A Major Comments

1. The Superfund non-time critical removal authority is being used for this Response Proposal. As such, and pursuant to the AOC, any decision made by EPA, in consultation with the MDEQ, will not constitute the final remedy for Segment 2 – a final remedy determination will be made in a later Record of Decision (ROD). At the time of the final ROD (or earlier, if warranted) the Agencies will evaluate whether additional response actions may be necessary for Segment 2. Also, consistent with CERCLA and the National Contingency Plan, ARARs will be evaluated for all subsequent response decisions (including potential ARARs not identified in this RP).

Response: Comment noted. No change to the Response Proposal (RP).

2. The document should include a section (probably in Section 1) describing the overall approach being taken at the site and the long-term plan for remediation, emphasizing that this is an upstream to downstream set of prioritized actions intended to quickly reduce potential contaminant exposures. A later residual risk assessment, informed by the long-term monitoring plan initiated in concert with these actions, will be used to assess the need for further actions at the site.

Response: The RP has been revised.

3. Section 4.1, Conceptual Site Model (CSM) and Figure 4-1 and Section 4.2, Remedial Action Objectives (RAOs) – These sections require revisions. Please see specific comments below. The single RAO currently proposed is overly broad and needs to relate more to the CSM.

Response: The RP has been revised.

4. Sediment Management Areas (SMAs)
   a. The Agencies agree that the five areas currently identified in Segment 2 should be SMAs. Pursuant to the AOC and SOW, other SMAs may be identified in the future.

Response: Comment noted. No change to the RP.

   b. SMAs 2-1 & 2-2 – As requested by EPA, the RP currently includes the pilot cap areas at Reaches J and K as SMAs, and includes them as common elements. However, upon further review, EPA now believes that these SMAs should be included in the complete evaluation process. Since remedy implementation work has already been done, the effectiveness, implementability, and cost assessment of these SMAs will be different than for the other SMAs, and can be done for both together. Please remove these from common elements and include in Section 5.5.

Response: The RP has been revised.
c. SMA criteria. The RP needs to provide additional information on the process used and multiple lines of evidence cited for the identification of SMAs. The discussion of the analysis of areas per the SMA criteria needs to be expanded, so there is confidence that all appropriate areas with elevated TEQ and potential for transport are targeted for consideration.

Response: The RP has been revised.

i. Contiguous deposits – The criteria for establishing a contiguous deposit should be clarified. Perhaps an expanded discussion in Section 3.2 that indicates how the geomorphic units were used to support sampling could clarify that sediment deposit areas were targeted for both chemical and stability evaluations. Then in Section 3.7.1 expand the discussion on what criteria were used to determine contiguous deposits of PCOIs.

Response: The RP has been revised.

ii. It is not clear that the depth of the deposit beneath the active bed (3.7.1) should be a line of evidence to identify SMAs. Depth is a factor in evaluating whether there is a “deposit” in that it helps to understand if the chemical measurements seem to be contiguous. Similarly, the depth of sediment with low levels of TEQ overlying the deposit (3.7.2) is unlikely to change the lateral boundaries (plan view footprint) delineation of the SMA. However, depth of the deposit may be relevant to the evaluation of alternatives.

Response: The RP has been revised. Section 3.7.2 was revised to reflect vertical and horizontal delineation, however, the depth of the contiguous TEQ deposits and how this information is used in the identification of SMAs, is provided in Section 3.8.1 and 3.8.2. No deposits were screened out due to the depth of the deposit.

iii. Please clarify how river geomorphic features factored into the identification of potential SMAs.

Response: The RP has been revised.

d. The SMA boundaries are preliminary and may be further refined. Additional delineation is likely to be necessary as part of the design phase of this response. The actual TEQ concentrations present in and around potential SMAs needs to be considered for the final design.

Response: Comment noted. No change to the RP.

e. It would be beneficial to add a section on areas of interest that did not become SMAs (similar to Section 3.6 in the Segment 1 RP).

Response: The RP has been revised.
5. Bank Management Areas (BMAs)
   a. As discussed, please add additional details on the banks, the screening process, and the proposed BMAs.

   **Response:** The RP has been revised.

   b. It is likely that the Agencies will agree that the areas in Segment 2 to be proposed in the revised RP should be BMAs. Pursuant to the AOC and SOW, other BMAs may be identified in the future.

