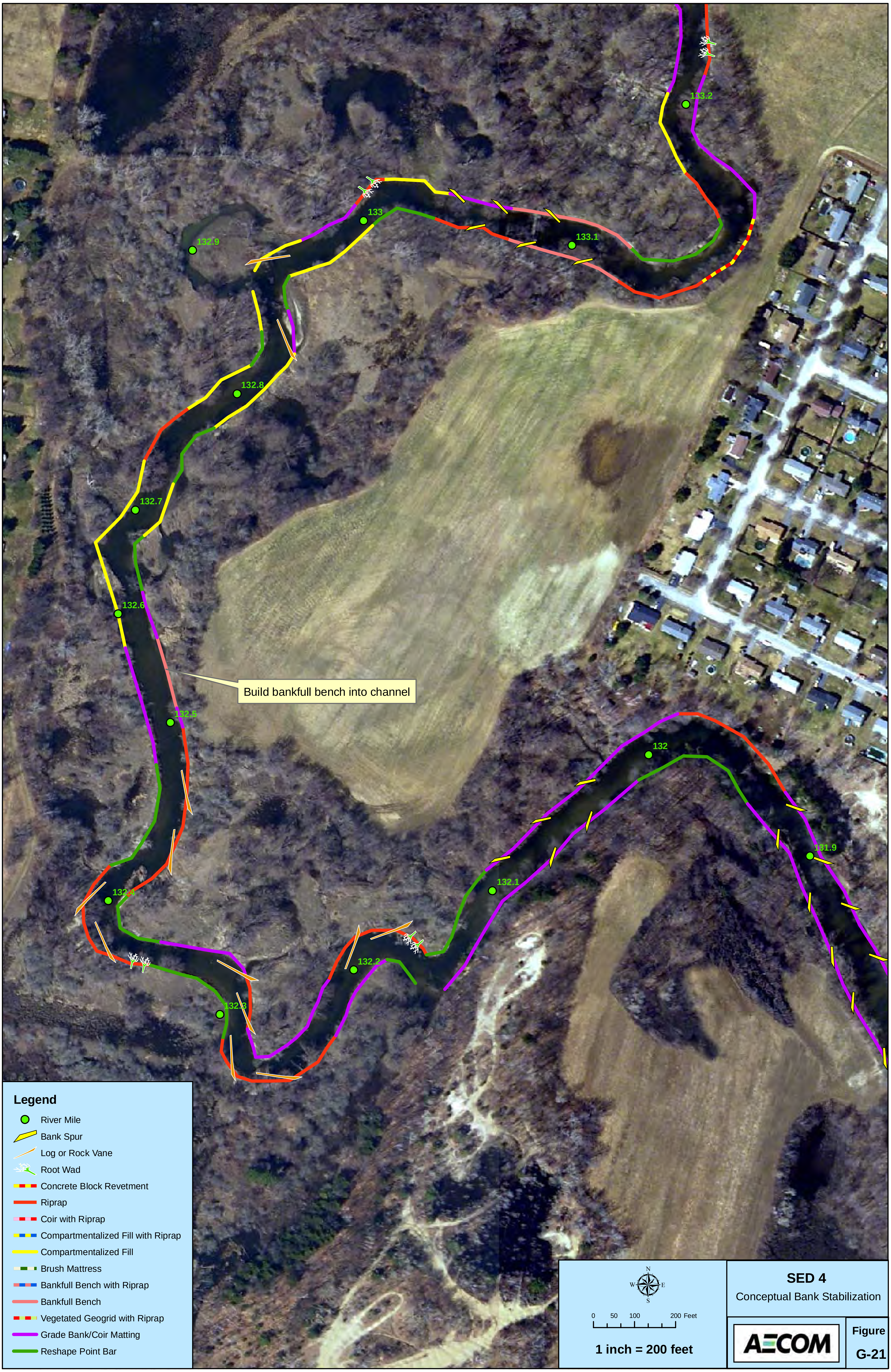
SED 4

Conceptual Bank Stabilization

Figure G-18


134.4
134.3
134.2
134.1
134
133.9
Apply riprap along toe of slope only
do not apply on upper slope
Build bankfull bench into channel
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench with Riprap
Bankfull Bench
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
S
W
E
0 50 100 200 Feet
1 inch = 200 feet
SED 4
Conceptual Bank Stabilization
AECOM
Figure
G-19


133.7
133.6
133.4
133.3
133.2
133.1
133
132.9
132.8
132.7
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench with Riprap
Bankfull Bench
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 4
Conceptual Bank Stabilization
AECOM
Figure
G-20



SED 4

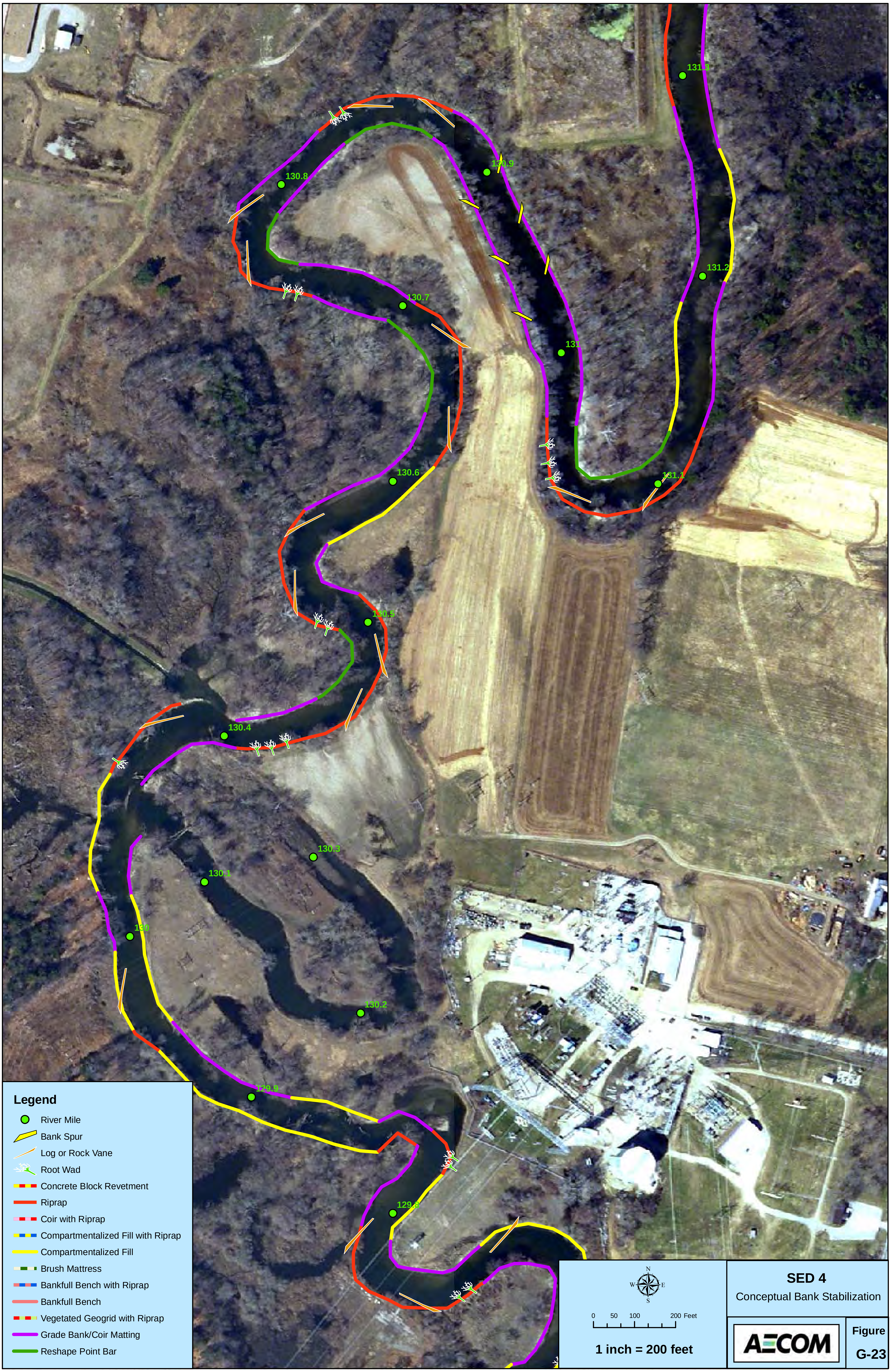
Conceptual Bank Stabilization

AECOM

Figure

G-21


132.1
131.9
131.8
131.7
131.6
131.5
131.4
131.3
131.2
Build bankfull bench into channel
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench with Riprap
Bankfull Bench
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 4
Conceptual Bank Stabilization
AECOM
Figure
G-22



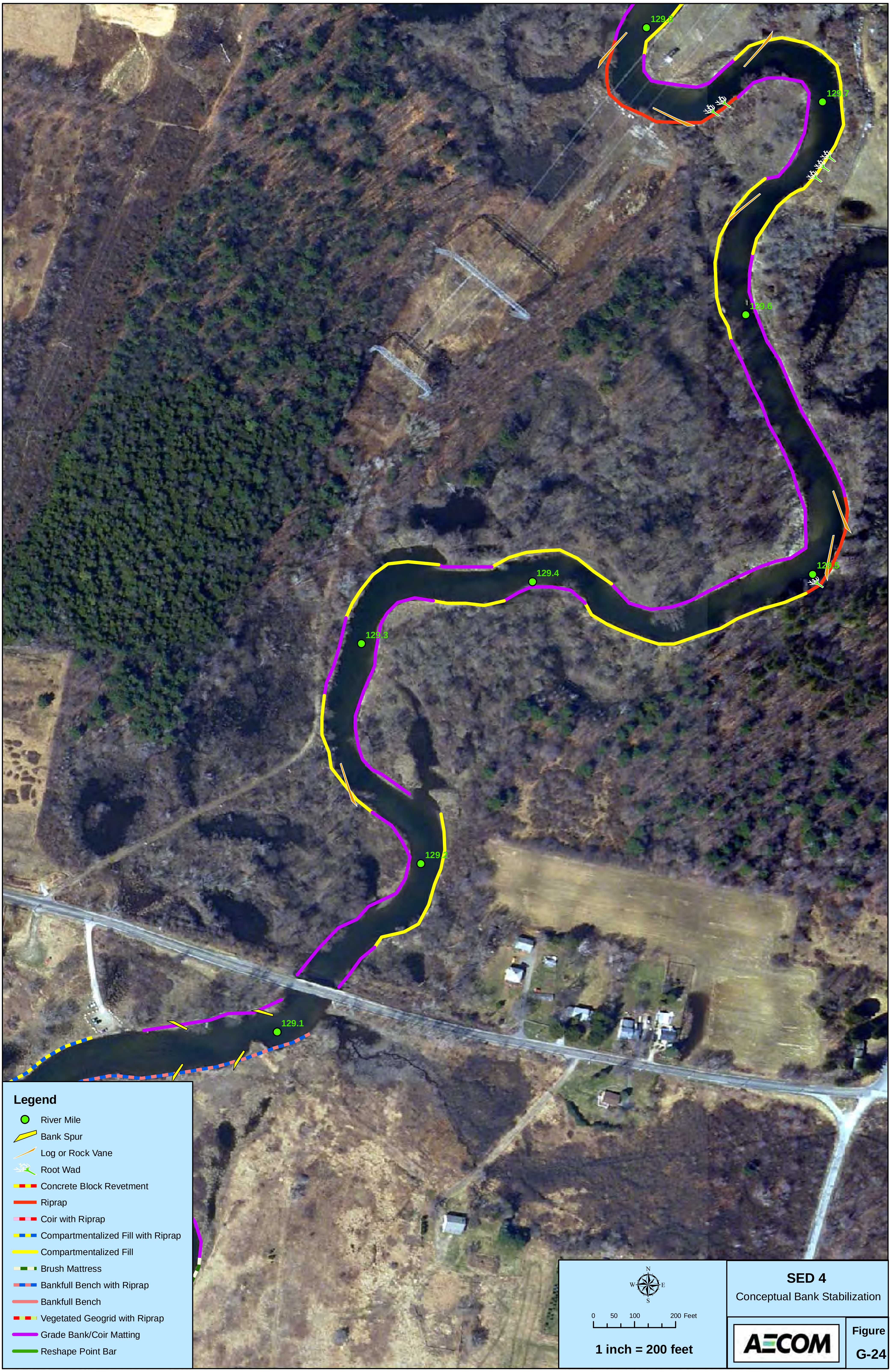
SED 4

Conceptual Bank Stabilization

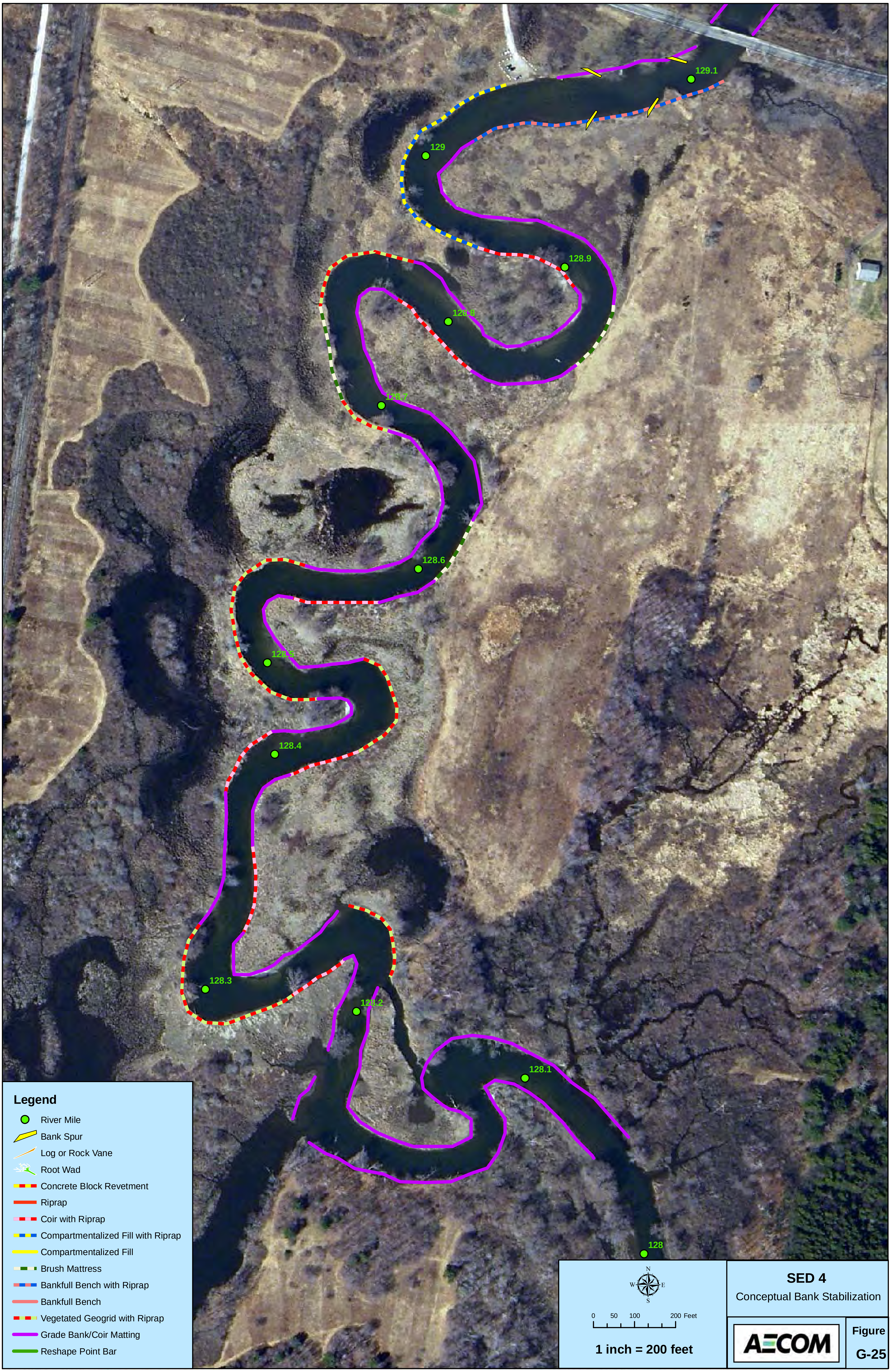
AECOM

Figure

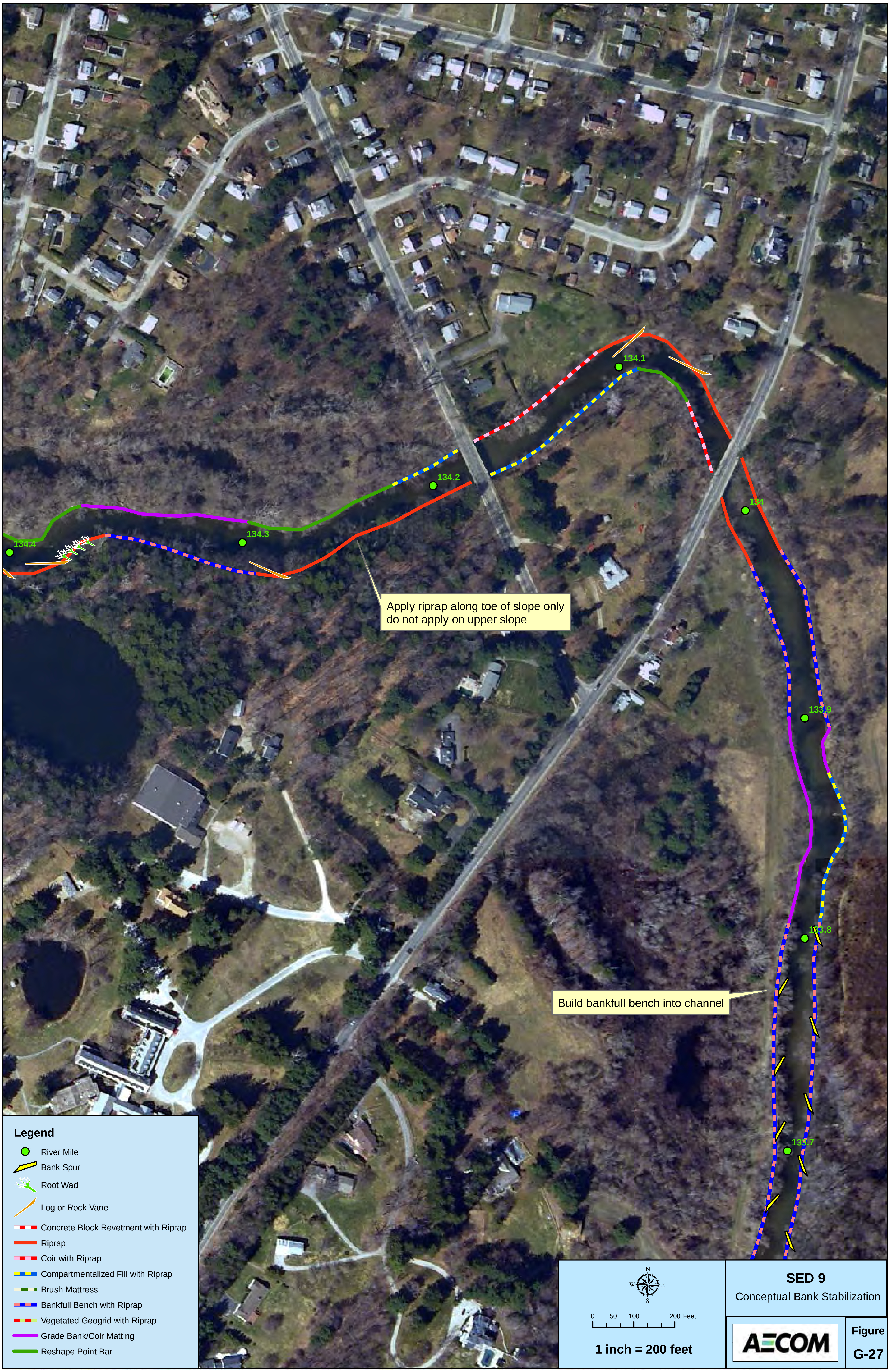
G-23



SED 4
Conceptual Bank Stabilization
Figure
G-24


129.1
129
128.9
128.8
128.7
128.6
128.5
128.4
128.3
128.2
128.1
128
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Brush Mattress
Bankfull Bench with Riprap
Bankfull Bench
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 4
Conceptual Bank Stabilization
AECOM
Figure
G-25