   **Response:** Comment noted. No change to the RP.

   c. Monitoring as a BMA option – Given the described proposed approach to identify BMAs, monitoring should be removed as a response option. In accordance with the proposed decision flow chart, elevated TEQ banks will require some level of monitoring, even if they are not initially identified as a Segment 2 BMA. Monitoring is appropriate as a component of the BMA stabilization alternatives.

   **Response:** The RP has been revised.

   d. BMAs at Reaches M and O – As requested by EPA, the RP currently includes the stabilization work at the Reach M and O banks as BMAs, and includes them as common elements. However, upon further review, EPA now believes that these BMAs should be included in the complete evaluation process. Since remedy implementation work has already been done, the effectiveness, implementability, and cost assessment of these BMAs will be different than for the other BMAs, and can be done for both together. Please remove these from common elements and include in Section 5.6.

   **Response:** The RP has been revised.

   e. It is important that Dow and the Agencies take a pragmatic look at all that might ultimately need to be done to a bank area to minimize the need to access a given property repeatedly and to minimize construction/ access damage to the subject properties. If bank stabilization is selected, during design it may be prudent to include consideration of other components in order to address the potential for exposure pathways other than erosion to the river (i.e., direct contact with high concentration surface soils). Possible location specific considerations include the ownership of the property (e.g., whether Dow owns the property); the surface concentrations of PCOIs; and the public and private use of the bank property.

   **Response:** Comment noted. No change to the RP.

6. Ethyl parathion – Please update the report with the additional information from 2012.

   **Response:** The RP has been revised.
7. Certain elements of the Segment 2 RP have been streamlined when compared to the Segment 1 RP. Overall, this improves the document. However, some useful information may have been lost in the process. For the public that may be unfamiliar with the response options, please add more description of the alternatives (similar to Section 5 of the Segment 1 RP).

**Response: The RP has been revised.**

8. Section 3.3.4 and Appendix D2 – Include a description of the updated BEHI that was completed in 2012. Discuss whether there were any changes to the BEHI evaluations that would call into question conclusions from using the earlier BEHI.

**Response: The RP has been revised. A discussion of the 2012 bank characterization has been added to the BMA section of the RP. Although the survey contained components of a traditional Rosgen evaluation, BEHI classifications were not determined as part of this study. Thus, BEHI classifications are not discussed as part of the BMA section of the RP.**

9. TEQ Transport Model Section 3.3.5 and Appendix D2 – The Agencies have some questions that relate to the TEQ transport model and its application to the evaluation of the SMA Response Alternatives. More detailed comments are provided below.

**Response: Comment noted. No change to the RP.**

10. Generally throughout the document, the word “protectiveness” should be evaluated and possibly changed (e.g., to “effectiveness” or another term) because the term is typically interpreted to mean that contaminant exposures do not exceed levels that constitute unacceptable risk, and this has not yet been determined. Or, the discussion should focus on how the secondary source control actions are expected to contribute to protectiveness.

**Response: The RP has been revised.**

11. Uncertainties – Two major areas were identified as uncertainties during the Agencies’ review: 1) Depth of active bed layer. There are outstanding questions about whether the information provided supports an active sediment bed depth that is less than two feet. Additional work/discussion of this issue is ongoing with the SEDA. This may call into question current statements about the stability of deposits and/or require additional evaluation of other areas. 2) Ecological receptors/endpoints. There are some questions about the screening steps for SCOIs, the method for setting the PLERs and the resulting values, and other ecological receptors. EPA has determined that these two major uncertainties do not hinder the development and selection of response options for the identified SMAs and BMAs, but may result in additional Segment 2 analysis/work, post-construction monitoring, and/or Task 10 analysis/work. Work is ongoing to resolve the issues. Please be aware that even if the Response Proposal is finalized for the purposes of soliciting public input on the options for current Segment 2 SMAs and BMAs, the Agencies reserve our rights to comment on the technical analysis around these issues.

**Response: Comment noted. No change to the RP.**
12. ARARs – Comments on Section 4.3 will be sent under separate cover.

Response: The RP has been revised to address ARARs. A separate response letter will be submitted to discuss Dow’s proposed changes.

B. Specific Comments

13. Page ES-2. Paragraph 5. This paragraph notes that the remedial action objectives (RAOs) were developed “in consultation with the Agencies.” Please modify this statement. The RAOs were shared during technical meetings but the Agencies did not agree to the RAOs as identified in the draft RP. See comments on RAOs below.

Response: The RP has been revised.