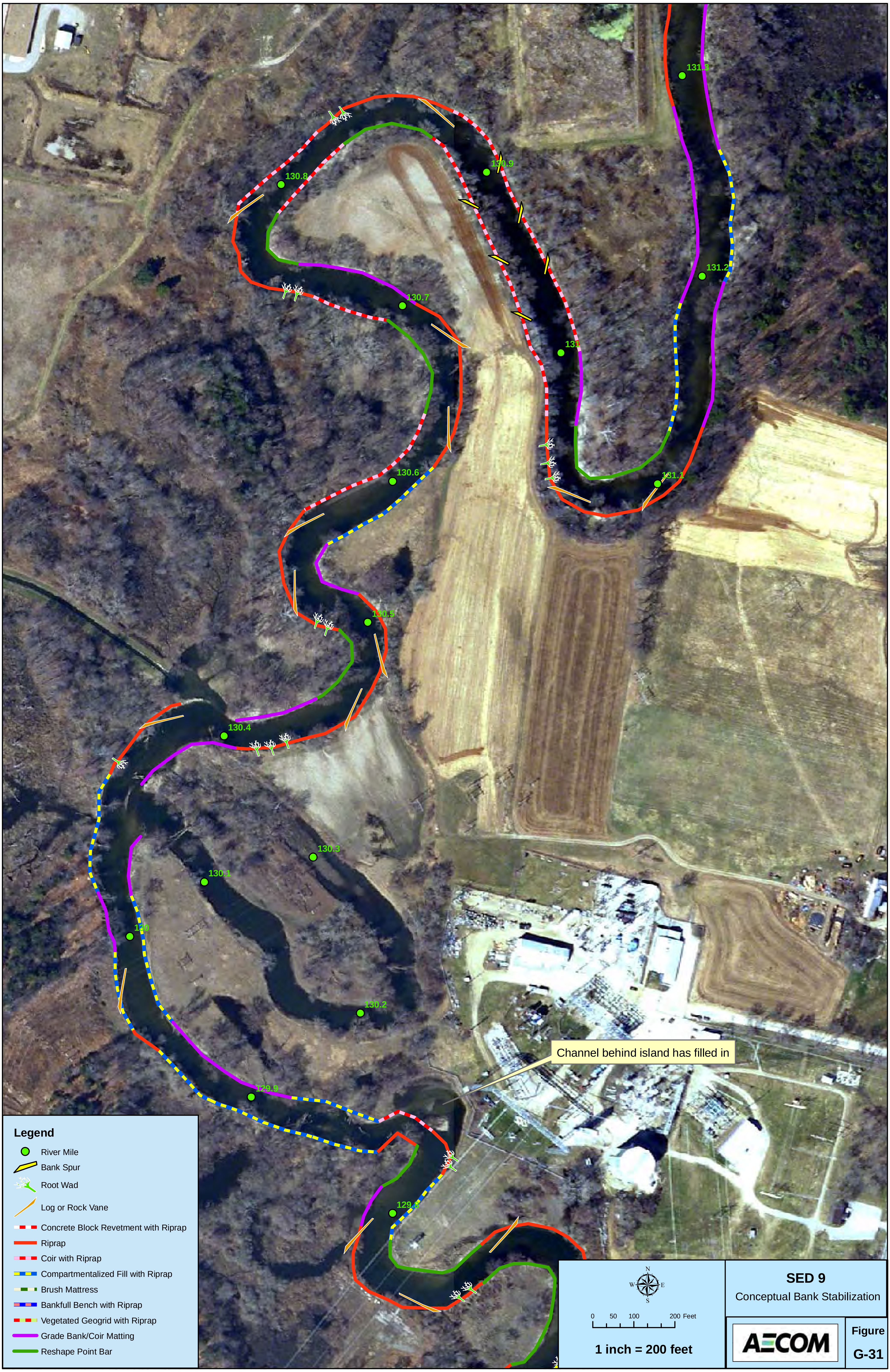
135.1
135
134.9
1
134.8
134.7
134.5
134.6
134.4
Legend
River Mile
Bank Spur
Root Wad
Log or Rock Vane
Concrete Block Revetment with Riprap
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Brush Mattress
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 9
Conceptual Bank Stabilization
AECOM
Figure
G-26


134.1
134.2
134.3
134.4
134
133.9
133.8
133.7
Apply riprap along toe of slope only
do not apply on upper slope
Build bankfull bench into channel
Legend
River Mile
Bank Spur
Root Wad
Log or Rock Vane
Concrete Block Revetment with Riprap
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Brush Mattress
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
S
E
W
0 50 100 200 Feet
1 inch = 200 feet
SED 9
Conceptual Bank Stabilization
AECOM
Figure
G-27


133.7
133.6
133.5
133.4
133.3
133.2
133.1
133
132.9
132.8
132.7
Legend
River Mile
Bank Spur
Root Wad
Log or Rock Vane
Concrete Block Revetment with Riprap
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Brush Mattress
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 9
Conceptual Bank Stabilization
AECOM
Figure
G-28

133.2
133
133.1
132.9
132.8
132.7
132.6
Build bankfull bench into channel
132.5
132
131.9
132.1
132.4
132.2
132.3
Legend
River Mile
Bank Spur
Root Wad
Log or Rock Vane
Concrete Block Revetment with Riprap
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Brush Mattress
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 9
Conceptual Bank Stabilization
AECOM
Figure
G-29

132.1
131.9
131.8
131.7
131.6
Build bankfull bench into channel
131.5
131.4
131.3
131.2
131
Legend
River Mile
Bank Spur
Root Wad
Log or Rock Vane
Concrete Block Revetment with Riprap
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Brush Mattress
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
S
E
W
0 50 100 200 Feet
1 inch = 200 feet
SED 9
Conceptual Bank Stabilization
AECOM
Figure
G-30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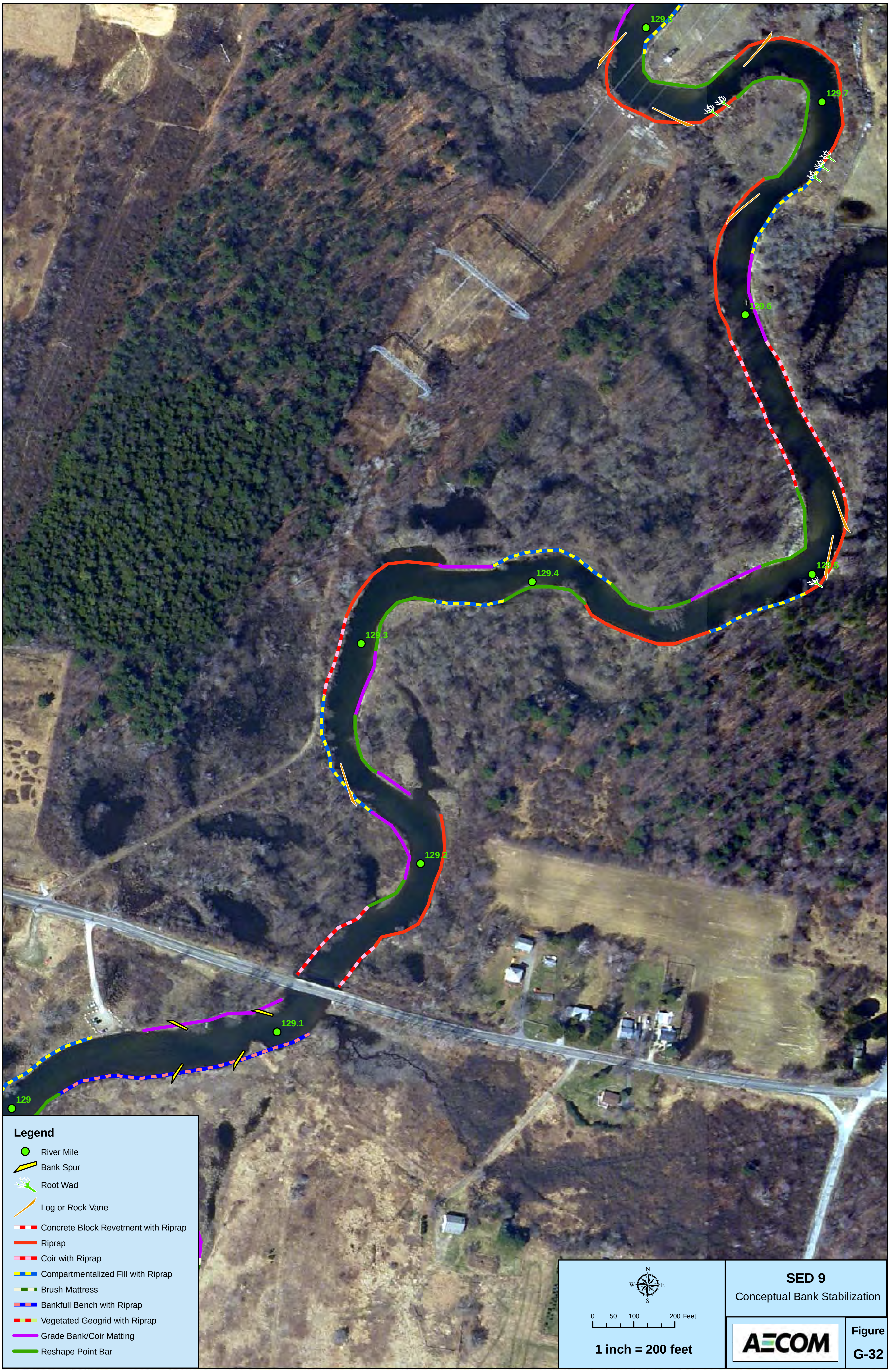
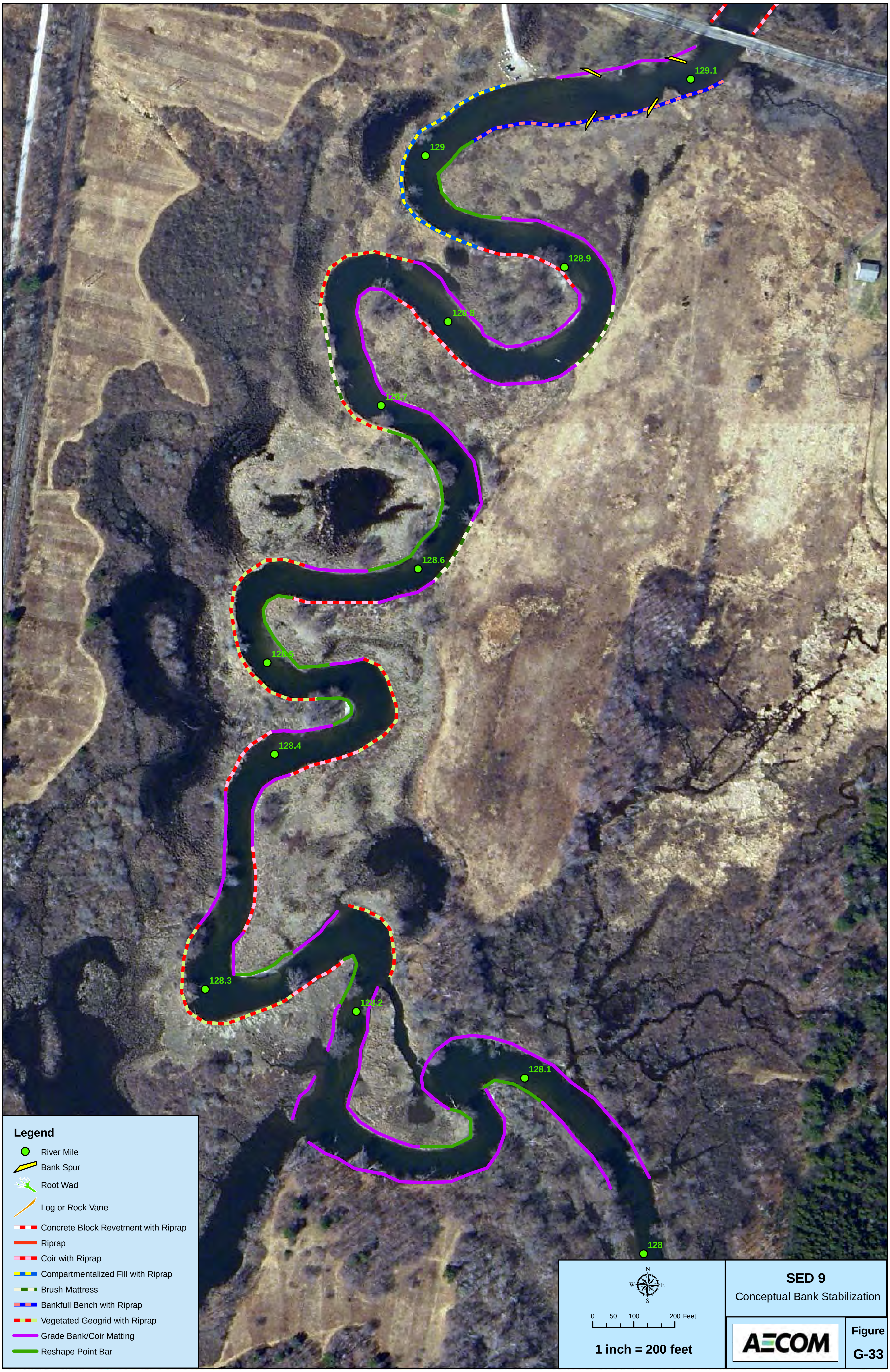
130.9
130.8
131.2
130.7
131
131.1
130.6
130.5
130.4
130.3
130.1
130
130.2
129.9
Channel behind island has filled in
Legend
River Mile
Bank Spur
Root Wad
Log or Rock Vane
Concrete Block Revetment with Riprap
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Brush Mattress
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0
50
100
200 Feet
1 inch = 200 feet
SED 9
Conceptual Bank Stabilization
AECOM
Figure
G-31



129.7
129.6
129.5
129.4
129.3
129.2
129.1
129
Legend
River Mile
Bank Spur
Root Wad
Log or Rock Vane
Concrete Block Revetment with Riprap
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Brush Mattress
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 9
Conceptual Bank Stabilization
AECOM
Figure
G-32


129.1
129
128.9
128.8
128.7
128.6
128.5
128.4
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128.2
128.1
128
Legend
River Mile
Bank Spur
Root Wad
Log or Rock Vane
Concrete Block Revetment with Riprap
Riprap
Coir with Riprap
Compartmentalized Fill with Riprap
Brush Mattress
Bankfull Bench with Riprap
Vegetated Geogrid with Riprap
Grade Bank/Coir Matting
Reshape Point Bar
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 9
Conceptual Bank Stabilization
AECOM
Figure
G-33

135.1
135
134.9
1
134.8
134.7
134.6
134.5
134.4
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Bankfull Bench
Grade Bank/Coir Matting
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 10
Conceptual Bank Stabilization
AECOM
Figure
G-34


134.4
134.2
134.1
134
133.9
133.8
133.7
Apply riprap along toe of slope only
do not apply on upper slope
Extended upstream 70 ft to encompass
entire outer meander bend
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Bankfull Bench
Grade Bank/Coir Matting
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 10
Conceptual Bank Stabilization
AECOM
Figure
G-35


133.7
133.6
133.5
133.4
133.3
133.2
133.1
133
132.9
132.8
132.7
132.6
Extended upstream 75 ft to encompass entire outer meander bend and allow for placement of vane
Extended downstream 250 ft through area of high near-bank stress
Extended upstream 110 ft to encompass entire outer meander bend
Extended downstream 85 ft to cover existing erosional bank
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Bankfull Bench
Grade Bank/Coir Matting
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 10
Conceptual Bank Stabilization
AECOM
Figure
G-36

SED 10

Conceptual Bank Stabilization

AECOM

Figure

G-37


132.1
131.9
131.8
131.7
131.6
131.5
131.4
131.3
131.2
131
Extended upstream 70 ft to allow for placement of vane
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Bankfull Bench
Grade Bank/Coir Matting
N
W E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 10
Conceptual Bank Stabilization
AECOM
Figure
G-38

131.3
130.9
130.8
131.2
130.7
131
130.6
131.1
130.5
130.4
130.3
130.1
130
130.2
129.9
Extended upstream 200 ft to cover entire outer meander and to allow for placement of vanes
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Bankfull Bench
Grade Bank/Coir Matting
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 10
Conceptual Bank Stabilization
AECOM
Figure
G-39


129.7
129.6
129.5
129.4
129.3
129.2
Extended upstream 75 ft to allow for placement of vane
129.1
129
Legend
River Mile
Bank Spur
Log or Rock Vane
Root Wad
Concrete Block Revetment
Riprap
Compartmentalized Fill with Riprap
Compartmentalized Fill
Bankfull Bench
Grade Bank/Coir Matting
N
W
E
S
0 50 100 200 Feet
1 inch = 200 feet
SED 10
Conceptual Bank Stabilization
AECOM
Figure
G-40

ARCADIS ANCHOR QEA AECOM

Appendix H

EPA Memorandum on Methodology for Calculating "Blended" Fish Concentrations

Human Health

Primary Study Area (Reaches 5 and 6)

In the HHRA, the exposure point concentrations (EPCs) were derived considering the data for brown bullhead, largemouth bass, sunfish, and yellow perch, skinned and trimmed fillet. Only largemouth bass ≥12 inches [30.45 cm] were considered in the EPC calculations.

In the MDPH survey, respondents indicated an approximately equal preference for bass/bullhead and perch/sunfish. Therefore, the concentration data for these two data groups (*i.e.*, bass/bullhead and perch/sunfish) were given equal weight to calculate EPCs in the PSA for the HHRA, as follows:

$$Blended_{human} = \left(0.5 \times BassBullhead\right) + \left(0.5 \times SunfishPerch\right)$$

To apply the FCM model output to the above equation, the following assumptions were required:

- Surrogate species for perch – Perch are not directly modeled in FCM; therefore a surrogate species was required. During calibration and validation, FCM simulations have indicated an approximate equivalence between yellow perch concentrations and largemouth bass concentrations; therefore FCM estimates of largemouth bass were substituted for perch;

- Age of largemouth bass – Age versus length assessment of site-specific largemouth bass data suggests that Age 9+ bass are an appropriate age class for fish greater than 12 inches in length. Field samples indicate that largemouth bass exceed an average of 12 inches length for all age classes between Age 5+ and 14+, with approximately equal representation across all age classes. The largest age class simulated in the model (9+) was therefore considered a reasonable estimate of the average for all fish above 12 inches length.

- Age of brown bullhead – Brown bullheads are medium-sized catfishes that usually reach about 8 to 14 inches (20 to 36 cm) in length, with a maximum age of 6 to 8 years. Based on site-specific data from the Housatonic River (most specimens aged at 3+ to 6+ years), the typical age of a harvested adult brown bullhead was estimated to be 5+ years.

- Proportion of "Sunfish/Perch" consisting of sunfish species – Although these species were combined in the HHRA statistical analyses of field samples, the consumption survey data used to develop relative weighting of species consumed for the Massachusetts reaches (Table 4-4 of the HHRA) indicates that perch and bass were strongly preferred over sunfish. Fewer than 2% of the respondents preferred sunfish to other resident species. Therefore, for the purposes of FCM modeling, the sunfish contribution was set to zero, and this group was therefore assigned 100% largemouth bass (used as surrogate for perch).

- Proportion of "Bass/Bullhead" consisting of bass – In the Exposure Prevalence phase of the HHRA, approximately half the respondents in the "all respondents" group and in the group who had consumed fish from the Housatonic River expressed a preference for predators (perch and bass), whereas approximately 15% of the respondents considered bullhead to be one of their top three fish preferences. However, the preferences were somewhat different for the respondents in the volunteer phase of the survey, with notably fewer individuals preferring bass and more preferring bullhead. Based on the joint consideration of these studies, this fish subgroup was assigned 50% bass and 50% bullhead.

Integrating the above information, the FCM comparisons to IMPGs were calculated using the following equation:

$$EPC = (0.25 \times Age\ 9\ Bass) + (0.25 \times Age\ 5\ Bullhead) + (0.5 \times Age\ 9\ Bass)$$

Which simplifies to:

$$Blended_{human} = (0.75 \times Age\ 9\ Bass) + (0.25 \times Age\ 5\ Bullhead)$$

Rising Pond

In the HHRA, the exposure point concentrations (EPCs) were derived considering Reach 8 brown bullhead, largemouth bass, pumpkinseed (sunfish), and yellow perch, skinned and trimmed fillet. Only largemouth bass ≥12 inches [30.45 cm] were considered in the EPC calculations.

In the HHRA, the combined fish exposure point concentration was calculated by summing one-half of the brown bullhead/largemouth bass/pumpkinseed EPC and one-half the yellow perch EPC.

$$Blended = (0.5 \times BassBullheadPumpkinseed) + (0.5 \times Perch)$$

As noted in the discussion for the PSA, in the MDPH survey, respondents indicated a similar preference for bass/bullhead and perch/sunfish. In the HHRA, the concentration data for these two data groups (*i.e.*, bass/bullhead/sunfish and perch), were given equal weight to calculate EPCs.

In applying the FCM model:

- Because sunfish comprise a small portion of the species preference (0 to 3%), the pumpkinseed contribution was omitted. Therefore, the bass/bullhead/sunfish group was parameterized using an assumption of 50% largemouth bass and 50% adult bullhead;

- As with the PSA, largemouth bass was used as a surrogate for perch;

- Age assumptions were the same as for the PSA;

- The consumption model is appropriate for Rising Pond, but may require customization for faster-flowing reaches of the downstream area due to the presence of trout in these reaches.

Integrating the above information, the FCM comparisons to IMPGs in Rising Pond were calculated using the following equation (same as PSA):

$$Blended_{human} = \left(0.75 \times Age\ 9\ Bass\right) + \left(0.25 \times Age\ 5\ Bullhead\right)$$

Appendix I

Results of Sensitivity Modeling Analyses Relating to Fish

APPENDIX I

Results of Sensitivity Modeling Analyses Relating to Fish

In EPA's September 9, 2008 comments on the March 2008 Corrective Measures Study (CMS) Report, the Agency expressed concerns regarding a few of the assumptions used by GE in the processing of fish PCB concentrations predicted by EPA's bioaccumulation model to calculate certain model output metrics. As such, EPA directed GE to evaluate the sensitivity of these assumptions on the calculated metrics involved. A brief summary of these comments is provided below:

- *EPA General Comment #17*: The analysis of percent reductions in PCB concentrations predicted for fish fillets presented in the CMS Report used initial concentrations in fish at the end of the model validation simulation. EPA stated that the percent reductions would be considerably different if initial conditions in fish were calculated by "spinning up" the first year of the model projection simulation (i.e., by using current boundary conditions to reflect the initial condition rather than historical boundary conditions). EPA directed GE to acknowledge this issue and provide a discussion of its effect on the assessment of the sediment alternatives.

- *EPA Specific Comment #38*: EPA noted that, in the original CMS Report, the "blended fish" calculations used for human health risk comparisons relied exclusively on concentrations in largemouth bass. EPA stated that, with the use of only this species, changes in fillet concentrations show more sensitivity to changes in water column PCB concentrations than would have been the case if species that derive more exposure from sediment sources (e.g., brown bullhead) were included in the calculations. As such, EPA directed GE to include a discussion of how the assessment of human risk evaluations was affected by the use of only largemouth bass.

- *EPA Specific Comment #60*: In this comment, EPA stated that it disagreed with GE's assignment of feeding preferences for osprey, and that the parameterization in the CMS was incorrectly based on the assumption that all modeled fish species would be consumed equally by osprey (Revised CMS Table 3-12). EPA noted that the differences between the CMS Report and EPA methods result in CMS-simulated fish tissue concentrations that are approximately 16% less than those calculated by EPA. These differences derive mainly from the following assumptions in the CMS: (1) a greater assumed proportion of forage fish in osprey diet; and (2) inclusion of younger age classes (on average) of white sucker and sunfish in osprey diet.

The Revised CMS Report applies the same basic assumptions as the original CMS Report. However, in response to EPA's comments, GE has evaluated the impact of each of the alternate methods described by EPA on the results of the modeling-based analyses presented in the Revised CMS Report. This appendix presents the results of these sensitivity analyses.

I.1 SENSITIVITY OF CALCULATED PERCENT REDUCTIONS IN FISH TO FISH INITIAL CONDITIONS

In General Comment #17 on the March 2008 CMS Report, EPA indicated its view that GE's use of initial concentrations in fish at the end of the model validation period resulted in an over-estimation of the reduction in PCB concentrations in fish fillets. EPA stated that the calculated percent reductions in fish would be considerably different if initial conditions in fish were calculated by "spinning up" the first year of the simulation (i.e., using current boundary conditions to reflect the initial condition rather than historical boundary conditions).

During a technical meeting on January 31, 2007, GE and EPA agreed that Year 1 of the model projection would begin immediately following the model validation period, and that simulated remediation in the Rest of River would also begin in Year 1 (to eliminate any unknowns regarding timing of Rest of River remediation efforts). It would be inconsistent with this approach to "reset" the initial conditions in the Food Chain Model (FCM), thereby assuming that fish in the Rest of River have instantly achieved equilibrium with the current boundary condition.

Nonetheless, to evaluate this issue, initial conditions in the fish were calculated by "spinning up" the first year of the projection simulation using current water column and sediment conditions (see Section 3.2.2.4 in the Revised CMS Report for a definition of "current" conditions), as described by EPA in this comment. "Spinning-up" is the process whereby initial conditions in the fish are determined by running the FCM with constant water column and sediment concentrations for a period of time that is sufficient for the fish to reach equilibrium with those exposures (approximately 10 years or more). The table below compares, by subreach, the original end-of-validation PCB concentrations in fish (fillets) with the initial concentrations in fish calculated using EPA's 10-year "spinning up" method.

Table I-1. Comparison of Spun-up Initial Conditions to Fish PCB Concentrations at End of Validation Period.

	Reach 5A	Reach 5B	Reach 5C	Reach 5D	Woods Pond
End-of-Validation Fish PCBs (mg/kg)	18	17	14	22	15
Spun-up Initial Conditions (mg/kg)	12	13	10	17	12

Given the long projection simulation period used for the CMS (52 years or more), resetting the initial condition in the fish has no impact on predicted fish concentrations at the end of the simulation. This is because, at the end of the simulation period, fish will have gone through several growth cycles in the model, causing fish concentrations to reach a new equilibrium with post-remediation sediment and water column PCB levels; and these levels are substantially different from the initial condition. However, resetting the initial condition does affect the calculated percent reduction in fish over the projection period (as noted by EPA, because the initial PCB concentrations in the fish are lower). A comparison of the percent reductions in Reach 5/6 and Reach 7/8 fish tissue resulting from the above-described EPA method for all sediment alternatives to the percent reductions included in the Revised CMS Report is presented in Tables I-2 and I-3 below, respectively.

Table I-2. Comparison of Calculated Percent Reductions in Fish PCB Concentrations (PSA).

	Percent Reduction in Fish PCB Concentrations During the Model Projection Period in the PSA									
	Reach 5A		Reach 5B		Reach 5C		Reach 5D		Reach 6	
	CMS	EPA	CMS	EPA	CMS	EPA	CMS	EPA	CMS	EPA
SED 1/2	60	41	47	28	48	29	57	45	44	27
SED 3	99	98	83	77	87	83	72	63	95	94
SED 4	99	98	98	97	97	96	98	98	99	98
SED 5	99	98	99	98	99	98	98	98	99	98
SED 6	99	98	99	98	99	98	98	98	99	99
SED 7	98	98	99	98	99	98	98	98	99	98
SED 8	99	99	99	99	99	99	99	98	99	99
SED 9	98	97	98	98	99	98	98	98	99	99
SED 10	77	66	62	49	59	44	51	37	76	68

Table I-3. Comparison of Calculated Percent Reductions in Fish PCB Concentrations (Reaches 7/8).

	Percent Reduction in Fish PCB Concentrations During the Model Projection Period in Reaches 7/8																	
	Reach 7A		Reach 7B		Reach 7C		Reach 7D		Reach 7E		Reach 7F		Reach 7G		Reach 7H		Reach 8	
	CMS	EPA	CMS	EPA	CMS	EPA	CMS	EPA	CMS	EPA	CMS	EPA	CMS	EPA	CMS	EPA	CMS	EPA
SED 1/2	52	28	48	27	50	29	51	28	54	36	63	44	45	41	60	44	43	41
SED 3	91	86	81	73	86	80	88	82	89	84	91	86	80	78	90	86	75	74
SED 4	96	94	85	79	91	87	93	89	93	91	94	91	83	82	93	91	79	78
SED 5	97	95	86	80	92	88	93	90	94	91	94	92	84	83	94	91	95	94
SED 6	97	96	96	95	98	98	94	91	96	95	95	92	94	93	94	92	97	96
SED 7	97	95	98	97	98	98	93	90	96	95	95	92	95	94	94	92	97	97
SED 8	97	96	99	99	99	99	94	92	98	97	96	93	98	97	95	93	97	97
SED 9	97	95	98	97	98	98	93	90	98	97	95	92	97	96	95	92	96	96
SED 10	68	53	62	47	67	51	69	57	75	62	75	62	59	56	73	62	57	55

As shown in these tables, percent reductions calculated using the alternate method described by EPA generally do not change significantly over those presented in the Revised CMS Report, except for SED 1/2 and SED 10. For SED 4 through SED 9 in Reaches 5 and 6, percent reductions generally decrease by 1% or less; in Reaches 7 and 8, percent reductions generally decrease by 5% or less. Under SED 3, percent reductions under the EPA method are lower than those presented in the Revised CMS Report by as little as 1% in some reaches and up to 5 to 10% in other reaches. Under SED 1/2 and SED 10, the predicted reductions in fish concentrations under EPA's method are generally between 10% and 25% lower than under the method used in the Revised CMS Report.[1]

[1] It should be noted, as discussed in Section 6.2.5.2 of the Revised CMS Report, that the most recent adult fish sampling data (primarily fillets) from Reach 5B/5C and Reach 6 (Woods Pond), which were collected in 2008, show even lower PCB concentrations in those fish than the initial concentrations used in EPA's model or the spun-up initial concentrations. This suggests that the upstream remediation and natural recovery processes reflected in SED 1/2 may achieve lower fish PCB concentrations than would be predicted by EPA's model for those alternatives using either the CMS method or the EPA method of calculating initial concentrations. This would be evaluated and confirmed through future long-term fish sampling.

I.2 MODEL SENSITIVITY TO USE OF LARGEMOUTH BASS ALONE IN "BLENDED" FISH CALCULATIONS

In Specific Comment #38 on the March 2008 CMS Report, EPA noted that, in the CMS, the "blended fish" calculations used for human health risk comparisons relied exclusively on concentrations in largemouth bass. EPA indicated that changes in fillet concentrations would show less sensitivity to changes in water column PCB concentrations if species that derive more exposure from sediment sources (e.g., brown bullhead) were included in the calculations. GE was directed to include a discussion of the sensitivity of the model to the use of solely largemouth bass.

To assess the sensitivity of using only largemouth bass (as opposed to a combination of fish species) to evaluate attainment of the IMPGs for human consumption of fish, the method used by EPA in the HHRA to calculate a "blended" fish concentration was adapted for use with the species simulated by EPA's FCM. The methodology used for calculating "blended" fish concentrations using the FCM output was provided by EPA to GE in an email dated November 12, 2008 (included as Appendix H to the Revised CMS Report). These blended fish results were then compared to the largemouth bass results used in the Revised CMS Report.

I.2.1. Blended Fish Calculation Method

Application of EPA's blended fish calculation method consisted of averaging model outputs across different species and size classes, as shown by the equation below, which was developed by EPA (Appendix H) for Reaches 5/6 and Reaches 7/8:

$$\textit{Blended Fish, R5/6 and R7/8} = [LMB_{(fillet,\ Age\ 9+)}] * 0.75 + [BB_{(fillet,\ age\ 5+)}] * 0.25$$

Blended fish assumptions for Connecticut were not provided by EPA in the November 12, 2008 email (Appendix H). In the HHRA, the calculation of fish concentrations in the Connecticut reaches used smallmouth bass data. In the CMS, the Connecticut 1-D Analysis was used to estimate fish concentrations in the Connecticut impoundments using the largemouth bass equations from EPA's FCM (see Appendix J of the Revised CMS Report). Similar to largemouth bass, smallmouth bass also have a length limit of 12 inches; therefore, only age classes corresponding to lengths greater than 12 inches were used in the calculation. Thus, the blended fish concentrations for Connecticut would be unchanged from what was used in the Revised CMS Report – that is:

$$\textit{Blended Fish, CT} = \textit{Average}\ (LMB_{(fillet,\ >=30.4\ cm)})$$

I.2.2 Results from Blended Fish Calculation

Application of EPA's blended fish averaging methods to FCM outputs results in PCB concentrations that are on average 5% higher than those documented in the Revised CMS Report, which were based on largemouth bass alone. The reasons for this average increase are due to both the exclusion of smaller sized largemouth bass (which have lower concentrations than the larger fish) and the inclusion of brown bullhead (which have higher concentrations as a bottom feeder) in the calculation.

To evaluate the impacts of the revised blended fish calculation method on the evaluations of the sediment alternatives, the extent of human fish consumption IMPG attainment resulting from the use of this blended fish PCB concentration was compared to that resulting from the sole use of largemouth bass, as used in the Revised CMS Report. These results are summarized in Tables I-4 through I-12 for each of the sediment alternatives. These tables show that the slight average increase in PCB concentrations resulting from use of the revised blended fish calculation method has a negligible effect on attainment of the human consumption IMPGs and, overall, generally results in slightly less IMPG attainment. Specifically, for each sediment alternative, use of the blended fish method would result in a few additional instances of non-attainment of those IMPGs, mostly for the deterministic CTE IMPGs. However, there are a few cases where an additional IMPG or IMPGs would be attained as result of the revised blended fish calculation method. Specifically, that method would result in attainment of the following additional IMPGs: (a) under SED 6 and SED 9, the deterministic RME IMPG based on an assumed 10^{-4} cancer risk and the deterministic CTE non-cancer IMPG for children in Reach 7C; (b) under SED 7, those same IMPGs in Reaches 7C and 8; and (c) under SED 8, the probabilistic RME non-cancer IMPG for adults in Reach 6.

I.3 MODEL SENSITIVITY TO OSPREY FEEDING PREFERENCES

In Specific Comment #60 on the March 2008 CMS Report, EPA noted that it disagreed with GE's assignment of feeding preferences for osprey (the species selected by EPA to represent piscivorous birds), and it asserted that the parameterization in the CMS was incorrectly based on the assumption that all modeled fish species would be consumed equally by osprey (Revised CMS Report Table 3-12). Based on information developed in the Ecological Risk Assessment (ERA), EPA contended that an alternate parameterization (namely, the prey preference matrix used for eagles) is a better representation of the osprey diet:

$$Blended_{raptor} = (0.6\times \text{Age 4 Sucker}) + (0.15\times \text{Age 5 Sunfish}) + (0.25\times \text{Age 5 Bass})$$

In addition, EPA stated that, based on the size range of fish consumed by osprey, it is more appropriate to assume a diet consisting of age 4+ white sucker, age 5+ sunfish, and age 5+ bass as surrogate age classes most representative of this range. The CMS used the average of multiple age classes, including ages 1+ to 5+ for white sucker, 2+ to 5+ for sunfish, and 1+ to 9+ for largemouth bass.

As a result of these differences, EPA noted that the concentrations calculated based on the method used in the CMS are 16% lower than those calculated by EPA using this alternative parameterization. These differences derive mainly from: (1) greater assumed proportion of forage fish in osprey diet in the CMS; and (2) inclusion of younger age classes (on average) of white sucker and sunfish in osprey diet in the CMS. As discussed below, GE does not agree with EPA's arguments, and has not changed its assumptions on osprey feeding preferences in the modeling presented in the Revised CMS Report. However, as also discussed below, GE has assessed the sensitivity of achievement of the IMPGs for piscivorous birds (represented by osprey) to EPA's assumed feeding preferences for osprey.

The assumption that all modeled fish species would be consumed equally by osprey was based on GE's interpretation of the ERA. For example, while the ERA notes that fish represent the predominant prey of osprey (assumed to be 100% in the ERA), it makes no mention of the composition of diet by fish species (EPA, 2004, Vol. 6, pp. H-25 – H-26); and the cited table on osprey diet (Table H.2-11) does not provide a clear basis for making that determination, particularly since none of the studies listed in that table was conducted on a large Northeastern river comparable to the Housatonic River. Furthermore, the ERA's discussion of the assumed PCB concentrations in fish consumed by osprey focuses on the effect of the assumed length of fish, rather than the species or how they might be weighted (Vol. 6, p. H-26). Similarly, the summary table on PCB concentrations in such fish provides no indication of weighting by species. In contrast, for bald eagles, the ERA explicitly defines the weighting applied for different guilds of fish (Vol. 6, Table K.2-2). All of these elements of the ERA indicate that EPA did not weight fish by species when calculating the dietary concentration of osprey. GE followed that approach in the CMS Report and the Revised CMS Report.

In any event, contrary to EPA's suggestion that the bald eagle's weighting scheme be applied to osprey, prey preferences of bald eagles and osprey likely differ, as would be expected based on Gause's Law of Competitive Exclusion (i.e., species competing for the same resources cannot stably exist). In contrast with the bald eagle's preference of sucker>bass>sunfish, Van Daele and Van Daele (1982) reported that osprey target bullheads and salmonids disproportionately when compared to netted samples and that yellow perch and suckers were underrepresented in the diet. Edwards and Collopy (1988) reported that adult ospreys took bass in proportion to their abundance but took sunfish and shad disproportionately relative to their abundance. Although these two studies do not provide an adequate basis for quantitatively defining weights, they suggest that preferences among osprey follow a trend of bullhead/sunfish>bass>sucker (i.e., almost opposite to the preferences of bald eagles). With respect to the age ranges used in the Revised CMS, the assignment of model age classes that correspond to the preferred size range (130 to 400 millimeters [mm]) for osprey used in the ERA (i.e., the age classes shown in Table 3-11 of the Revised CMS Report) was based on analysis of site data and EPA's model inputs, as follows:

- As the EPA FCM does not include length as a parameter, it was necessary to correlate the preferred length range to weight, a parameter used in the model. Log-log plots of length and weight data from the EPA and GE datasets were generated for each of the modeled species, and regressions from the data were used to convert the length range to a weight range.

- The resulting weight ranges were then compared to the weights input in the EPA FCM for each fish age class to establish the age classes that fall within the preferred osprey size range.

The attached Figure I-1 contains an example for Cyprinids. Based on the length/weight relationship shown in this figure, the 130 to 400 mm size range corresponds to a weight range of 20 to 600 grams. This weight range was then compared against the age-weight inputs in EPA's FCM for Cyprinids (summarized in Table I-13 below; also shown in Table 2 of Appendix C2 of EPA's Final Model Documentation Report [EPA, 2006]):

Table I-13. Cyprinid Age versus Weight.

Cyprinid Age Class	1	2	3	4	5	6
Range (grams)	0.2 – 3.0	3.0 – 5.0	5.0 – 8.0	8.0 – 12	12 – 20	20 – 25

From the EPA FCM inputs, the only age class for cyprinids having weights within the range of 20 to 600 grams is age 6, the last modeled age class. Thus, this is the age class listed for cyprinids in Table 3-11 of the Revised CMS Report. The same approach was employed for all of the species listed in Table 3-11 of the Revised CMS Report. GE believes that this approach for determining the age classes for osprey prey is appropriate. In fact, use of the ERA's size range extending up to 400 mm was already conservative, given that that range is greater than ranges reported in several studies (e.g., Cramp and Simmons, 1980; Van Daele and Van Daele, 1982; Prevost, 1982).

While GE does not agree with EPA's alternate parameterization of osprey feeding preferences, the significance of the method proposed by EPA was evaluated by: (a) increasing the PCB concentrations predicted by the model for fish consumed by osprey for all alternatives, using the CMS approach regarding this species' prey, by the 16% cited by EPA; and then (b) comparing those increased concentrations again to the IMPG for piscivorous birds based on osprey (3.2 mg/kg in fish prey). Table I-14 below illustrates the impact of this alternate approach on the number of averaging areas achieving this IMPG for each of the sediment alternatives.

Table I-14. Number of Averaging Areas Meeting IMPG for Piscivorous Birds.

Alternative	Number of Averaging Areas Meeting IMPG using CMS Approach	Number of Averaging Areas Meeting IMPG After Applying 16% Increase to Model-Predicted Concentration	Comments
SED 1/2	0 of 14	0 of 14	No changes in IMPG attainment
SED 3	6 of 14	6 of 14	No changes in IMPG attainment
SED 4	11 of 14	10 of 14	Change from attaining IMPG to non-attainment in Reach 7G
SED 5	13 of 14	11 of 14	Change from attaining IMPG to non-attainment in Reach 7C and 7G
SED 6	14 of 14	14 of 14	No changes in IMPG attainment
SED 7	14 of 14	14 of 14	No changes in IMPG attainment
SED 8	14 of 14	14 of 14	No changes in IMPG attainment
SED 9	14 of 14	14 of 14	No changes in IMPG attainment
SED 10	0 of 14	0 of 14	No changes in IMPG attainment

As shown in the above table, the method proposed by EPA would not have a large impact on attainment of the IMPG for piscivorous birds or on the comparison among alternatives in terms of achieving that IMPG.

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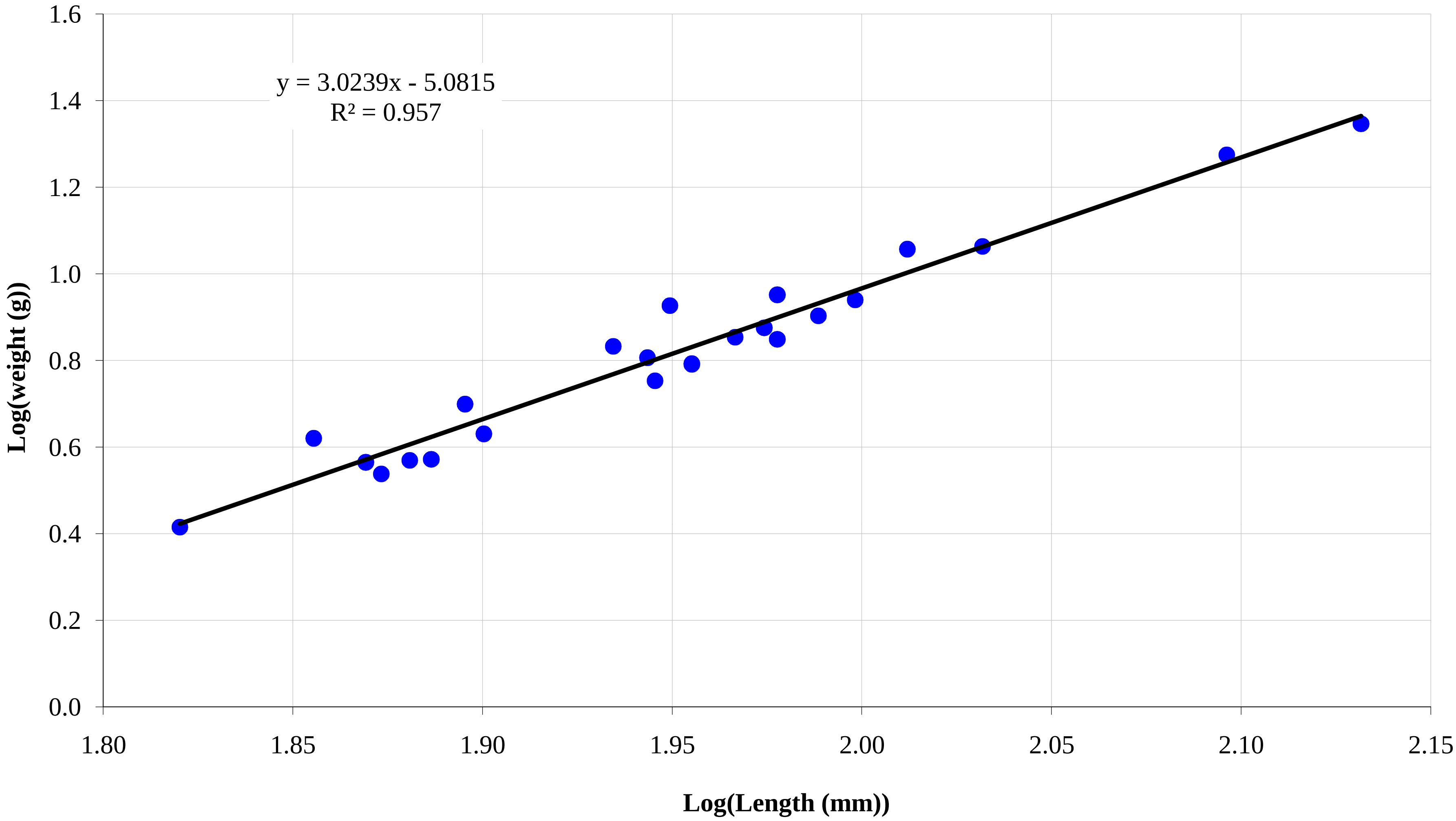

Figure I-1. Length-weight relationship in cyprinids from Reaches 5 and 6.