14. Executive Summary, page ES-3, last paragraph – Remove “that minimizes short-term impacts” from the end of the first sentence. Short-term impacts will be evaluated as part of the effectiveness criteria.

Response: The RP has been revised.

15. Section 2.4 - Source Control, P.5, “…Dow implemented these additional advanced water treatment processes prior to federal regulation of industrial discharges implemented through the Clean Water Act in 1976.” Comment: Passage of the Clean Water Act occurred in 1972. Also in effect prior to this was Michigan Public Act 245 of 1929, Water Resources Commission.

Response: The RP has been revised.

16. Section 2.5 - PCOI Distributions in the River – Page 6. Paragraphs 1 and 2 of the section. These paragraphs suggest that the PCOIs are all buried in the river sediment and in the banks. This should be rewritten for accuracy and clarity. PCOIs are present at high concentrations in some surface sediment and surficial bank soils. For example, Figure 3-9B of the RP shows that the majority of the surface samples along the NE bank of the Tittabawassee River for reaches M,N,O, P and Q exceed 1,000 ppt total dioxin/furan toxic equivalence (TEQ), with many surface samples exceeding 5,000 and 10,000 ppt TEQ. Surface concentrations of bank soils and in-channel sediments do tend to be lower in concentration than the buried portions of the deposits, however, surface concentrations are significant in some areas.

Response: The RP has been revised.

17. Section 2.6 – Geomorphological Characteristics, page 7, last paragraph of section – This paragraph discusses bank changes as shown by comparative aerial photos.

a. The statement in the RP that the river channel has undergone relatively little lateral migration since the 1930’s seems to be inconsistent with previous evaluations. For example, the 2007 Geomorph Pilot Site Characterization Report, Upper Tittabawassee River and Floodplain Soils, Midland Michigan (UTR Report), Page 5-
32, identifies in Reach L “a significant migration of the entire river channel toward the northeast over time.” In addition, page 5-33 of the Final UTR Report notes for Reaches M, N, and O a “substantial channel movement over time toward the outside bends at each of the three meander bends…” Please clarify the channel migration findings for Segment 2, particularly as they are relevant to the goal of limiting bank and TEQ erosion into the river.

Response: The RP has been revised to provide current interpretation of the aerial photography of the river channel.

b. Please include the historical air photos comparisons for all of Segment 2 (not just segments I through J as shown on Figure 2-3).

Response: The RP has been revised.

c. This section does not discuss the apparent changes at Reach K on the northern bank.

Response: The RP has been revised to address comment 17a, 17b and 17c, however our interpretation does not include an apparent change at Reach K.

18. Section 2.6.1 - In Channel Geologic Stratigraphy, Page 8. This section should be clarified to indicate that glacial till does contain till sand units that can be extensive, and that the till sands have different hydraulic conductivity.

Response: The RP has been revised, however there is limited geologic information for Segment 2 and is not relevant for this RP.

19. Section 2.7.2 – Statement “these response actions will result in an overall reduction of toxicity equivalent quotient (TEQ) spatially-weighted average concentration (SWAC) in Segment 1, and reduce downstream PCOI transport.” This is an important statement, but a bit out of context. Additional information should be provided to support the statement that SCOI remediation in Segment 1 will reduce the PCOI SWAC. A sentence or two of explanation would suffice, but some information should be provided as to why the statement is true. See comment 50.a below.

Response: The RP has been revised.

20. Section 2.7.2.2 - Reach D Dredging and Capping (2007 – 2009), Page 9. This section should also include a description of the “natural cap” that is developing outside of the Reach D cofferdam footprint.

Response: The RP has been revised.
21. Sections 2.7.3.3 and 2.7.3.4 – Please add the length of bank that was addressed at Reach O. The reference report for Reach O should be the recently submitted final report (2012), not the 2010 report.

Response: The RP has been revised.

22. Section 2.7.3.5 – Statement “This pilot study was designed to evaluate the effectiveness of an innovative natural capping system, formed by installing a cellular confinement system (geocells) on the river bottom. . .” Instead of (or along with) geocells, this should be called the “CCS” corresponding to later references to this area/action in the document. Also a similar reference to CCS should be included in Section 2.7.3.6 on the same page.

Response: The RP has been revised.

23. Section 3.1 – Summary of Existing Documents and Data
   a. Page 14. Paragraph 1. This paragraph notes that the bulleted investigations were reviewed and approved by various agencies. Not all the items listed were approved. For example, the bank erosion modeling has not yet been approved.

   Response: The RP has been revised.

   b. Bank soil sampling and analysis needs to be added to the list. Should the benthic community survey be listed among these bullets? Also, later in the text there is a discussion of a bank/floodplain vegetation community survey – should that also be listed here?

   Response: The RP has been revised.

24. Section 3.2, and its sub-sections – Please eliminate “of In-Channel Sediment” from the heading because the section discusses both sediment (3.2.1) and banks (3.2.2). Please add some introduction to 3.2 about banks. Alternatively, current section 3.2.2 could be turned into a new section 3.3, and the remainder of the numbering adjusted.

Response: The RP has been revised.

25. Section 3.2.1 – In-Channel Sediment Nature and Extent
      i. See major comment 4.c related to the identification of contiguous deposits

      Response: The RP was updated to address comment 4.c.

      ii. It should be noted that the step out sampling conducted in accordance with June 2008 IRA Implementation Decision Tree was not for final delineation of sediment deposits. It was conducted as an Interim Response Activity (IRA) to determine if additional early actions were necessary to control transport risk. The 10,000 ppt TEQ interim response value is not a final clean up criteria and
Response to Agencies’ October 6, 2012 Review Comments on the Draft Tittabawassee River Segment 2 Response Proposal  
March 29, 2013

no numeric clean up criteria has been established yet by the Agencies.

Response: Comment noted. No change to the RP.

b. Page 16. Paragraph 3. Review of the composite data indicates that additional work may be necessary before this type of methodology can be further applied to Segment 2. There is high variability in the duplicate sampling. Please note that the Agencies have not fully approved this methodology (see the approval with modification letter from EPA to Dow dated May 10, 2012).

Response: Comment noted. No change to the RP.

c. Page 16. Paragraph 3. Statement “The composite sampling was conducted to provide an understanding of the current variability in surface sediment concentrations.” Because composite sampling is intended to account for variability between sample points, please clarify this statement. Was the sampling looking at “variability” or trying to use another method, in addition to the older core data, to understand how surface conditions differ throughout the segment?

Response: The RP has been revised.

26. Section 3.2.1.1 In-Channel Sediment Primary Constituents of Interest and Figure 3-5

a. Please revise or supplement Figures 3-2, 3-3A, 3-3B, and C3-3C to show TEQ concentrations less than or equal to 100 ppt TEQ and greater than 100 ppt TEQ but less than or equal to 500 ppt TEQ.

Response: No change to the RP. An evaluation of Segment 2 deposits using a break point <100 ppt was conducted, and presented to the Agencies. As discussed during the Agency meetings, using a break point of <100 ppt TEQ does not highlight any additional deposit areas that should be evaluated as a SMA/BMA or "other area of interest". Also discussed in Section 3.8, depositional areas in Segment 2 were used as an additional line of evidence to identify potential SMA areas. This additional line of evidence further supports that additional potential SMAs are not present in Segment 2. Thus, the lowest break point in the figures continues to be < 500 ppt.

b. This section needs to be expanded to explain the utility of using length weighted averages (LWAs) and clarify that both individual samples and LWA were used in the assessment of nature and extent of contamination. Also, please provide a description of how the non-detects were used in the calculation of the LWAs. Was the entire core length used to calculate the LWA or just that portion of the core that had detectable concentrations? Note that only the portion of core with detectable concentrations was used in the bank evaluation of LWA.

Response: The RP has been revised.
c. Please include and discuss the bedload sampling results for Segment 2.

**Response:** No change to the RP. In 2008 bedload samples were collected from Segment 2 and are provided in the 2009 ATS Report. Dow believes the incremental composite sampling provides data that is current and more representative of active bed concentrations and is a more suitable monitoring method for the future.

d. In addition to presenting the results of 2012 composite sampling, the RP should include core-based analysis. Similar to RP 1, please provide a discussion of the nature and extent and calculated SWAC from the core samples. Also, in the last sentence of this section insert “surface” or “active bed” between “average” and “sediment TEQ”.

**Response:** The RP has been revised.

e. Figure 3-5. The figure does not identify the type of duplicates that are being reported (i.e., bowl vs. field).

**Response:** The RP has been revised.

27. Section 3.2.1.2 and 3.6.2.2 – In-Channel Sediment Secondary Constituents of Interest.
   a. SCOI screening process - general comment on the screening steps. Why compare the SCOI concentrations to background concentrations and toxicity test-derived screening values before comparing to literature-derived toxicity screening benchmarks? The number of samples and results are not so overwhelming to justify the pre-screening to background and toxicity test-derived values. This would be a more robust screen if all SCOI concentrations were compared to toxicity screening benchmarks.