H:\GENcms\MODEL\FDCHN\Analysis\IMPG\Length_Weight_Relationships\lip_wgt_age_Cyprinids.xls(chart_for_CMS_Comment_SC60)

Table I-4. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED1 / SED 2).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					7.9	9.5	8.0	9.8	8.6	6.0	6.0	6.1	5.3	3.9	3.1	3.4	2.6	3.6	0.2	0.1	0.08	0.08
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					7.3	9.3	7.4	9.5	8.6	6.4	5.7	6.3	5.5	4.1	3.2	3.5	2.8	3.6	0.2	0.1	0.08	0.08
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 52-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.
BBD: Bulls Bridge Dam Impoundment
LL: Lake Lillinonah
LZ: Lake Zoar
LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG
(grey) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs
(white) = model prediction exceeds the IMPG

CTE = central tendency exposure
RME = reasonable maximum exposure

Table I-5. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED 3).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.24	3.5	2.1	6.4	0.73	1.2	2.5	1.9	1.4	1.0	0.84	1.4	0.72	1.7	0.04	0.03	0.02	0.02
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.25	3.0	1.8	6.3	0.71	1.3	2.1	1.8	1.4	1.0	0.82	1.3	0.72	1.6	0.04	0.03	0.02	0.02
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 52-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.

BBD: Bulls Bridge Dam Impoundment
LL: Lake Lillinonah
LZ: Lake Zoar
LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG
(grey) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs
(white) = model prediction exceeds the IMPG

CTE = central tendency exposure
RME = reasonable maximum exposure

Table I-6. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED 4).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.25	0.41	0.47	0.38	0.22	0.52	2.1	1.2	0.94	0.66	0.56	1.2	0.48	1.5	0.02	0.01	0.01	0.01
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.26	0.39	0.42	0.40	0.23	0.50	1.6	1.1	0.84	0.62	0.52	1.1	0.46	1.3	0.02	0.01	0.01	0.01
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 52-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.

BBD: Bulls Bridge Dam Impoundment
LL: Lake Lillinonah
LZ: Lake Zoar
LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG
(grey) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs
(white) = model prediction exceeds the IMPG

CTE = central tendency exposure
RME = reasonable maximum exposure

Table I-7. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED 5).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.25	0.22	0.17	0.35	0.18	0.45	2.0	1.2	0.89	0.61	0.52	1.1	0.45	0.35	0.01	0.009	0.006	0.006
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.26	0.23	0.17	0.36	0.18	0.42	1.6	1.0	0.79	0.57	0.49	1.0	0.43	0.34	0.01	0.009	0.006	0.006
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 52-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.

BBD: Bulls Bridge Dam Impoundment
LL: Lake Lillinonah
LZ: Lake Zoar
LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG
(grey) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs
(white) = model prediction exceeds the IMPG

CTE = central tendency exposure
RME = reasonable maximum exposure

Table I-8. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED 6).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.25	0.21	0.16	0.34	0.17	0.42	0.50	0.19	0.80	0.35	0.49	0.43	0.41	0.22	0.009	0.006	0.005	0.004
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.26	0.22	0.16	0.35	0.17	0.40	0.41	0.20	0.70	0.34	0.45	0.40	0.39	0.22	0.009	0.006	0.005	0.004
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 52-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.

BBD: Bulls Bridge Dam Impoundment

LL: Lake Lillinonah

LZ: Lake Zoar

LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG

(grey) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs

(white) = model prediction exceeds the IMPG

CTE = central tendency exposure

RME = reasonable maximum exposure

Table I-9. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED 7).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.27	0.23	0.18	0.36	0.19	0.44	0.25	0.19	0.85	0.33	0.49	0.36	0.42	0.19	0.009	0.006	0.005	0.004
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.29	0.25	0.18	0.39	0.19	0.42	0.23	0.20	0.75	0.33	0.46	0.35	0.40	0.20	0.009	0.006	0.005	0.004
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 55-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.

BBD: Bulls Bridge Dam Impoundment
LL: Lake Lillinonah
LZ: Lake Zoar
LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG
(gray) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs
(white) = model prediction exceeds the IMPG

CTE = central tendency exposure
RME = reasonable maximum exposure

Table I-10. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED 8).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.16	0.14	0.11	0.26	0.12	0.37	0.10	0.11	0.73	0.16	0.41	0.14	0.37	0.16	0.007	0.005	0.004	0.004
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.17	0.15	0.11	0.29	0.13	0.34	0.10	0.12	0.63	0.18	0.38	0.15	0.35	0.17	0.006	0.005	0.004	0.003
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 81-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.

BBD: Bulls Bridge Dam Impoundment
LL: Lake Lillinonah
LZ: Lake Zoar
LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG
(grey) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs
(white) = model prediction exceeds the IMPG

CTE = central tendency exposure
RME = reasonable maximum exposure

Table I-11. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED 9).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.31	0.26	0.18	0.40	0.16	0.45	0.23	0.18	0.85	0.21	0.49	0.21	0.41	0.23	0.01	0.007	0.005	0.005
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					0.31	0.27	0.18	0.41	0.16	0.42	0.21	0.20	0.75	0.22	0.45	0.22	0.39	0.24	0.009	0.006	0.004	0.004
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 52-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.

BBD: Bulls Bridge Dam Impoundment
LL: Lake Lillinonah
LZ: Lake Zoar
LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG
(grey) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs
(white) = model prediction exceeds the IMPG

CTE = central tendency exposure
RME = reasonable maximum exposure

Table I-12. IMPGs for human consumption of fish tissue compared to projected fillet-based fish PCBs calculated using EPA's "blended" fish method (top panel) and the sole use of largemouth bass (bottom panel) (SED 10).

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					4.5	6.9	6.5	11	3.7	4.0	4.5	4.3	3.7	2.7	2.1	2.6	1.8	2.8	0.1	0.08	0.06	0.05
Blended Fish Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Tissue Type	Assessment Type	Exposure Assumptions	Risk Level	IMPG (mg/kg)	Average Fish Tissue (Fillet) PCB Concentration (mg/kg) [1]																	
					Reach 5A	Reach 5B	Reach 5C	Reach 5D	Reach 6	Reach 7A	Reach 7B	Reach 7C	Reach 7D	Reach 7E	Reach 7F	Reach 7G	Reach 7H	Reach 8	BBD	LL	LZ	LH
					4.2	6.6	5.8	11	3.7	4.2	4.2	4.4	3.7	2.8	2.2	2.6	1.9	2.7	0.1	0.08	0.05	0.05
Bass Fillets	Deterministic	RME	10^{-6} Cancer Risk	0.0019																		
			10^{-5} Cancer Risk	0.019																		
			10^{-4} Cancer Risk	0.19																		
			Non-Cancer -- Child	0.026																		
			Non-Cancer -- Adult	0.062																		
		CTE	10^{-6} Cancer Risk	0.049																		
			10^{-5} Cancer Risk	0.49																		
			10^{-4} Cancer Risk	4.9																		
			Non-Cancer -- Child	0.19																		
			Non-Cancer -- Adult	0.43																		
	Probabilistic	RME (5th percentile)	10^{-6} Cancer Risk	0.0064																		
			10^{-5} Cancer Risk	0.064																		
			10^{-4} Cancer Risk	0.64																		
			Non-Cancer -- Child	0.059																		
			Non-Cancer -- Adult	0.12																		
		CTE (50th percentile)	10^{-6} Cancer Risk	0.057																		
			10^{-5} Cancer Risk	0.57																		
			10^{-4} Cancer Risk	5.7																		
			Non-Cancer -- Child	0.71																		
			Non-Cancer -- Adult	1.5																		

Notes

[1] Model endpoint concentrations after 52-year projection (autumn average); whole body concentrations divided by a factor of 5.0 to convert to fillet basis. Results for CT impoundments are highly uncertain as they were estimated from the CT 1-D Analysis.

BBD: Bulls Bridge Dam Impoundment
LL: Lake Lillinonah
LZ: Lake Zoar
LH: Lake Housatonic

Key

(blue) = model prediction is lower than the IMPG
(gray) = model prediction is lower than the cancer IMPG, but is not lower than the corresponding non-cancer IMPGs
(white) = model prediction exceeds the IMPG

CTE = central tendency exposure
RME = reasonable maximum exposure

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Appendix J

Connecticut 1-D Analysis

APPENDIX J

CT 1-D Analysis

The polychlorinated biphenyl (PCB) fate, transport, and bioaccumulation model developed by the U.S. Environmental Protection Agency (EPA) does not extend below Rising Pond Dam, and therefore, cannot be used to predict the response of the River to various potential remedial scenarios below that impoundment. For this reason, GE developed a semi-quantitative one-dimensional (1-D) framework (hereafter referred to as the Connecticut [CT] 1-D Analysis) that incorporates the available data from the CT section of the River, as well as predictions from the EPA Downstream Model (i.e., the model developed by EPA for the portion of the river between Woods Pond Dam and Rising Pond Dam), to provide estimates of future changes in PCB concentrations in the water column, surface sediment, and fish in the four major impoundments in the CT portion of the River (i.e., Bulls Bridge Dam impoundment, Lake Lillinonah, Lake Zoar, and Lake Housatonic).

J.1. Overview of Approach

As described in the Corrective Measures Study (CMS) Proposal (ARCADIS BBL and Quantitative Environmental Analysis, LLC [QEA], 2007), the CT 1-D Analysis focused on the Bulls Bridge Dam impoundment, since this location contains high-resolution (i.e., finely-segmented) sediment cores with radionuclide dating, and is one of the routine fish sampling sites used in GE's biennial fish sampling in the CT portion of the River (Blasland, Bouck & Lee, Inc. [BBL] and QEA, 2003). The CT 1-D Analysis described in this Appendix simulates the response of water column, surface sediment, and fish PCB concentrations in the Bulls Bridge Dam impoundment to changes in PCB loads passing over Rising Pond Dam based on the following approach:

- Water column PCB concentrations passing over Rising Pond Dam, as predicted by the EPA model, were used in conjunction with an "attenuation factor" to estimate the particulate-phase PCB concentrations of sediments depositing in the Bulls Bridge Dam impoundment in the future. In this analysis, the term "attenuation factor" refers to an empirical multiplier that accounts for decreases in PCB concentrations from upstream to downstream in the River that result from dilution (due to inputs of flow and sediment from the watershed) as well as other loss mechanisms such as deposition and volatilization (details are described in Section 2.2.3 below).

- These estimated particulate-phase PCB concentrations were then used in conjunction with a sediment deposition rate for the Bulls Bridge Dam impoundment (as determined from a high-resolution sediment core) as input to a 1-D model of the sediment column that calculates surficial sediment PCB concentrations in that impoundment. This model is similar in structure to the bed component of the Environmental Fluid Dynamics Code

(EFDC) model developed by EPA for the River between the Confluence and Rising Pond Dam (see Section 2 below for a description of the setup and calibration of the 1-D bed model) and uses the principle of mass balance to simulate the fate and transport of PCBs in the system.

- The 1-D bed model performs a time-variable mass balance calculation to predict future changes in surface sediment PCB concentrations based on future changes in PCB deposition (i.e., reductions in the PCB load passing Rising Pond Dam that result from the implementation of remediation in Reaches 5 through 8 for the various sediment alternatives).

- The water column and sediment PCB concentrations computed for the Bulls Bridge Dam impoundment in this analysis were then multiplied by an impoundment specific attenuation factor (as described in Section 3 below) to provide estimates of PCB concentrations in the three impoundments downstream of Bulls Bridge Dam: Lake Lillinonah, Lake Zoar, and Lake Housatonic.

For fish, the EPA food chain model (FCM) developed for Reach 8 was then used to simulate the bioaccumulation of contaminants by fish in the CT impoundments based on the computed water column and sediment concentrations (as directed by EPA in its conditional approval of the CMS Proposal). PCB concentrations in smallmouth bass (i.e., the species for which the most robust temporal and spatial data coverage exist in CT) were extrapolated from the existing FCM predator model. Development and calibration of the CT FCM is described in Section 4 below.

J.2. Bulls Bridge Sediments

J.2.1 Model Description

As described above, a 1-D sediment bed model (similar in structure to the bed component of the EFDC model developed by EPA for Reaches 5 through 8) was developed to simulate changes in surficial sediment PCB concentrations in the Bulls Bridge Dam impoundment over time. This model represents a single column of sediment, for which solids fluxes and water column PCB concentration time-series are specified as boundary conditions, and uses a mass balance to calculate sediment PCB concentrations and fluxes over time. This model was developed by QEA, and has been used previously at other sites to evaluate sediment mixing depths and diffusive transport rates of contaminants through sediment and sediment capping materials (e.g., Alcoa 2003).

The 1-D bed model developed in this application simulates sediment PCB concentrations over a total depth of 150 cm. The bed was segmented into 150 1-cm layers at the beginning of the simulation. The thickness of the top-most and bottom-most layers in the model vary over time based on the magnitude of sediment deposition. As additional sediments are deposited, the thickness of the top layer increases until reaching a critical value (i.e., 1.1 cm), at which point this surface layer is split into two; at the same time, the bottom two layers are combined into a “deep reservoir.”

Fate processes simulated by the 1-D bed model include sediment mixing (due to biological activity), diffusion of dissolved-phase PCBs within the pore water and to the water column, and three-phase equilibrium partitioning among dissolved-phase, dissolved organic carbon (DOC)-bound, and particulate-phase PCBs. In this model, the water column compartment is not simulated (water column concentrations are provided as inputs); therefore short-term sediment erosion and deposition processes are not calculated, but rather are accounted for as a net solids flux (i.e., the combined effect of erosion and deposition) to the bed over time.

The sediment bed model calibration spanned the 42-year period between 1963 and 2004. The 1963 date represents the assumed date of peak Cesium-137 observed in a finely-segmented sediment core collected from the Bulls Bridge Dam impoundment; only one finely-segmented sediment core has been collected from this impoundment that has a Cesium-137 depth profile sufficient for dating of the deposited sediments (core BBD-CS-02 collected in 1998; BBL and QEA, 2003). The 2004 date represents the end of the EPA model validation period.

As described above, this model requires solids fluxes and water column PCB concentration time-series as inputs. These inputs were derived over the 42-year model calibration period as follows:

1963 – 1980: Due to a lack of data over this time period, water column particulate-phase PCB concentrations were assumed to remain constant, and were estimated based on the average sediment concentration from core sections corresponding to this time period in the dated high resolution sediment core collected from this impoundment (i.e., core BBD-CS-02).

1980 – 1990: Due to a lack of data over this time period, water column particulate-phase PCB concentrations were again considered to be constant, and were based on the average sediment concentration from core sections corresponding to this time period in the same dated high resolution core collected from the Bulls Bridge Dam impoundment, as discussed further below.

1990 – 2004: This time period corresponds to the calibration period used in the EPA Downstream Model; therefore, water column PCB concentrations in the Bulls Bridge Dam impoundment were estimated based on the water column PCB concentration passing Rising Pond Dam (predicted by the EPA model), modified by an attenuation factor that accounts for reductions in PCB concentration between Rising Pond and Bulls Bridge. The development of this attenuation factor (which was refined during calibration of the 1-D model) is described below.

J.2.2 Inputs

A summary of the non-time-variable inputs/coefficients used in the 1-D bed model is provided in Table J-1. When available, site-specific data from the Bulls Bridge Dam impoundment were used to develop the necessary inputs;[1] Figure J-1 shows the sediment sampling locations within this impoundment. However, there were several inputs for which no impoundment-specific data existed. In these cases, inputs from the calibrated and validated EPA model of Rising Pond were used (as noted in Table J-1).

[1] Since the extent of this impoundment is not well defined, aerial photography was used to identify the likely depositional region upstream of Bulls Bridge Dam. The extent of this area is shown in Figure J-1 and defines the Bulls Bridge Dam impoundment for this analysis.

Table J-1. Non-Time-Variable Inputs/Coefficients Used in the 1-D Bed Model

Model Input	Parameter	Value	Units	Data Source
Sediment	Bulk Density	0.99	g/cm^3	Site-specific data
	Porosity	0.61	---	Site-specific data
	Organic carbon fraction (f_{oc})	0.99	%	Site-specific data
	Dissolved Organic Carbon	16.5	mg/L	Same as Primary Study Area (PSA) and Downstream Models
	Sediment A_{doc} (DOC-binding effectiveness coefficient)	0.10	---	Same as PSA and Downstream Models
	Sediment-water mass transfer coefficient (K_f)	1.52	cm/d	Same as PSA and Downstream Models
	Diffusion coefficient in porewater	0.86	cm^2/d	Same as PSA and Downstream Models
	Sediment mixing rate (top 7 cm)	1.4E-09	m/s	Same as Downstream Model
	Sediment mixing rate (7 to 14 cm)	1.4E-10	m/s	Same as Downstream Model
	Sediment mixing rate (below 14 cm)	0	m/s	Same as Downstream Model
	Net settling rate	1.3	cm/yr	Site-specific data
Water Column	log K_{oc}	6.5	L/kg	Same as PSA and Downstream Models
	Water column A_{doc}	0.01	---	Same as PSA and Downstream Models
	Dissolved Organic Carbon (DOC)	6.5	mg/L	Same as PSA and Downstream Models
	Organic carbon fraction (f_{oc})	8.2	%	Site-specific data

Notes:
g/cm^3 = gram(s) per cubic centimeter
--- = not applicable
% = percent
mg/L = milligram(s) per liter
cm/d = centimeter(s) per day
cm^2/d = squared centimeter(s) per day
m/s = meter(s) per second
cm/yr = centimeter(s) per year
L/kg = liter(s) per kilogram

J.2.2.1 Sediment Bed Inputs

Sediment bed parameters that were derived from site-specific data collected within the Bulls Bridge Dam impoundment include bulk density, porosity, and sediment total organic carbon (TOC). These values were assumed to be constant with depth, and were assumed to remain constant over the duration of the model simulation. Bulk density and porosity were estimated from historical sediment data collected from the surficial 6 inches of sediment in the Bulls Bridge Dam impoundment by first calculating a length-weighted average for each individual core, and then averaging over the impoundment. This resulted in an average bulk density equal to 0.99 g/cm^3. Similarly, the average sediment organic carbon fraction (f_{oc}) was calculated using the same method, resulting in an average f_{oc} used in the model of approximately 1%. Average bed porosity (0.61) was calculated based on the average dry bulk density and an assumed solids specific density of 2.65 g/cm^3.

As discussed in the model description, PCB data from the GE high resolution core BBD-CS-02 were used to estimate the average sediment PCB concentrations in sediments deposited between 1963 and 1980. The average concentration from the dated core sections corresponding to this period (i.e., 1.77 milligrams/kilogram [mg/kg] from the 32-45 cm depth interval; see Figure J-2) was used as the sediment PCB initial condition for all layers in the model. This value also was used for the water column particulate-phase PCB inputs over this time period, as described below.

In addition to the bed parameters described above, the 1-D model requires the specification of a sedimentation rate to simulate sediment deposition in the model. The sedimentation rate calculated for high resolution core BBD-CS-02 (1.3 cm/yr, as described in the RCRA Facility Investigation Report [RFI Report; BBL and QEA, 2003]) was used in the 1-D bed model.

J.2.2.2 Water Column Inputs

The 1-D bed model requires specification of a time series of total suspended solids (TSS) and water column PCB concentrations, which are used to calculate the PCB concentration of depositing sediments. Water column PCB and solids inputs were specified differently over the 42-year calibration period for each of the three time periods described above (i.e., 1963-1980, 1980-1990, and 1990-2004). Figures J-3 and J-4 present the water column TSS and PCB boundary conditions for the 42-year calibration period, respectively. The TSS and PCB concentrations shown in these figures have been scaled by attenuation factors that account for changes in TSS and PCB concentrations between Rising Pond and Bulls Bridge Dam, as discussed below.

During the periods from 1963-1980 and 1980-1990, few water column PCB data were collected from the Bulls Bridge Dam impoundment (only four samples, all of which were non-detect at a detection limit of 22 nanograms per liter [ng/L]); further, only a limited amount of TSS and sediment PCB data exist from this time period. Consequently, water column particulate-phase PCB concentrations were derived from average sediment concentrations in core sections corresponding to each respective time period in the dated high resolution core described above (1998 GE core BBD-CS-02). This approach assumes that particulate-phase PCBs in the water column prior to 1990 were consistent with sediments deposited over the same period as determined by core dating. Three-phase partitioning was used to back-calculate average whole-water PCB concentrations using the particulate-phase concentrations for both periods. The average whole-water PCB concentrations calculated in this manner were 42 ng/L for the period from 1963-1980 and 8.3 ng/L for the period from 1980–1990 (Figure J-4).

In addition, only four samples collected during this (pre-1990) time period from Bulls Bridge were analyzed for TSS and water column particulate organic carbon (POC). Based on these data, an average value of 8.2% was specified for the water column organic carbon fraction (f_{oc}; equal to POC divided by TSS) during this time period. While these four samples were the only available information to estimate water column f_{oc}, it was judged that the use of these four samples was insufficient for estimating an average TSS concentration for this pre-1990 period. Therefore, TSS data collected by the U.S. Geological Survey (USGS) at Gaylordsville (located approximately 2.5 miles downstream of Bulls Bridge Dam) during 1979 were used to estimate an average TSS concentration of 20 mg/L, which was used in the model to represent pre-1990 conditions.[2] This assumes that TSS concentrations at Gaylordsville are representative of those observed at Bulls Bridge; this assumption was deemed sufficient for this analysis given the proximity of these two locations.