**Response:** No change to the RP. Whereas screening could be conducted in a variety of sequences, changing the screening sequence does not change the outcome of the risk analysis. Additionally, the sequence used in the RP was intended to help inform Segment 2 risk-management decisions. Background and site-specific toxicity test-derived screening levels were used as the first steps in the screening process because literature-based screening benchmarks were considered less relevant for decision-making. Similarly, site-specific toxicity testing provided detailed insight into concentrations that were (and were not) toxic.

The comparison of SCOIs to literature-based screening values is available on Table B1.6A. Table B1.6A provides the maximum concentrations of every SCOI and provides literature-based ecological screening level benchmark (ESLB) for each SCOI. Further, this table identifies SCOI concentrations at each location and highlights where the maximum concentration was observed. Thus, the requested information is provided in the Response Proposal.

b. SCOI screening process - background concentration screen. Is it appropriate to use background concentrations as the first step in the SCOI screening process, when these values were obtained from a relatively small number of samples? If a SCOI is
elevated in background, this should not automatically rule out SCOIs that are elevated in downstream samples.

Response: No Change to the RP. Please see the response to Comment 27.a. Furthermore, Dow believes that the number of background samples is sufficient to determine whether higher COCs exist upstream of the Dow site, and thus whether they factor into the risk-management decision for the site. In addition, Appendix B1 of the RP provides information supporting the basis of the background screening, as follows:

- **Table B1.6A** provides a tabular summary of maximum detected values for each SCOI, all background values considered, and all ESLBs. The background values were evaluated as part of the screening process.

- **Attachment B1.7** provides an uncertainty evaluation with regard to considerations related to the background screening. This evaluation demonstrated that the background screening values were sensible; the background screening did not overlook SCOIs that should otherwise have been retained.

c. SCOI screening process - frequency of detection screen. Is frequency of detection an appropriate SCOI screen? If an SCOI is detected at high concentrations, but only in a few samples at one location, this location should be evaluated against the appropriate benchmark, regardless of the SCOI's segment-wide detection frequency.

Response: No change to the RP. The use of frequency of detection is an appropriate screen and it is founded in USEPA guidance for ecological risk assessment, as was cited in the Response Proposal. In addition, Appendix B1, Sections 4.2 (sediment) and 4.3 (bank soil) discusses each SCOI that was not retained based on frequency of detection by examining the magnitude of the criteria exceedance. In each case, the exceedances were low. Finally, Tables B1.7A and B1.9A identify the exact number and frequency of detection values, with a comparison of maximum values to criteria. The information demonstrates that all data were compared to benchmarks (as indicated in the comment), that the frequency of detection was among many considerations, and that excluding SCOIs was appropriate each time this rationale was used.

d. How are bioaccumulative chemicals of concern such as hexachlorobenzene being evaluated (e.g., the PLER for chlorobenzenes does not address bioaccumulation)?

Response: No change to the RP. Based on the SCOI and PCOI data in fish (summarized in the Task 4 Fish Monitoring Plan (FMP)), bioaccumulation of PCOIs, not SCOIs, is the basis of action for Segment 2. Please see the discussion on bioaccumulation in Section 3.7.3 of the Response Proposal. Please note: The Fish Monitoring Plan (submitted April 2012) also describes why future monitoring of chemicals in fish tissues should focus on PCOIs rather than SCOIs.
e. Why are there only 27 surface sediment sample locations used in the sediment screening (page 18, 1st paragraph)? There appear to be at least 37 locations that have not been addressed by previous remediation.

_Response:_ No change to the RP. There were only 27 SCOI samples (of the 37 locations) that were available for screening because not all 37 cores were sampled and analyzed in the upper 1 foot of sediment. The screening of surface sediment was done for locations sampled in the upper 1 foot of sediment, as defined by a mid-depth of less than or equal to 1 foot below the sediment surface (i.e., so this included samples from the interval of 0 to 2 feet). Table B1.2A identifies each location and the depth interval with SCOI data available. In addition, all 37 locations were included in the SCOI screening for the upper 2 foot interval of the sediment column, as described in Appendix B1, Attachment B1.6A and Attachment B1.6B.

f. Footnote 3 on page 18. Were there SCOIs that were encountered in the Reach O remediation that did not go through the screening process? Inclusion of this data in the evaluation is important due to the limited sample density and to provide as much data as available to represent unsampled areas.