During the period from 1990-2004 (corresponding to the calibration period used in the EPA Downstream Model), water column PCB and TSS concentrations in the Bulls Bridge Dam impoundment were estimated based on the water column concentrations passing Rising Pond Dam as predicted by the EPA model, multiplied by an attenuation factor as described below.

J.2.2.3 Model Calibration Attenuation Factors

Attenuation factors were developed to account for gains/losses of TSS and PCBs between Rising Pond and the Bulls Bridge Dam impoundment to facilitate 1-D sediment model calibration. Two attenuation factors were needed:

- A TSS attenuation factor to reflect the observed increase in sediment yield (load per unit watershed area) between Rising Pond and Bulls Bridge Dam.
- A water column PCB attenuation factor to account for reductions in PCB concentration between Rising Pond and Bulls Bridge Dam (due to increased flows resulting in dilution, and loss of PCBs due to volatilization and sorption, and the subsequent settling of particulate-bound PCBs).

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[2] The 1979 USGS study is the only comprehensive TSS study that has been conducted at the Gaylordsville gaging station. During this study, 218 TSS samples were collected, a majority of which were collected over a 6-month period (from April to September 1979).

Development of the TSS attenuation factor was achieved by comparing flows at these two locations (using the USGS flow records from Great Barrington [USGS Gage #01197500] and Gaylordsville [USGS Gage #01200500], which were assumed to be representative of flow conditions at Rising Pond Dam and Bulls Bridge Dam, respectively), in conjunction with a comparison of the available TSS data from just downstream of Bulls Bridge Dam (USGS TSS data collected in 1979 at Gaylordsville) with the EPA model-predicted TSS concentrations exiting Rising Pond. As described above, this method implicitly assumes that TSS concentrations at Gaylordsville are similar to those at Bulls Bridge Dam, which was deemed sufficient for this analysis given the proximity of these two locations. The method used to determine the TSS attenuation factor was as follows:

- USGS daily average flow data were used to compute average yearly flows at the two locations described above (Gaylordsville and Great Barrington; top panel of Figure J-5). The ratio of annual average flow at these two stations averaged over the period of 1979-2006 yielded a flow increase factor of 3.2 (bottom panel of Figure J-5).

- A separate comparison of daily average flow values from 1979 and other years between 1990 and 2004 (i.e., the EPA model calibration period) was conducted to find a year containing flows that were similar in magnitude to those observed in 1979. A comparison of the distribution of daily average flows in 1979 at Gaylordsville to those predicted by the EPA model in 2003 is shown in Figure J-6 (note that flows shown for 2003 represent model-predicted flows at Rising Pond Dam that have been scaled up based on the factor of 3.2 estimated from Figure J-5). This comparison was used to establish that flow conditions in 1979 and 2003 were generally similar (i.e., flow conditions during the 1979 TSS sampling were similar to those in 2003, indicating that any observed differences in solids between the USGS data collected in 1979 and the model-predicted TSS in 2003 are likely the result of an increased solids yield between Rising Pond and Gaylordsville, and not a difference in flow conditions).

- TSS at both locations (binned according to flow in 500 cubic feet per second [cfs] increments) are plotted versus flow in Figure J-7. The left panel shows that at a given flow rate, the TSS concentrations predicted by the EPA model at Rising Pond Dam are lower than those measured at Gaylordsville, especially for flows exceeding 5,000 cfs. This indicates that the solids yield from the watershed between Great Barrington and Gaylordsville must increase. This is consistent with the observations by the USGS in its 1994-1996 loading study (USGS 2000), which concluded that an approximately three-fold increase in solids yield occurred between Great Barrington (20.6 tons/yr/mi^2) and Ashley Falls (58.4 tons/yr/mi^2), a USGS gaging station near the Massachusetts (MA)/CT border. Application of a multiplication factor of four to the Rising Pond TSS values (to account for the increase solids yield) is needed to obtain agreement between the two TSS data sets, particularly at higher flows (Figure J-7, right panel). Given that

Bulls Bridge Dam is further downstream than Ashley Falls, this 4X increase is not inconsistent with the USGS study.

Based on this analysis, the TSS attenuation factor used to calibrate the Bulls Bridge Dam 1-D model was set to four – i.e., TSS concentrations in the Bulls Bridge Dam impoundment for years including and after 1990 were calculated by multiplying the model-predicted concentrations at Rising Pond Dam by a factor of four.

Similarly, water column PCBs exiting Rising Pond were multiplied by an attenuation factor to account for the reduction in PCB concentrations between Rising Pond and Bulls Bridge that result from the PCB loss mechanisms described above. While PCBs in the Bulls Bridge Dam impoundment were expected to be lower for these reasons, no data are available to estimate the PCB attenuation factor; therefore, this factor was used as the primary calibration parameter in the 1-D model.

J.2.3 Calibration

The results from the 1-D sediment model calibration are shown on Figure J-8, in which a time-series of surface sediment PCB concentrations in the Bulls Bridge Dam impoundment is shown. This figure demonstrates that there is a reasonably good agreement between the surface sediment PCB data in the Bulls Bridge Dam impoundment and the model output using a calibrated value of 0.1 for the PCB attenuation factor (described above).[3]

Accordingly, the 1-D model for the Bulls Bridge Dam impoundment based on this calibration was used to project future PCB concentrations in this location under the various sediment alternatives studied in the CMS – i.e., future PCB concentrations predicted by the EPA model at Rising Pond Dam were multiplied by 0.1 to estimate water column PCB concentrations in the Bulls Bridge Dam impoundment.

J.3. Development of Attenuation Factors for Downstream CT Impoundments

Surface sediment PCB concentrations in the impoundments downstream of Bulls Bridge Dam are relatively low and appear to be largely affected by dilution of PCBs that originate from upstream. Therefore, PCB concentrations in the three impoundments downstream of Bulls Bridge Dam (i.e., Lake Lillinonah, Lake Zoar, and Lake Housatonic; see Figure J-9) were estimated from PCB concentrations calculated at Bulls Bridge Dam (Section 2.2.3), reduced by impoundment-specific dilution factors that reflect the flow increase at each impoundment relative to the Bulls Bridge Dam impoundment. Subsequently, the resulting

[3] Note that the calibrated PCB attenuation factor (0.1) produces a greater reduction in surface sediment PCB concentrations than it would if only dilution due to increases in flow were considered (0.37). This difference likely results from a combination of increasing solids yield and PCB loss via deposition and/or volatilization.

water column and sediment PCB concentrations calculated for each impoundment were then used in the EPA Food Chain Model to evaluate fish PCB concentrations in these downstream CT impoundments (as described in Section 4 below).

The attenuation factors for Lake Lillinonah and Lake Zoar were estimated from the flows measured by the USGS gaging stations between Bulls Bridge and the Stevenson Dam (at the downstream end of Lake Housatonic; Table J-2). Daily average flow data collected between 2003 and 2007 were used in this flow analysis, as these were the only years containing a complete data set at each gaging station. Daily average flow within each impoundment was determined as follows:

- Bulls Bridge Dam flow was calculated by subtracting the Tenmile River flow (USGS Gage #01200000) from the Housatonic River flow at Gaylordsville (Figure J-9).
- Lake Lillinonah flow was calculated by summing flow in the Housatonic River at Gaylordsville with flow from the Still River (USGS Gage #01201487) and Shepaug River (USGS Gage #01202501; Figure J-9).
- Lake Zoar flow was set equal to the flow measured in the Housatonic River at the Stevenson Dam (USGS Gage #01205500; Figure J-9).

The average flow representative of each impoundment was calculated by averaging the daily average flows described above over the period from 2003 to 2007. These average flows were subsequently divided by the average flow at Bulls Bridge to calculate the impoundment-specific attenuation factors. Table J-2 below summarizes the average flows and the corresponding attenuation factors within each impoundment.

The Lake Housatonic attenuation factor could not be estimated from the flow data because there were no USGS gaging stations within or just downstream of that impoundment. Therefore, the Lake Housatonic attenuation factor was estimated based on changes in drainage area in that region. Geographic Information System (GIS) analysis determined that the ratio of drainage areas for Lake Housatonic and Lake Zoar is approximately 1.075; this value was therefore multiplied by the Lake Zoar attenuation factor to estimate the attenuation factor for Lake Housatonic.

Table J-2. Summary of Gaging Stations, Average Flows and Attenuation Coefficients for CT Impoundments

Impoundment	Bulls Bridge	Lake Lillinonah	Lake Zoar	Lake Housatonic
Gaging Station(s)	Housatonic River at Gaylordsville, Tenmile River	Housatonic River at Gaylordsville, Still River, Shepaug River	Housatonic River at Stevenson	---
Average Flow (cfs)	1666	2295	3261	3506[1]
Flow Attenuation Factor[2]	1	1.4	2.0	2.1

Notes:

[1] Flow estimated from drainage area increase.

[2] Flow attenuation factors are relative to Bulls Bridge. As such concentrations at downstream impoundments are estimated by dividing the results for the Bulls Bridge Dam impoundment by the attenuation factors listed above.

J.4. Food Chain Model (FCM) Development and Calibration

As directed by EPA in its April 13, 2007 conditional approval letter for the CMS Proposal, GE used EPA's FCM from Reach 8 (Rising Pond) to simulate the bioaccumulation of PCBs in fish within the Connecticut impoundments. Fish species used in EPA's model include largemouth bass, brown bullhead, white sucker, sunfish, and cyprinids. Largemouth bass are the modeled predatory species in the FCM; however, for the Connecticut portion of the river, smallmouth bass data are most prevalent. Therefore, model predictions of largemouth bass were used as a surrogate for smallmouth bass for calibration of the model.[4]

[4] EPA noted in its Specific Comment #126 on the CMS Report that GE's use of the largemouth bass model as a surrogate for smallmouth bass is reasonable provided that the lipid contents of Connecticut smallmouth bass are similar to largemouth bass upstream of Woods Pond Dam. Figure J-10 provides a comparison between distributions of lipid content in smallmouth bass from Connecticut and largemouth bass collected upstream of Woods Pond Dam, using all available GE and EPA fillet data. This figure demonstrates that the central tendency in lipid content between the two species is relatively similar (approximately 1% for both species); the arithmetic mean lipid content is approximately 1.4% for largemouth bass and 1.2% for smallmouth bass. Further, while the lipid content in largemouth bass collected from the PSA is generally more variable, the range in lipids between the two species is relatively consistent.

J.4.1 Inputs

FCM parameters, including food energy parameters, growth rates, respiration rates, assimilation efficiencies, elimination rates, and feeding preferences for modeled species, were unchanged in this application of the model, and are described in detail in EPA's Final Model Documentation Report (EPA, 2006b).

Exposures to the modeled biota include PCBs from the water column and surface sediment, both on a dissolved-phase and particulate organic-carbon normalized basis. These concentrations were developed in the 1-D Analysis as described in Section 2. Attenuation factors derived from flow differences, as described in Section 3, were applied to the Bulls Bridge Dam impoundment water column and sediment PCB concentrations to simulate exposure concentrations to the biota in the downstream CT impoundments (Lake Lillinonah, Lake Zoar, and Lake Housatonic).

FCM simulations were performed for the time period between 1963 and 2004 (the same as the CT sediment bed model calibration period described above) to predict PCB concentrations in biota in the four Connecticut impoundments. The resulting PCB concentrations were compared to fish data collected by GE from the same timeframe, where available, at each impoundment. These data were measured on a fillet basis, and therefore needed to be converted to whole-body concentrations (which the model computes). For purposes of this comparison, the measured fillet PCB concentrations were multiplied by a factor of 2.3 to convert the data to a whole-body basis, consistent with the method used by EPA in the Ecological Risk Assessment (ERA; EPA, 2004a) and in the FCM calibration (EPA 2004b; EPA 2006a).

J.4.2 Results

The calibration results were first graphically compared to site-specific fish PCB data (converted to a whole-body equivalent) to evaluate the reasonableness of the calculation. The model simulation results were compared to measured PCB data for smallmouth bass, bullhead, and sunfish at Bulls Bridge, Lake Lillinonah, Lake Zoar, and Lake Housatonic (where available) from the beginning of the fish sampling program (in the late 1970s) through 2004 on both a wet-weight basis (Figures J-11 through J-13) and a lipid-normalized basis (Figures J-14 through J-16).[5] Cyprinid data from Connecticut were not available and white sucker data were only available from the Connecticut reaches for a single year (1979) and therefore were not compared to modeled PCB concentrations due to the limited data set.

[5] Additional fish data were collected in the Connecticut portion in the River in 2006 and 2008 but are not shown on the figures since the model simulation ends in 2004.

The calculated wet-weight PCB concentrations in smallmouth bass are somewhat lower than the measured concentrations (converted to whole-body concentrations) in 1990-1996 and 2004 at Bulls Bridge, but are within the range of the data for other years at that location and for all years at Lake Lillinonah and Lake Zoar (Figure J-11). Generally, the predicted lipid-normalized PCB concentrations in smallmouth bass are somewhat lower than observed concentrations (converted to whole-body concentrations) at Bulls Bridge and Lake Zoar, but are within the range of the data at those locations and at Lake Lillinonah (Figure J-14). These comparisons indicate that the FCM-calculated concentrations provide a fairly reasonable representation of measured smallmouth bass PCB concentrations (converted to whole-body concentrations) at these three locations.[6] There are no contemporary smallmouth bass PCB data within Lake Housatonic to assess the FCM performance in that impoundment.

While very few bullhead data were collected in the Connecticut portion of the River since 1990, the modeled concentrations appear to provide a reasonable representation of PCB concentrations on a wet-weight and lipid-normalized basis at Bulls Bridge and Lakes Lillinonah and Zoar (Figures J-12 and J-15, respectively). There are insufficient data to make this comparison for Lake Housatonic.

For sunfish, there are also limited measured data since 1990. However, based on the data that exist, including those collected from 1979-1989, FCM predictions are within the range of the measured PCB concentrations (converted to whole-body concentrations) on both a wet-weight and a lipid-normalized basis at Bulls Bridge and Lakes Lillinonah and Zoar (Figures J-13 and J-16, respectively). The model slightly over-predicts the measured PCB concentrations (converted to whole-body concentrations) on a wet-weight basis at Bulls Bridge, Lake Lillinonah, and Lake Zoar in certain years, but matches the data well on a lipid-normalized basis. Again, there are insufficient data to make this comparison for Lake Housatonic.

In order to assess overall model bias and precision, the same quantitative model performance metrics used by EPA in its Final Model Documentation Report to evaluate bias and precision of the FCM (described on pages 4-116 to 4-119 in EPA [2006b]) were applied in the evaluation of the CT 1-D Analysis estimates. As described in the FMD,

[6] In its Specific Comment #129 on the CMS Report, EPA stated that the under-prediction of PCB concentrations in bass at Bulls Bridge suggests that the Bulls Bridge attenuation factor may have been set too low. However, there is no apparent bias in the model predictions for the other species simulated at Bulls Bridge, which could suggest a difference in food web structure or physiological parameters between this reach and the upstream reaches (Woods Pond and Rising Pond) for which FCM was calibrated (no adjustment of FCM parameters was made during development of the CT 1-D Analysis). Moreover, the predicted concentrations in fish at Bulls Bridge are based solely on the water column and sediment exposures predicted by the CT 1-D Analysis. Increasing the sediment concentrations to account for an apparent low bias in the Bulls Bridge bass by increasing the attenuation factor (as suggested by EPA) would compromise the sediment calibration and would be inconsistent with the data used to establish the attenuation factor.

EPA's FCM Phase 2 Calibration was evaluated using a model bias (MB*) statistic (Arnot and Gobas, 2004), which was derived on both a species-specific and reach-specific basis. This MB* statistic is the geometric mean of the ratio of simulated and measured PCB concentrations, and is a measure of the systematic overprediction (MB > 1) or underprediction (MB < 1) of the model (EPA, 2006b). In addition, EPA evaluated the overall model accuracy and precision using the mean absolute percent error (MAPE) metric. Table J-3 presents these statistics on both a wet-weight and a lipid-normalized basis.

Table J-3. Summary of Quantitative Model Performance Metrics Used to Evaluate CT 1-D Analysis

Basis	Comparison Type	Group	Number of Tissue PCB Measurements	Model Bias (MB*) Statistic[1]	Model Accuracy/ Precision (MAPE[2]) Statistic
Wet-Weight	All Data		659	1.26	60%
	By Reach	Bulls Bridge	206	1.01	56%
		Lake Lillinonah	237	1.22	55%
		Lake Zoar	192	1.54	65%
		Lake Housatonic	24	2.27	85%
	By Species	Smallmouth bass	414	0.97	50%
		Bullhead[3]	100	1.36	61%
		Sunfish[4]	145	2.56	86%
Lipid-Normalized	All Data		525	0.67	65%
	By Reach	Bulls Bridge	164	0.65	59%
		Lake Lillinonah	202	0.63	69%
		Lake Zoar	159	0.75	65%
		Lake Housatonic	0	--	--
	By Species	Smallmouth bass	360	0.57	66%
		Bullhead[3]	60	0.95	51%
		Sunfish[4]	105	0.95	67%

Notes:

[1] MB > 1 indicates systematic overprediction, and MB < 1 indicates systematic underprediction.

[2] MAPE = Mean average percent error.

[3] Includes brown and yellow bullhead, where available.

[4] Includes pumpkinseed, bluegill, redbreast sunfish, and redear sunfish, where available.

The overall model bias statistic is 1.26 on a wet-weight basis (indicating a slight overprediction) and 0.67 on a lipid-normalized basis (indicating somewhat of an underprediction); this calibration thus provided a balance between wet-weight and lipid-normalized concentrations. For comparison, the model bias statistics for EPA's calibration of the FCM in the PSA and Reach 7/8 ranged from 0.8 to 1.3 by reach and from 0.8 to 2.3 by species. Thus, the CT 1-D FCM calibration was judged to be of similar quality to EPA's calibration in the upstream reaches. Similar to EPA's FCM, some variations in MB* are observed among species and reaches. The overall MAPE is 60% on a wet-weight basis, and 65% on a lipid-normalized basis. For comparison, overall MAPE for EPA's calibration of FCM for Reaches 5-8 was approximately 50% for all data and ranged from 30% to 71% by reach. Given the large uncertainty in the CT 1-D Analysis methodology, this level of combined accuracy/precision was considered acceptable for this extrapolation.

Overall, the application of FCM to the CT impoundments based on the exposure concentrations estimated using the CT 1-D analysis appears to provide a sufficient fit to the data such that the model can be used to develop future predictions in the CT portion of the river.

J.5. Summary

Although much less sophisticated than EPA's model for the Confluence to Rising Pond Dam, the CT 1-D analysis described above provides a means of estimating future changes in PCB concentrations within the four major Connecticut impoundments of the River in response to remedial actions performed upstream. The method predicts water column, surface sediment, and fish PCB concentrations within Bulls Bridge Dam impoundment, Lake Lillinonah, Lake Zoar, and Lake Housatonic based on the PCB loading passing over Rising Pond Dam as predicted by the EPA model. The method is based on the first principle of conservation of mass, maximizes the use of available sediment and fish data collected from these impoundments, and leverages the fish bioaccumulation modeling work performed by EPA in the Massachusetts reaches of the River to predict responses in CT.

It should be recognized, however, that the results from the CT 1-D Analysis are very uncertain due to the empirical, semi-quantitative nature of the analysis, as well as the significant data limitations. For example, the sediment bed model was calibrated against a single sediment core collected from the Bulls Bridge Dam impoundment, which yielded a single deposition rate and average PCB concentration in sediments deposited between 1963 and 1980 (see Section 2.2.1). While this core exhibited an interpretable Cesium-137 profile that supported the model application, it likely does not represent the full range of sediment deposition conditions in the impoundment. Likewise, extrapolation of the EPA model predictions of water column TSS and PCB concentrations at Rising Pond Dam to the Bulls Bridge Dam impoundment was accomplished using simple attenuation factors that were parameterized based on data from 1979 or by calibration (see Sections 2.2.3 and 2.3). A similar approach based on flow dilution was used to extrapolate the results from the Bulls Bridge Dam impoundment to downstream impoundments. This simplified approach does not account for the many processes affecting PCB fate and transport and consequently adds to the uncertainty in the calculation. For these reasons, while the CT 1-D Analysis provides a means of generally assessing the impact of the different sediment alternatives on the CT impoundments, the resulting estimates cannot be regarded as reliable predictions of specific PCB concentrations and thus cannot be used as a reliable way of making fine distinctions among the alternatives, particularly when the concentrations are low and generally similar.