_Response:_ The Reach O locations that have been remediated do not provide information for determining the necessity of future actions in Segment 2. Moreover, the biased sampling of depositional areas and the SCOI screenings of the upper 1 foot and upper 2 foot intervals (with some depths of 2 feet and 4 feet below sediment surface, respectively) in the remainder of Segment 2, compensate for the sample density. Thus, the data used in the SCOI screening are appropriate and adequate for this evaluation.

g. Figure 3.7 and text at bottom of page 18. Dow is comparing ethyl parathion to the PLER in the upper one foot of sediment. The active sediment bed depth has not yet been determined for this segment. Please discuss how many locations exceed the PLERs and EPA threshold in the upper two feet – this would be consistent with what was done in Segment 1.

_Response:_ The RP has been revised.

28. Section 3.2.1.3- This section discusses a core in Reach K with an “oily/greasy look.” Analytical data for SCOIs has not been collected from this core location and therefore it may not be appropriate to conclude there is no evidence of NAPL at this location. Please discuss if any other review of the boring logs was conducted to determine if elevated photoionization detector (PID) reading or odor was present at this or any other Segment 2 locations.

_Response:_ The RP has been revised.
29. Section 3.2.2.1
   a. Page 20, paragraph 2. It should be noted that the step out sampling described was based on an IRA for the identification of high concentrations of TEQ in surficial soils to evaluate the need for early actions. The 10,000 ppt TEQ step out concentration was never intended and should not be interpreted as a final acceptable concentration in surficial soils. No numeric clean up criteria has been established yet by the Agencies.

   **Response:** Comment noted. No change to the RP.

   b. Page 20, paragraph 3. This paragraph needs to be clarified to indicate that 13 target bank areas were initially identified as having potential for near term transport risk.

   **Response:** The RP has been revised.

   c. Add a description of the reach N sampling in 2012.

   **Response:** The RP has been revised.

30. Section 3.2.2.2 - Bank Soil PCOIs
   a. Add the results from the 2012 Reach N sampling.

   **Response:** The RP has been revised.

   b. Please revise or supplement the bank figures to show TEQ concentrations less than or equal to 100 ppt TEQ and greater than 100 ppt but less than or equal to 500 ppt TEQ.

   **Response:** No change to the RP. The bank figures continue to use < 500 ppt as the lowest break point, consistent with the in-channel evaluation. In addition, as part of the BMA evaluation, a TEQ index was determined for each bank which considered both bank TEQ LWA and bank height. Significant TEQ deposits were identified as banks with the highest TEQ index that contain 50% of the total bank TEQ index, and not based on a "binned" TEQ LWA value.

   c. Figure 3-9A shows a boring at approximately RK-225 where high levels of TEQ are present below the bottom of the bank and possibly in the adjacent river sediments. It does not appear that sampling in river sediments adjacent to this bank was conducted. This area should be further evaluated as a potential Segment 2 SMA and/or BMA.

   **Response:** The figure in the RP has been revised. The location of the bottom of bank in Reach K was further evaluated, and it was determined that the TEQ levels near station 225+00 are located above the bottom of the bank. The bottom of the bank revisions are reflected in Figure 3-50A.

   d. Page 22, paragraph 2. Please provide a detailed description of how the proxy work was conducted; how the proxy work was tested; and the estimated error/uncertainty in the proxy process. It does not appear that a written report was provided to the
Agencies on how the proxy values were determined or tested. This can come as a separate submittal from the revised RP, but the Agencies want to establish a submittal date for this. It probably makes sense to do this for the entire Tittabawassee River system, not just Segment 2. After review of the written description of the proxy process, the Agencies may request additional work, including additional sampling in a subset of critical areas that should be verified with actual analytical data.

**Response:** The RP has been revised. The content and associated figures for Section 3.2.2.2 for the draft RP has been replaced and the new content reflects the revised nature and extent discussion for the Segment 2 banks. Proxy data were not used in the revised evaluation of Segment 2 bank TEQ deposits. As discussed with the Agencies, if bank TEQ levels were not available, these banks were identified as an uncertain TEQ deposits. For instance, bank TEQ levels along the northeast bank of Reach L are not available; therefore, these banks have been identified as an uncertain TEQ deposit and will be evaluated further to resolve uncertainty. In some areas of the Tittabawassee River floodplain, proxy data are used to represent the TEQ levels where TEQ data are not available. The proxy TEQ levels are generally based on TEQ data from floodplain areas with similar geomorphic features, soil type, and locations along the river. The proxy process will be further evaluated in the future, and the results of the proxy re-evaluation may affect the use of proxy data in the bank TEQ evaluation in Response Proposals of downstream segments.

e. Page 22, paragraph 4. This paragraph should also discuss whether variability in sample concentrations within a geomorphic unit may also be due to sampling issues associated with the heterogeneous nature of the contamination.