J.6. References

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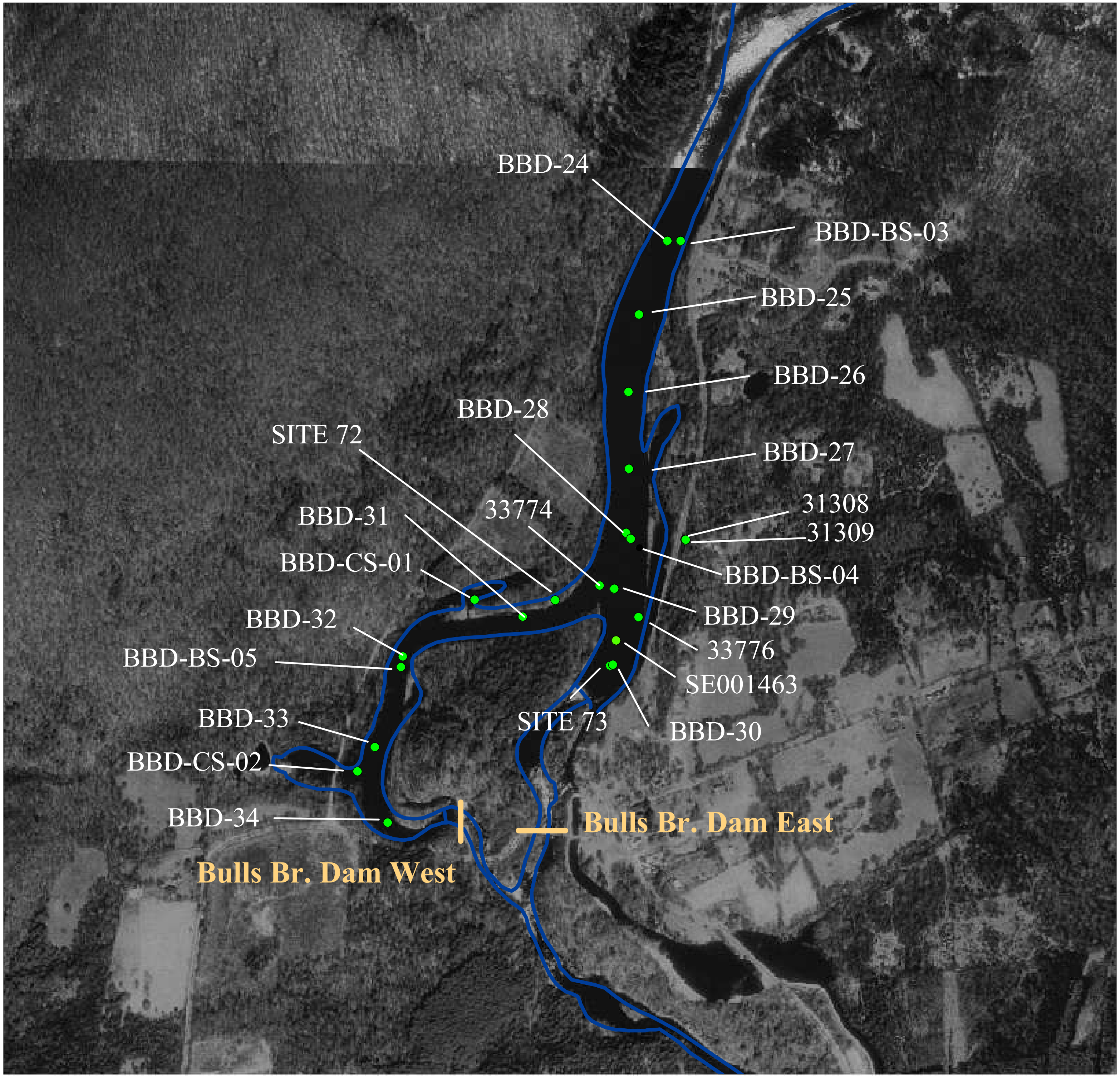
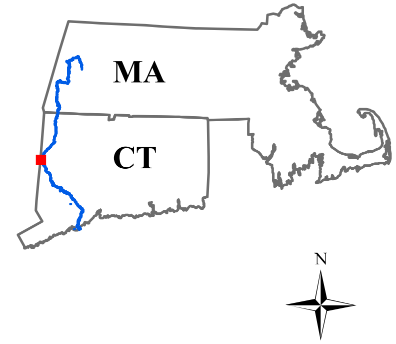


Locator



Scale

0 0.1 0.2 Miles

Legend

Sampling Locations

Shoreline

Notes:
Data collected by: BBL (1998), LMS (1992, 1986), USGS, CAES (1980) and USEPA (2001).
Sampling locations (labeled with sample IDs) are areas where samples were collected from top 6 in of sediments.

Figure J-1.
Sediment sampling locations within the BBD impoundment.

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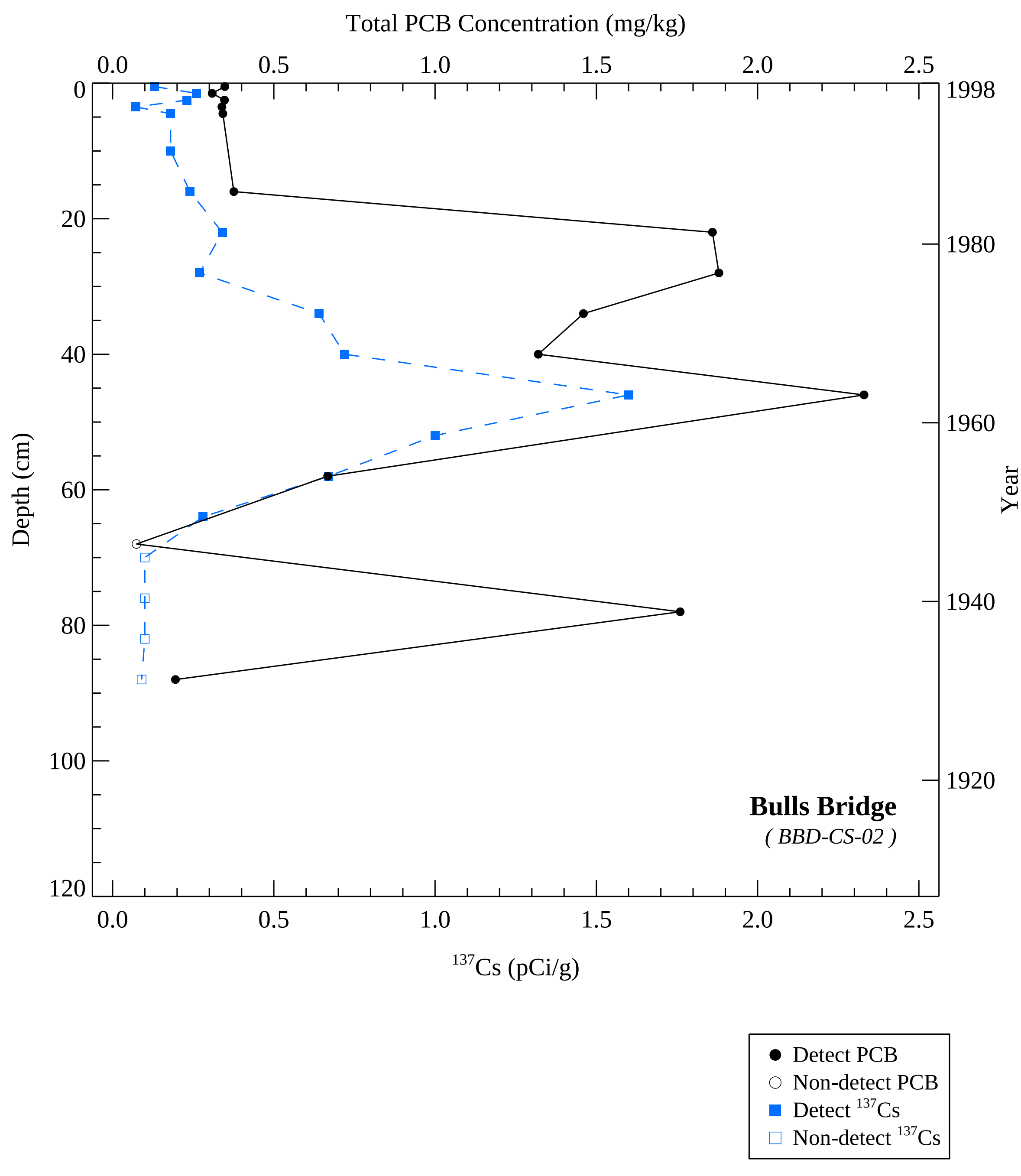

Figure J-2. PCB and ^{137}Cesium data from GE high resolution core (BBD-CS-02) collected at Bulls Bridge.

Notes: Sample (BBLID 7771) collected from 9-11 cm depth interval with total PCB=0 mg/kg was excluded from analysis. Non-detect data plotted at 1/2 MDL.

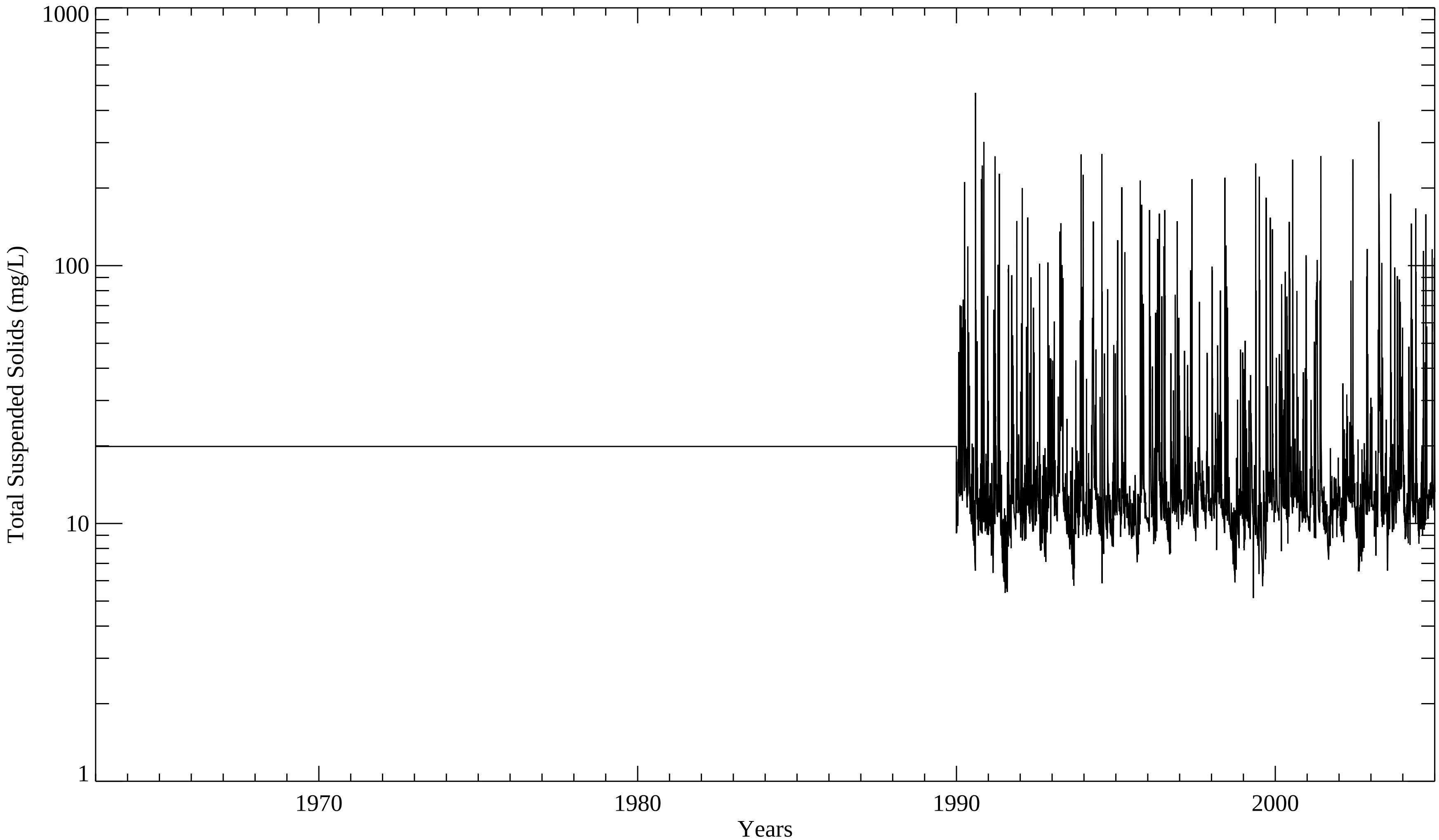

Figure J-3. Temporal profile of calculated water column TSS concentrations at Bulls Bridge from 1963 to 2004.

1963-1990 TSS concentration is an average of USGS data collected in 1979 at Gaylordsville.
1990-2004 TSS concentrations were calculated from downstream model output for Rising Pond and mutliplied by four to account for increased solids yield.

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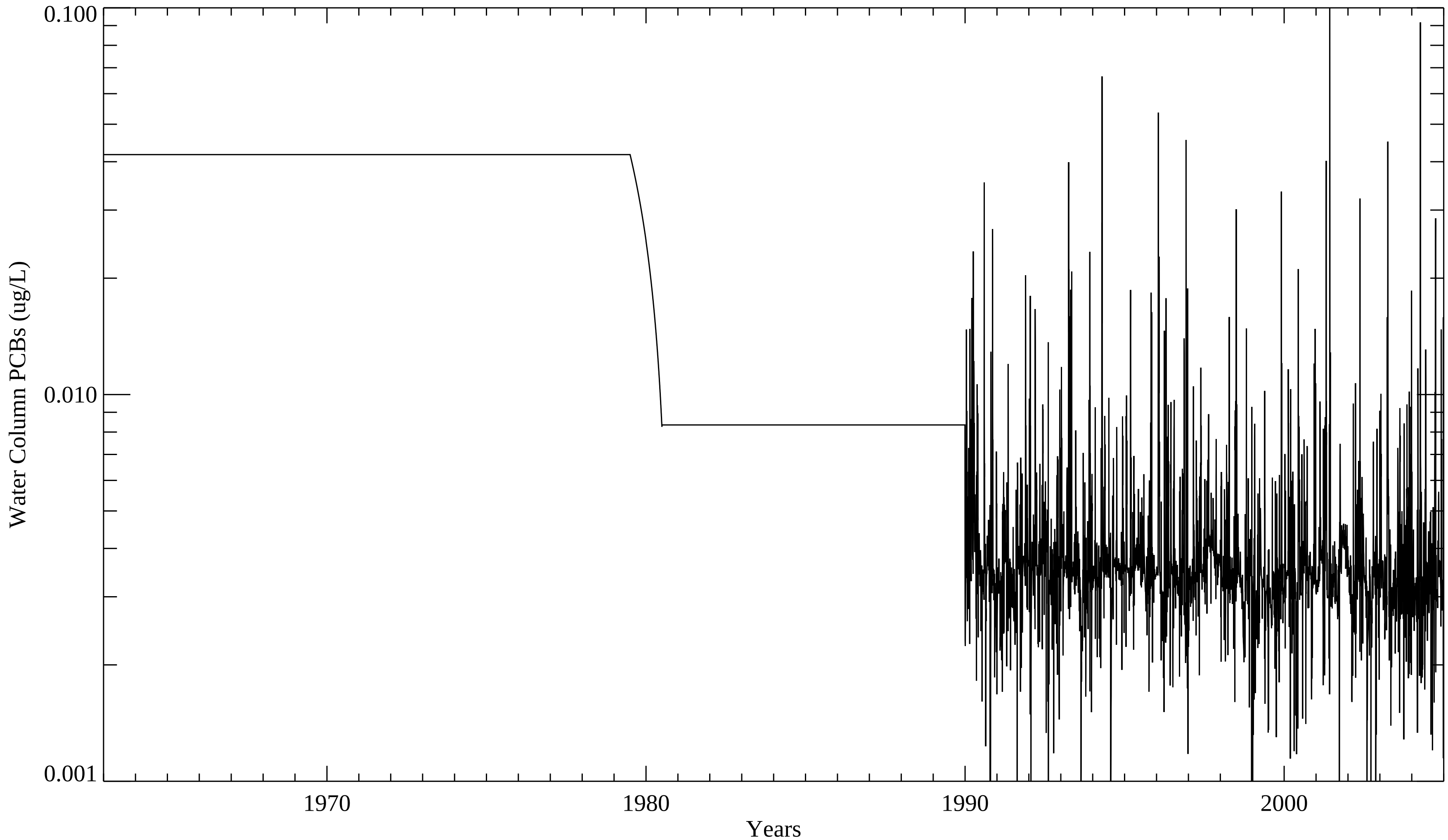

Figure J-4. Temporal profile of calculated water column PCB concentrations at Bulls Bridge between 1963 and 2004.

1963-1990 PCBs were calculated from high resolution core data (BBD-CS-02).
1990-2004 PCBs were calculated from downstream model output for Rising Pond divided by 10 to account for dilution.

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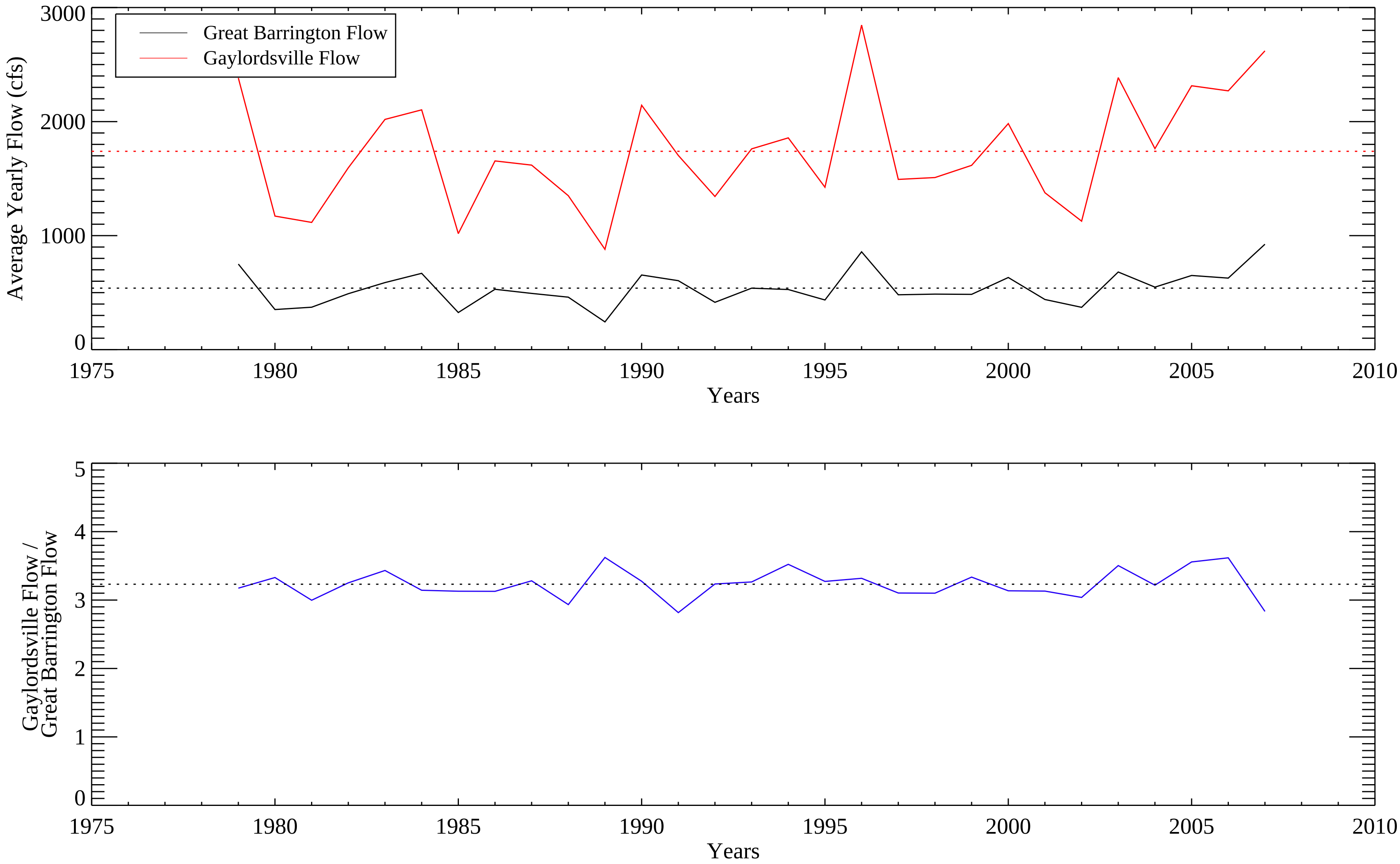

Figure J-5. Temporal plots of annual average USGS flow data at Great Barrington and Gaylordsville.

Note: Dotted lines represent average of annual flows (top panel) and ratios (bottom panel).

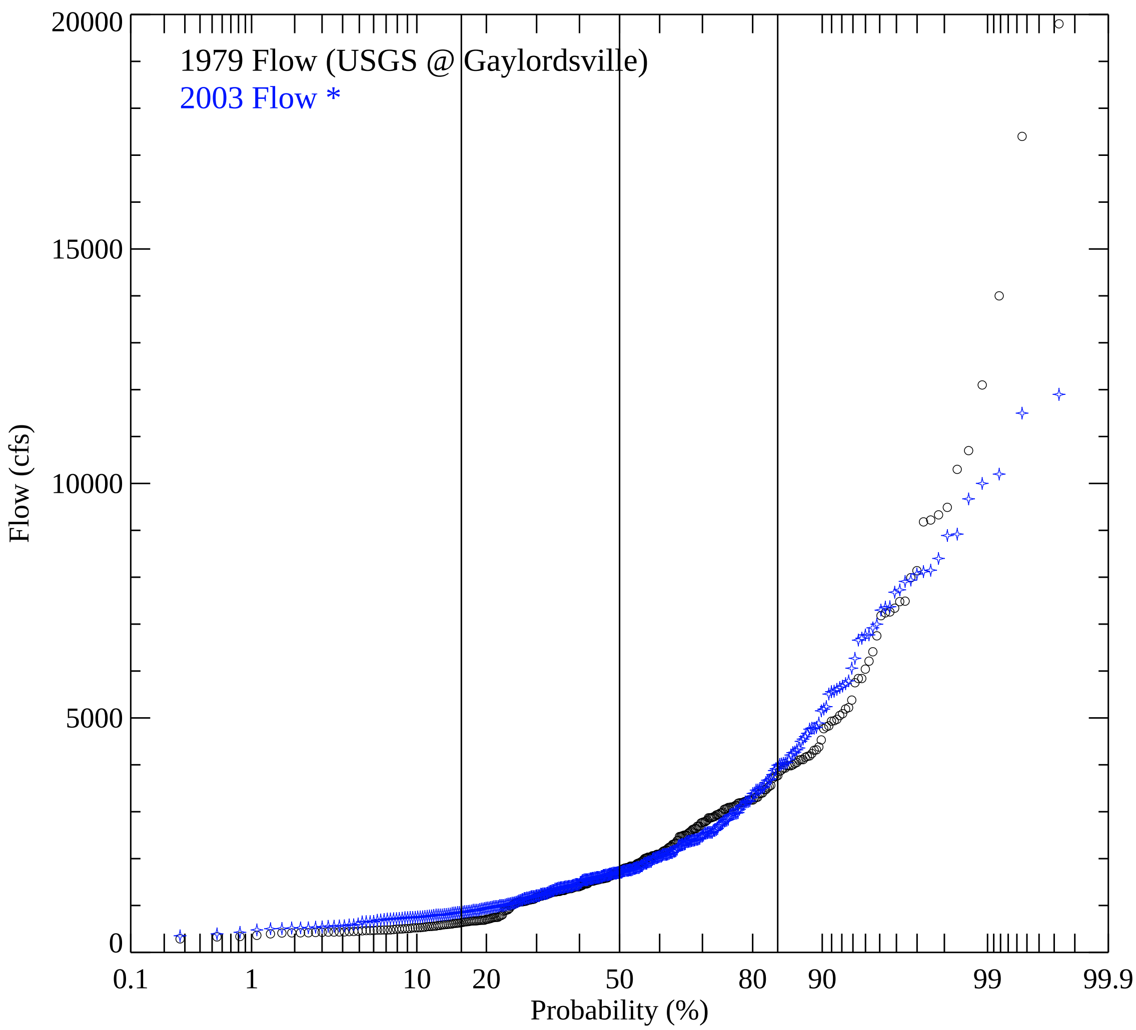

Figure J-6. Comparison of daily average flows at Gaylordsville between 1979 and 2003.

* 2003 flows are EPA Downstream model flows at Rising Pond multiplied by 3.2 to account for the flow difference between Rising Pond and Bulls Bridge.

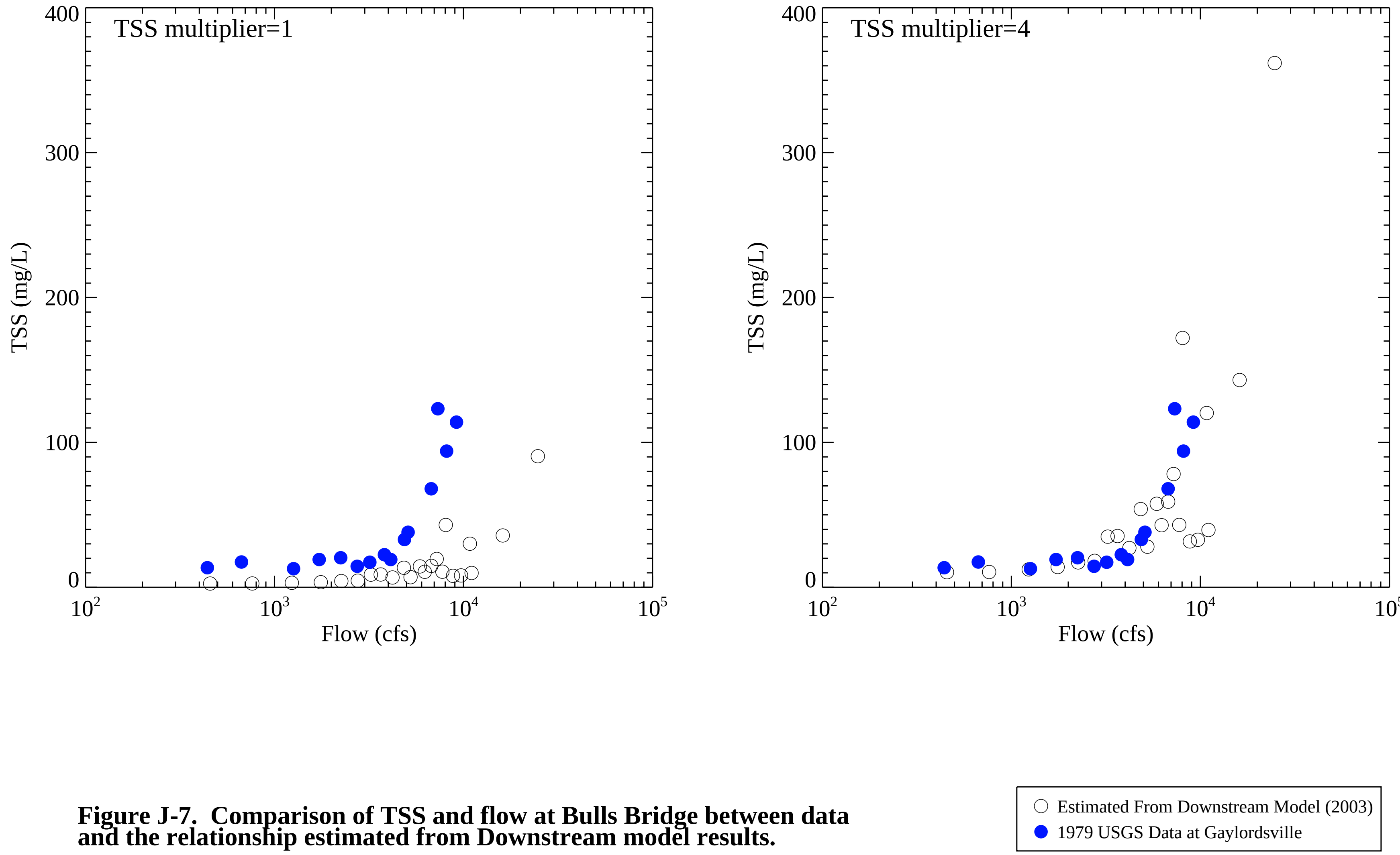

Figure J-7. Comparison of TSS and flow at Bulls Bridge between data and the relationship estimated from Downstream model results.

Rising Pond flows calculated by the Downstream model were multiplied by 3.2 to approximate Bulls Bridge conditions. For both data sets the TSS values were averaged in 500 cfs bins.

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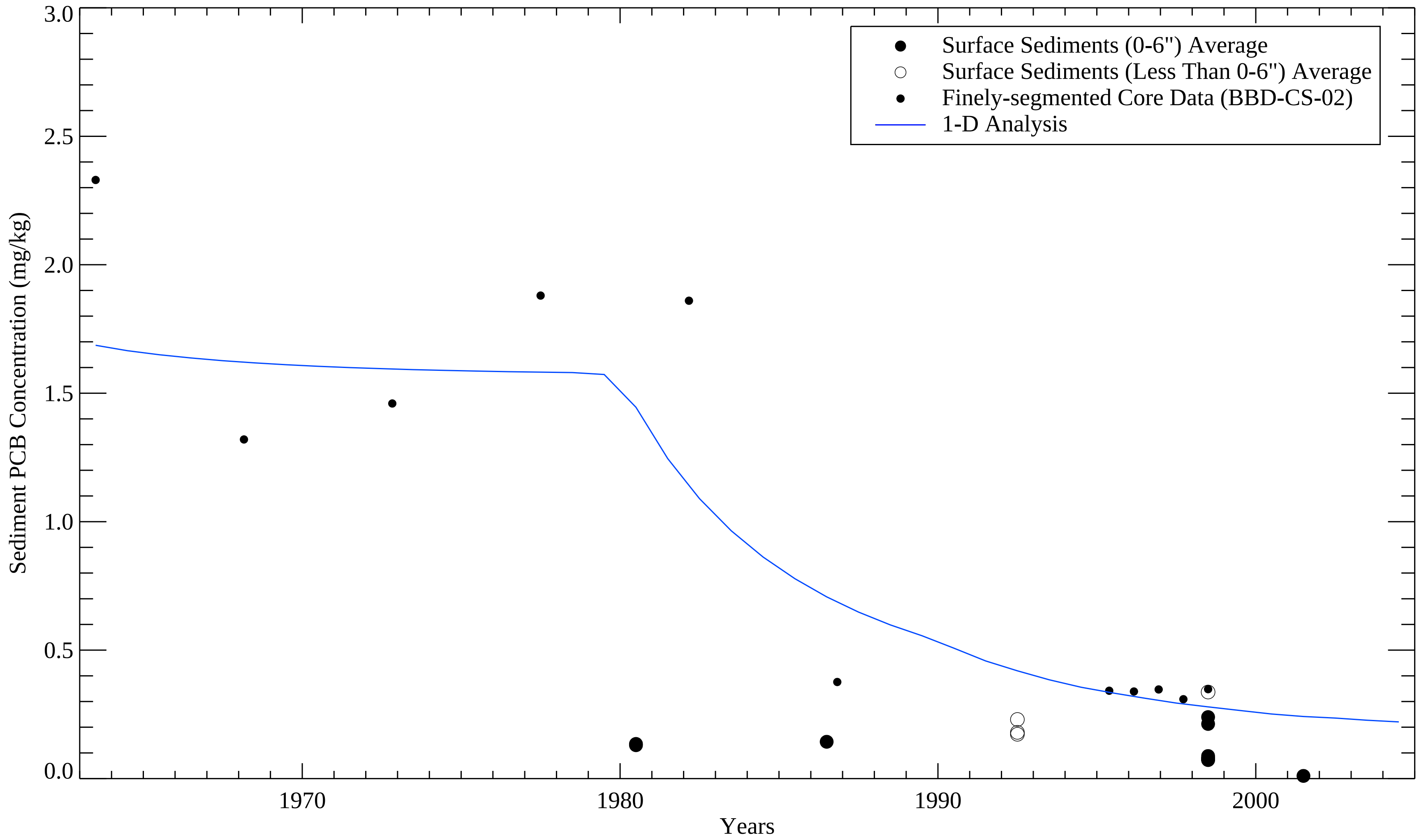

Figure J-8. Comparison of surface (0-6") sediment PCB concentrations calculated from the 1-D Analysis with data collected at Bulls Bridge.

if\zl - H:\GENcms\DOCUMENTS\reports\Revised_CMS_Report\Appendices\Appendix_J_CT1D_Analysis\Figures\FigureF_8_6in_temporal_notAveraged.pro
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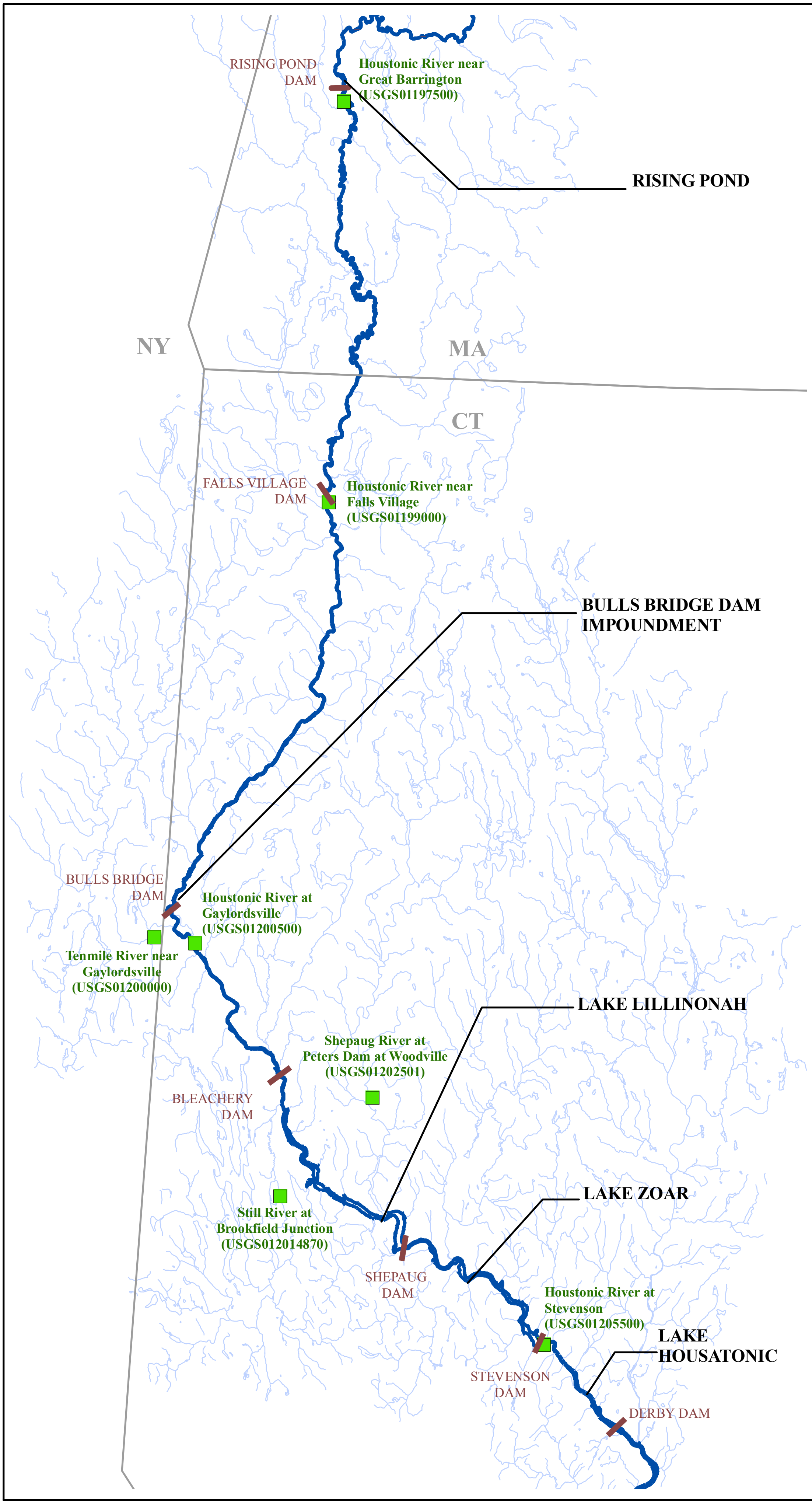
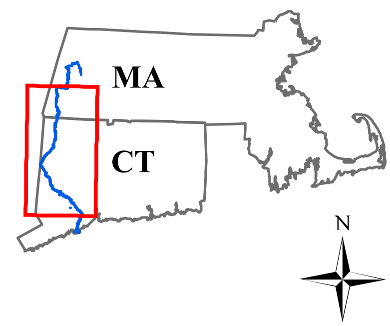


Locator



Scale

100 50 0 Miles

Legend

- Major Dams
- State Boundaries
- USGS Gaging Stations
- Housatonic River
- Watershed

Figure J-9.
Map of major USGS gaging stations between Rising Pond Dam, MA and Lake Housatonic, CT.

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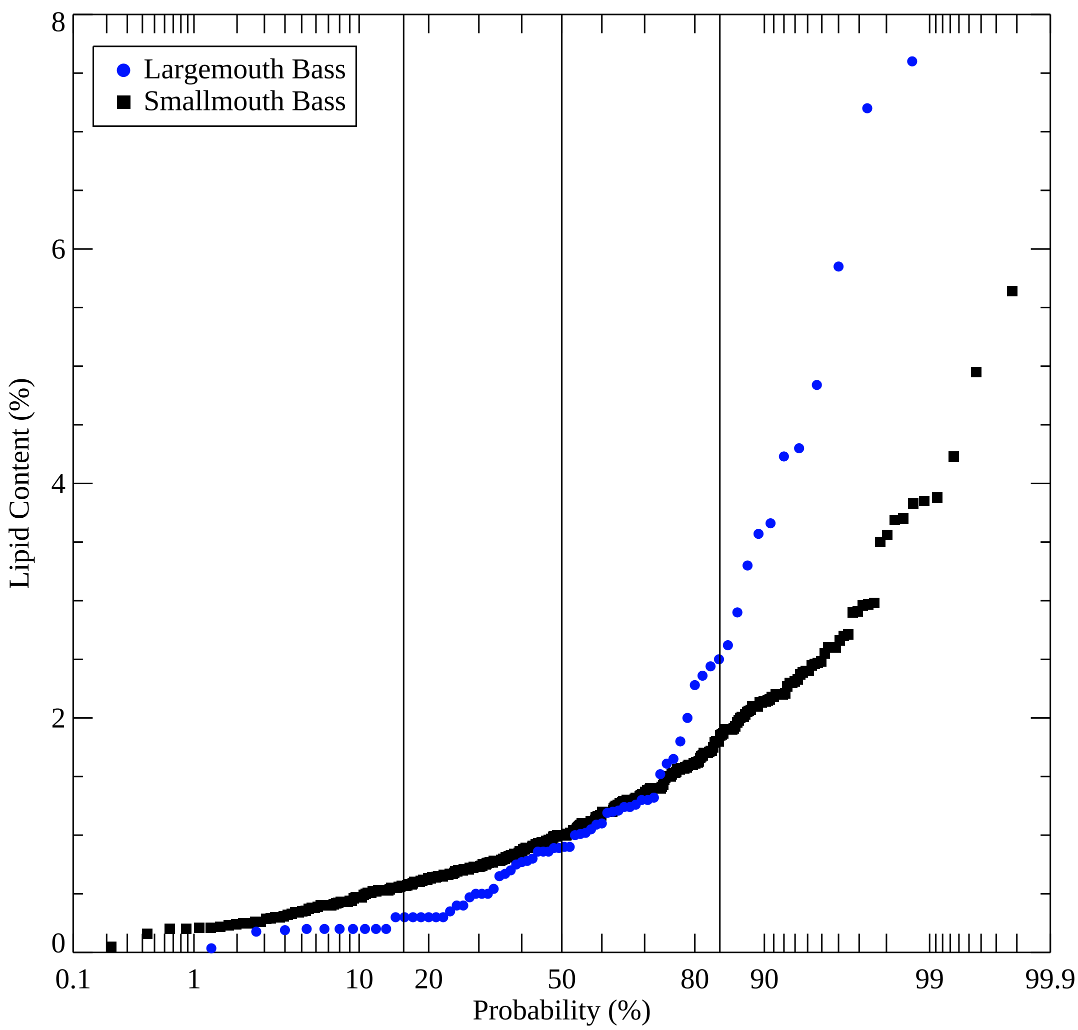

Figure J-10. Probability distribution of lipid content for largemouth bass (collected in the PSA) and smallmouth bass (collected in CT).

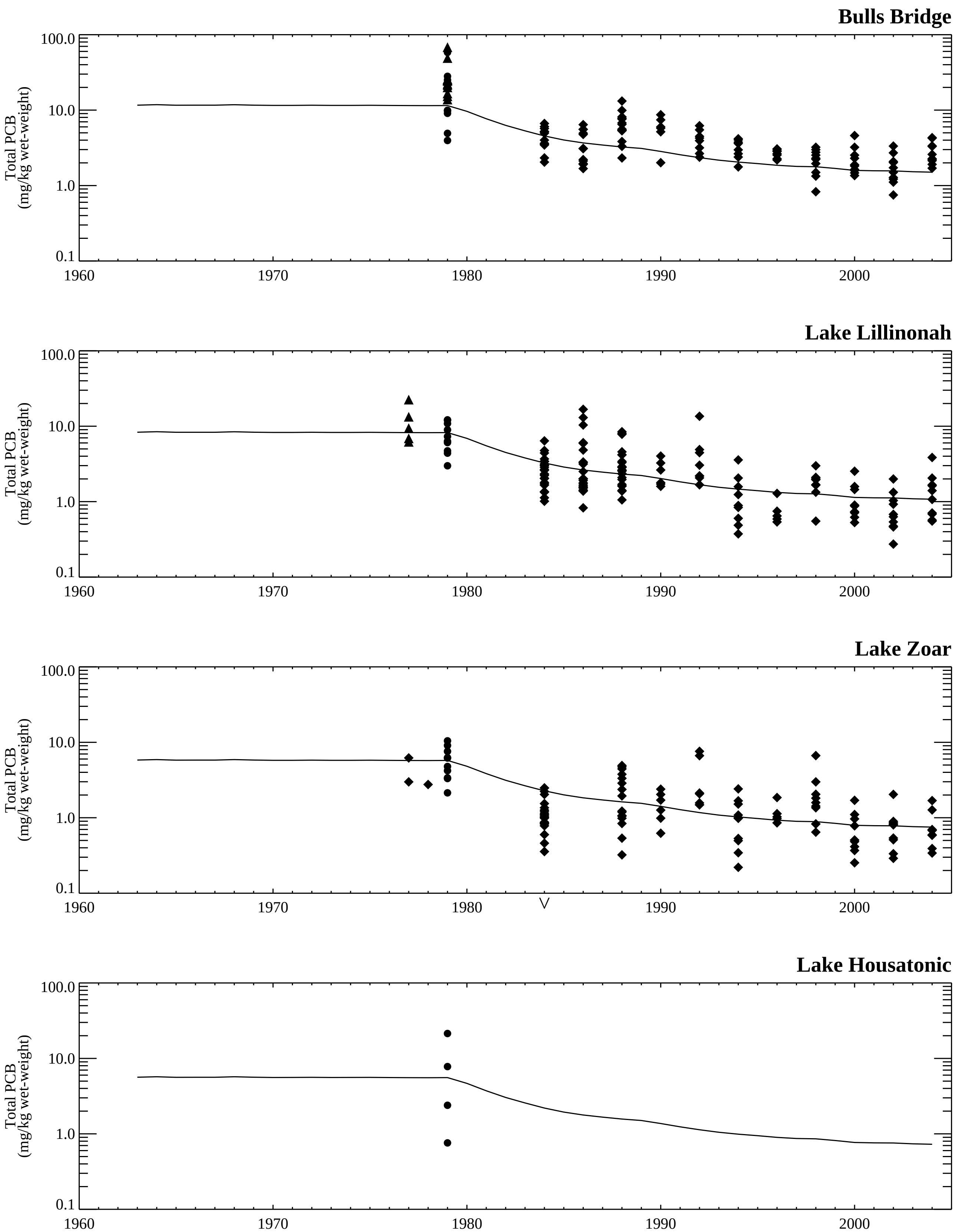

Figure J-11. Wet-weight PCB concentrations in smallmouth bass estimated from the CT 1-D Analysis.