**Response:** The RP has been revised.

31. Section 3.2.2.3 - Bank Soil SCOIs and Evaluation of Bank Soil SCOIs

a. See comments above on the in-channel SCOI screening.

**Response:** Comment noted. No change to the RP. Also see responses to items 27.a through 27.g.

b. Use of the LWAs may be reasonable for screening for risk to aquatic receptors, but it is not appropriate for evaluating risk to receptors exposed directly at the bank.

**Response:** Use of LWAs is appropriate for the purpose of this Response Proposal, which is to evaluate bank soils as a potential source to in-channel sediment samples. The LWA concentration is the appropriate concentration because, if erosion of the bank does occur, the soil would mix as it enters the river and aquatic organisms would be exposed to an average SCOI concentration from the eroded bank. Aquatic receptors are not directly exposed to the bank deposits. Moreover, the Segment 2 Response Proposal does not include consideration of terrestrial wildlife exposure to the banks, as the banks are only considered as a potential...
future SCOI contributor to the river for this Response Proposal. Evaluation of risk to terrestrial receptors directly at the bank will be considered in the Floodplain Response Proposal and/or the Task 10 risk assessment efforts.

32. Section 3.3.1 - Segment 2 Bed Stability Evaluation
   a. Please include the Segment 2 scour chain data, an empirical line of evidence. If it is not possible to interpret the historical scour chain data because of a lack of adequate field documentation, then the need for new scour chains should be discussed with the Agencies to supplement our understanding of active bed depth (most appropriately as part of the ongoing SEDA discussions).

   **Response:** The historic scour chain data cannot be properly interpreted due to a lack of necessary information in the field notes regarding how the chains were located and measured. As such, no change to the RP has been made.

   b. Please provide the reference for Figure 3-13 and the documentation to support the statement that the sediment depth potentially affected by bedform formation is one half of the total bedform height. It is not clear why the entire amplitude of the dune is not considered to be part of the “active bed.”

   **Response:** The RP has been revised.

33. Section 3.3.1.1
   a. This section makes the point that the sediment bed is in a state of dynamic equilibrium with little net deposition or erosion when spatially averaged over the entire bed. While this is likely true, it is important to remember that we are also concerned with local erosion, even on a shorter time frame, and its potential impact of remobilizing contamination that is not currently exposed at the surface. In addition, because bathymetry cannot be conducted during lower flow periods in the Tittabawassee River, seasonal changes in bed elevations may be missed by the differential analysis.

   **Response:** Comment noted. No change to the RP.

   b. Provide a hydrograph that shows the flows over time relative to when the bathymetric measurements were taken.

   **Response:** The RP has been revised.

   c. Page 25, last full paragraph – Please explain “shift in horizontal position.”

   **Response:** The RP has been revised.

Response: The RP has been revised.

e. Statement – “Due to the nature of the 2003 survey (i.e., singlebeam transects, which do not provide complete coverage of the river bed), differential bathymetry was not performed for the 2003-2007 period.” At one point the Agencies saw this analysis. Please consider including this. Although there are recognized challenges in interpreting the data, the analysis could further support the general conclusion of this section that “that bed elevation changes generally occurred in consistent locations within the channel from one period to the next.”

Response: The 2003 bathymetry survey is of limited value for the bed stability evaluation, even for supporting a general conclusion, due to the limited bed coverage achieved during this survey. Thus, a discussion of this survey has not been included in the revised RP.

34. Section 3.3.1.2

a. What were the flow conditions under which the bedforms were measured? Discuss the expected differences in bedform heights from other flows (higher flows than those occurring prior to the bathy events). What is the maximum amplitude of the sand waves that is expected based on current velocities measured in the Tittabawassee River?

Response: RP has been updated. Bedform height estimates for other flow conditions will be presented in the SEDA report.

b. Figure 3-17 horizontal scale is in miles. This would be easier to evaluate if the horizontal scale were in feet as in Figure 3-16.