Notes: FCM run TV_EPA040; Deposition model run 35
Model output is autumn averaged PCB concentration (Aug. 28 - Oct. 26) for game fish, age 6+.
Fillet to whole body conversion factor = 2.3. SMB fish ages > 3 (when determined);
Prep for 2004 individual samples assumed to be fillet.

1-D Analysis
● Fillet (skin off)
◆ Fillet (scales off/skin on)
▲ Fillet (scales on/skin on)

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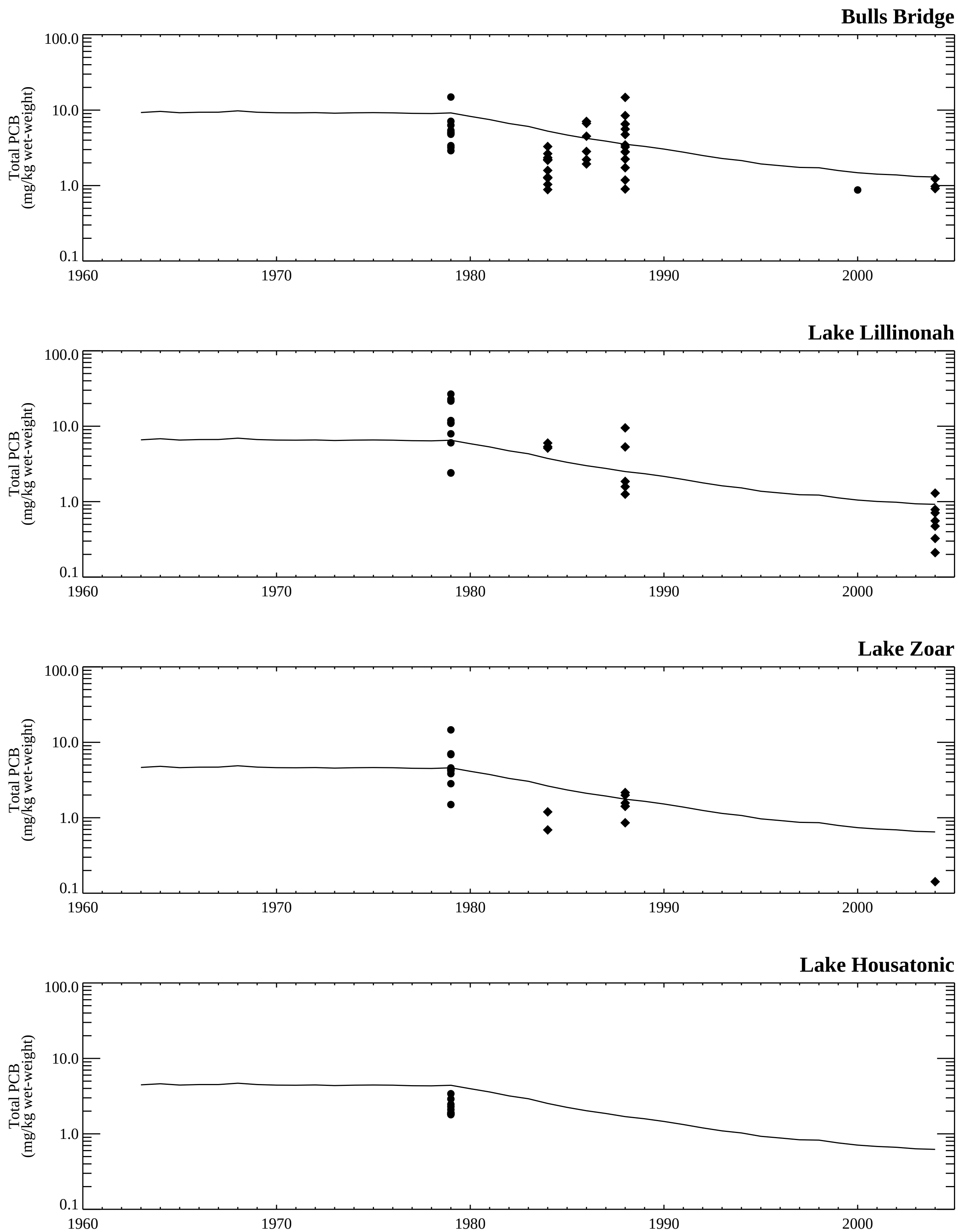

Figure J-12. Wet-weight PCB concentrations in bullhead (brown and yellow bullhead, where available) estimated from the CT 1-D Analysis.

Notes: FCM run TV_EPA040; Deposition model run 35
Model output is autumn averaged PCB concentration (Aug. 28 - Oct. 26) for game fish, age 6+.
Fillet to whole body conversion factor = 2.3. SMB fish ages > 3 (when determined);
Prep for 2004 individual samples assumed to be fillet.

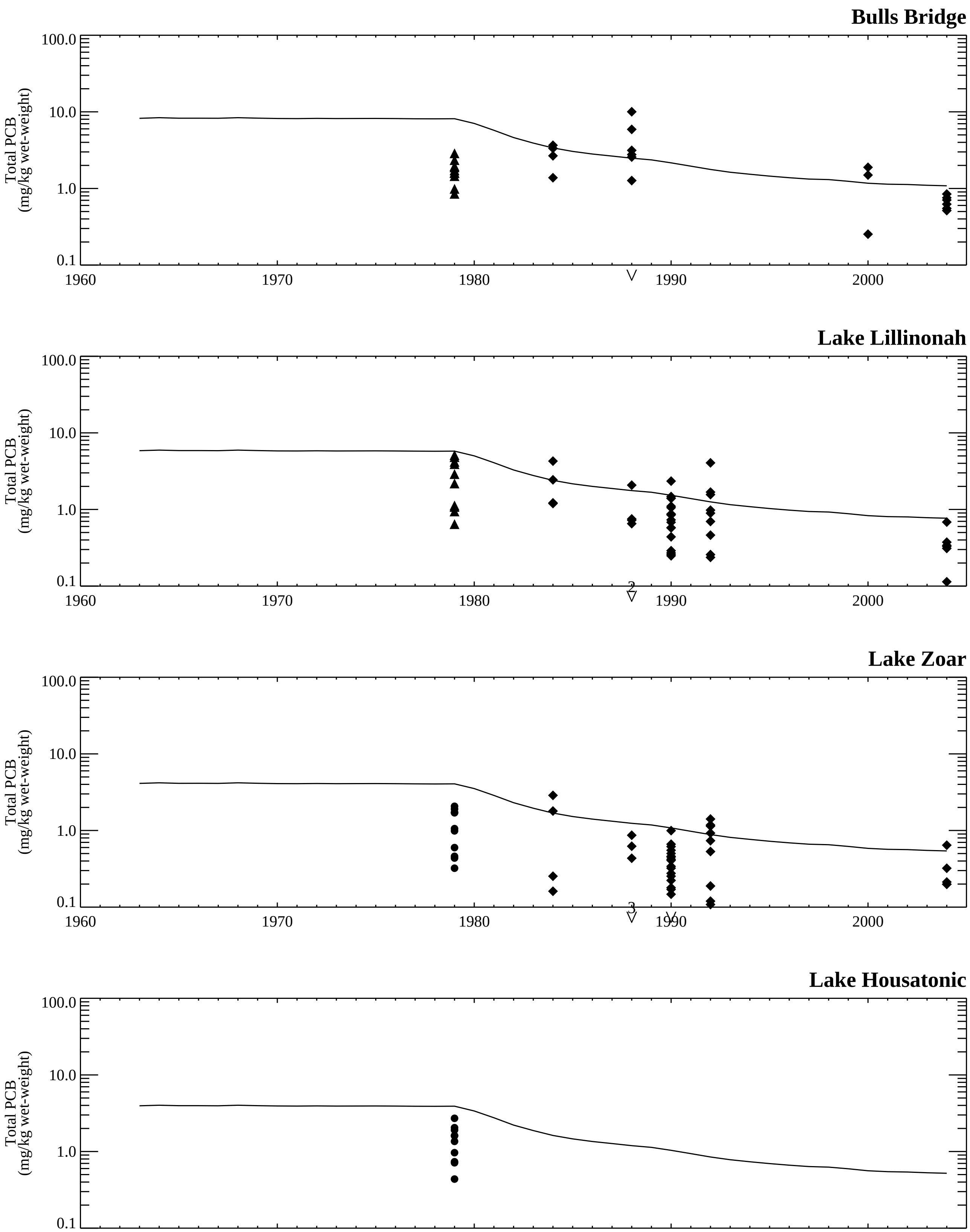

Figure J-13. Wet-weight PCB concentrations in sunfish (pumpkinseed, bluegill, redbreast sunfish, and redear sunfish, where available) estimated from the CT 1-D Analysis.

Notes: FCM run TV_EPA040; Deposition model run 35
Model output is autumn averaged PCB concentration (Aug. 28 - Oct. 26) for game fish, age 6+.
Fillet to whole body conversion factor = 2.3. SMB fish ages > 3 (when determined);
Prep for 2004 individual samples assumed to be fillet.

—— 1-D Analysis
● Fillet (skin off)
◆ Fillet (scales off/skin on)
▲ Fillet (scales on/skin on)

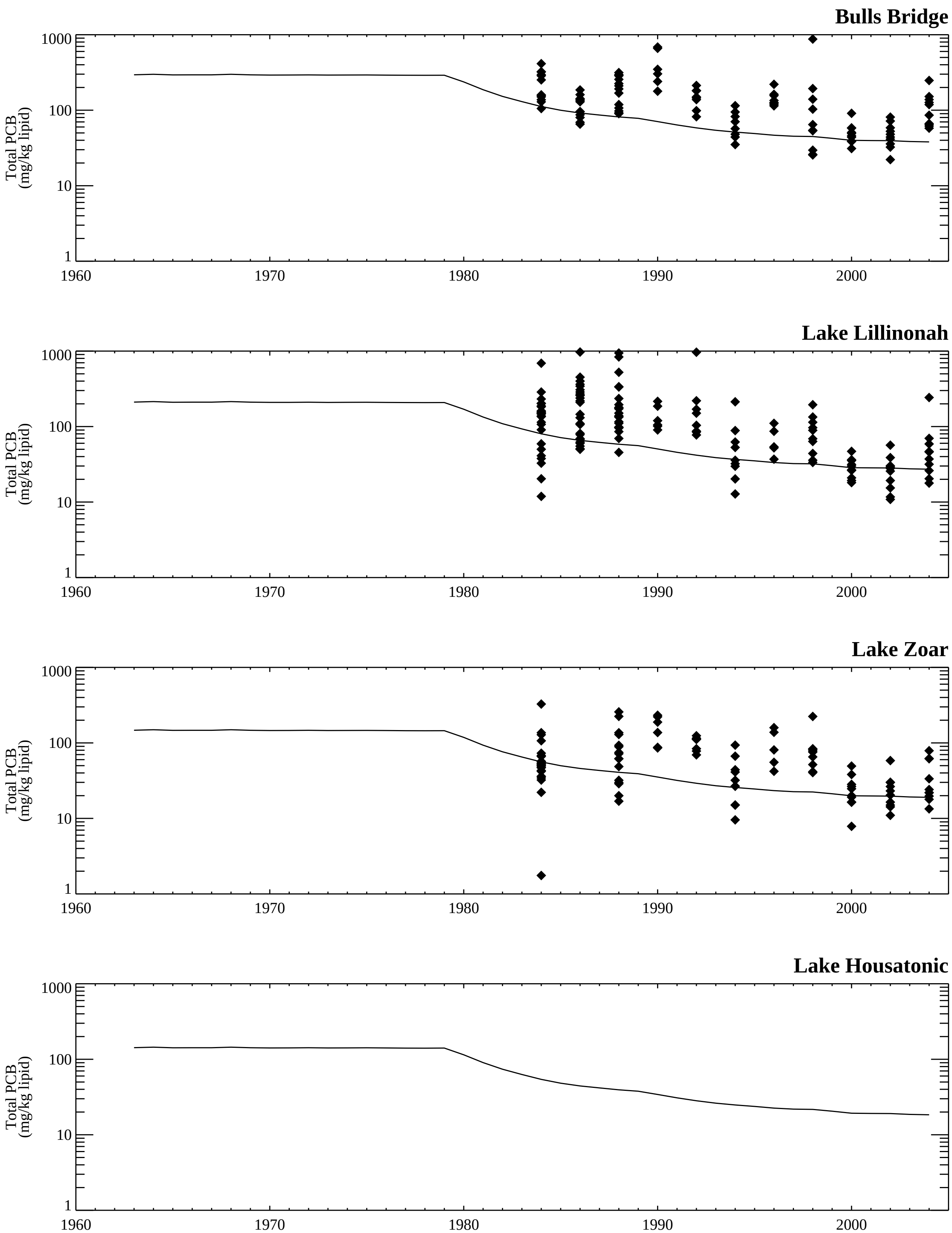

Figure J-14. Lipid-normalized PCB concentrations in smallmouth bass estimated from the CT 1-D Analysis.

1-D Analysis
● Fillet (skin off)
◆ Fillet (scales off/skin on)
▲ Fillet (scales on/skin on)

Notes: FCM run TV_EPA040; Deposition model run 35
Model output is autumn averaged PCB concentration (Aug. 28 - Oct. 26) for game fish, age 6+.
SMB fish ages > 3 (when determined);
Prep for 2004 individual samples assumed to be fillet.

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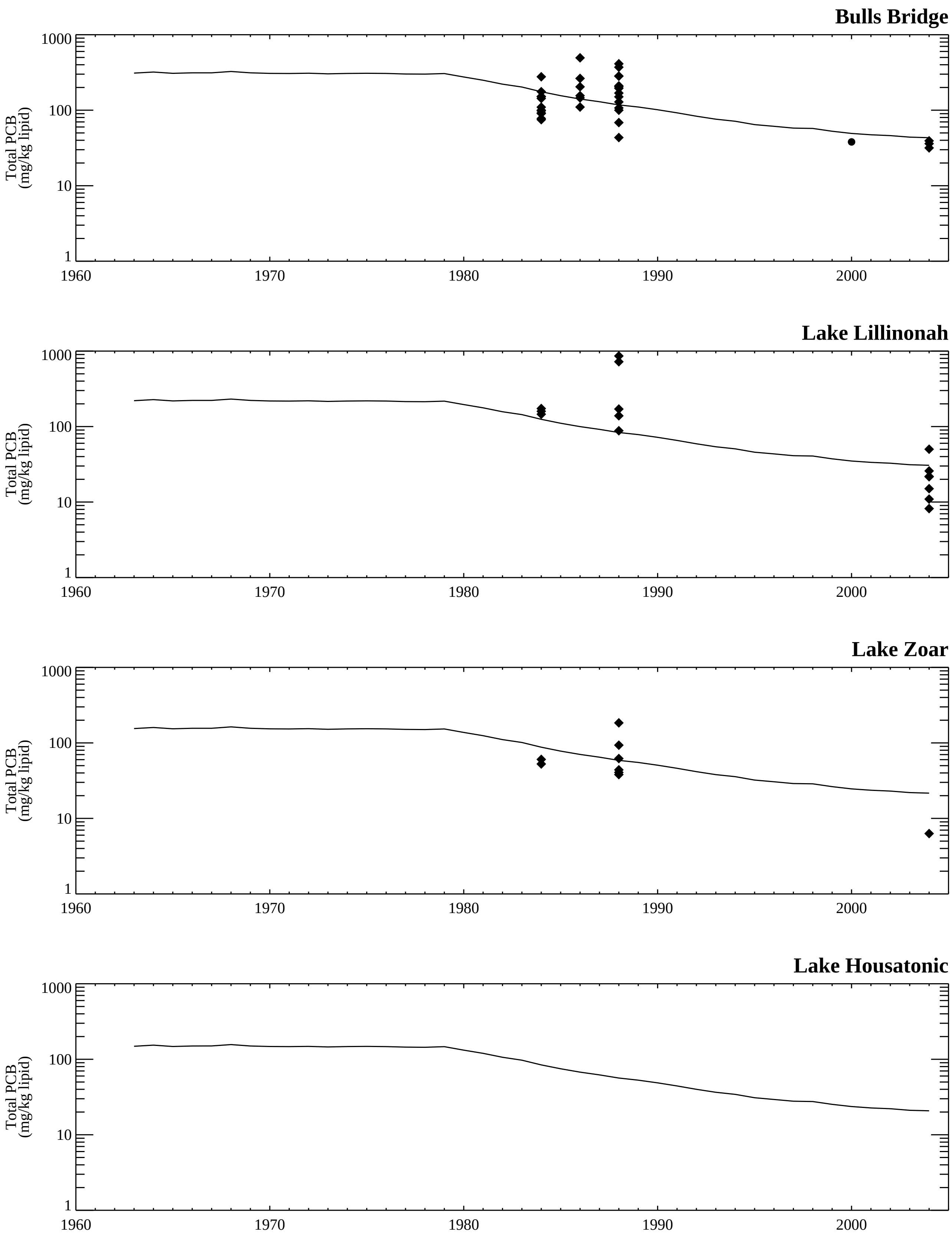

Figure J-15. Lipid-normalized PCB concentrations in bullhead (brown and yellow bullhead, where available) estimated from the CT 1-D Analysis.

Notes: FCM run TV_EPA040; Deposition model run 35
Model output is autumn averaged PCB concentration (Aug. 28 - Oct. 26) for game fish, age 6+.
SMB fish ages > 3 (when determined);
Prep for 2004 individual samples assumed to be fillet.

—— 1-D Analysis
● Fillet (skin off)
◆ Fillet (scales off/skin on)
▲ Fillet (scales on/skin on)

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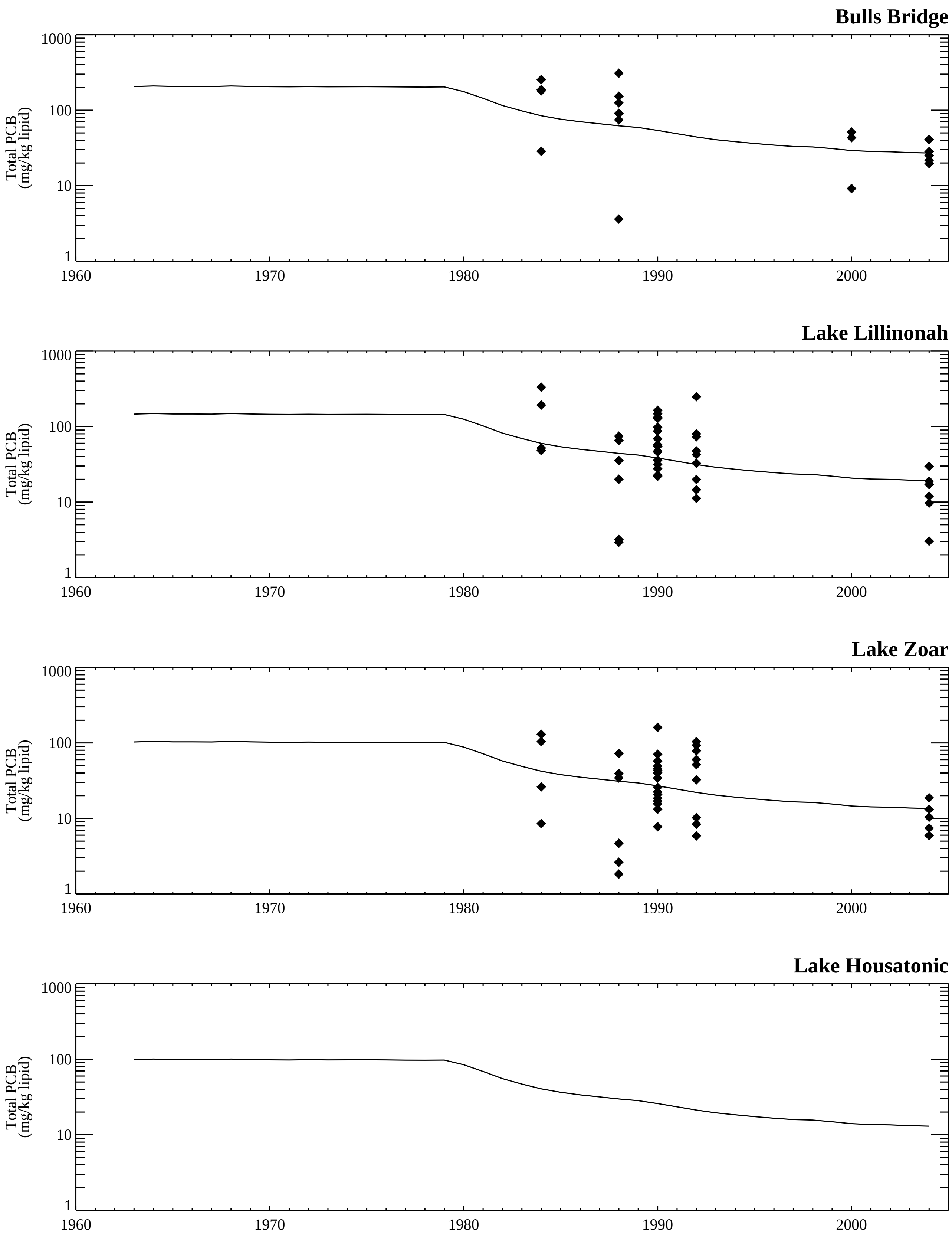

Figure J-16. Lipid-normalized PCB concentrations in sunfish (pumpkinseed, bluegill, redbreast sunfish, and redear sunfish, where available) estimated from the CT 1-D Analysis.

Notes: FCM run TV_EPA040; Deposition model run 35
Model output is autumn averaged PCB concentration (Aug. 28 - Oct. 26) for game fish, age 6+.
SMB fish ages > 3 (when determined);
Prep for 2004 individual samples assumed to be fillet.

——— 1-D Analysis
● Fillet (skin off)
◆ Fillet (scales off/skin on)
▲ Fillet (scales on/skin on)

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