Response: The RP has been revised.

c. p. 27: "Cumulative probability distributions of bed form heights along the three longitudinal transect[s] are compared for each multibeam survey in Figure 3-18...95 percent of the bed form heights computed from the 2007 through 2012 multibeam bathymetry measurements were less than 0.8 ft., and less than 0.5 percent of the bed form heights exceeded 1.5 ft..."

Comment: Figure 3-18 is hard to understand. How were these CDFs actually calculated from the data? Looking at Figure 3-17 it would appear that the bed form heights have a pretty clear central tendency at around 0.5 to 0.8 ft., yet according to the CDF shown in Figure 3-18, 0.5 ft. is shown as something like the 95th percentile value. It would appear that this CDF was automatically generated somehow by looking at all small-scale roughness features in the data, rather than actually picking
out peaks and troughs from the dunes. Clearly there are some smaller ripples superimposed on the larger dunes (e.g., midway through the upper and middle transects in Figure 3-17) but including these in the CDF is really not telling us much about bed mobility/potential depth of reworking, which is what we are interested in. It would be much more direct to say that the dune height is typically 0.5-1 ft. and leave it at that. Or if it must be left in, there needs to be substantially more description about how peaks and troughs were picked out of the data and an acknowledgement that the smaller ripples are not the focus of this exercise. As currently described in the text, and shown in Figure 3-18, the reader is left thinking that a 0.5 foot dune is somehow a rare thing, which it clearly is not.

**Response:** The RP has been revised.

35. Section 3.3.1.3
   a. MDEQ generated Figure 1 (attached), which is a graph that shows the maximum bed elevation differentials at each Segment 2 bed pin location. The station location of the bed pins is plotted on the X axis. MDEQ’s review of this information shows that the active bed depth, as measured by bed pin measurements between 2008 and 2012, appears to vary geographically as you move through Segment 2. Maximum bed pin elevation changes of two feet or greater are present in some parts of Segment 2 to at least the Reach L/M boundary.

   **Response:** Comment noted. No change to the RP.

   b. p.28: "The maximum change in bed elevations was 2.5 ft...."
   Comment: Based on the limited description of the bed pin data, it appears that the bed pins are indicating systematically higher bed elevation changes than the multibeam surveys. Is this a result of the bed pins themselves? There should be more discussion of this discrepancy somewhere in the report

   **Response:** The RP has been revised.

36. Section 3.3.1.4, p.28: "...the median bed form height was below 0.2 ft. in each of the multibeam surveys." See comment on 3.3.1.2 above. This number depends entirely on how bed forms are picked from the data using whatever algorithm is used to do this. More detail is needed.

   **Response:** The RP has been revised.

37. Section 3.3.2
   a. Pg 30, Sec 3.3.2, next to last para: The practice of adjusting the effective particle diameter for one of the non-cohesive sediment size classes to calibrate the sediment transport model is not a commonly accepted modeling protocol. It is recommended that the impact of this procedure on the modeling results be determined by choosing a data driven effective diameter for class S-3.
Response: No change to the RP. The data-based methodology for estimating the effective diameter of class 3 (medium/coarse sand) sediment particles relies on an average value that is calculated from a large number of data points (i.e., effective diameter values for specific grain size distribution (GSD) samples). Spatial variability in GSD data produces a range of effective diameter values for the population of samples, with the average value being one statistical measure of the population. Adjusting the effective particle diameter of class 3 sediment during model calibration is valid because uncertainty exists in a representative value for use in the model due to variability in the GSD data. Thus, the average value of the data does not necessarily provide the best representative value of effective particle for use in the model. This will be discussed further in the SMDA report.

b. Please discuss the results of the modeled 50-year flood event.

Response: The RP has been revised.

38. Pg 31, Sec 3.3.3 and Figures 3-22a and 3-22b:

a. The first paragraph discusses that active bed depth greater than 1 ft occurs “in a few predictable locations.” How do the areas of greater active bed depth relate to PCOIs and SCOIs not currently within a SMA?

Response: No change to the RP. A comparison of the predicted active bed depths and Segment 2 TEQ deposits was conducted. All PCOIs and/or SCOIs were addressed in Sections 3.8.1 and 3.8.2, SMAs, or Section 3.8.2.6, Other Areas of Interest.

b. Statement – “The ability of the sediment transport model to reliably predict the spatial distribution of the active bed depth was evaluated through comparisons of model predictions to differential bathymetry data.” It’s difficult to discern the level of agreement between the approaches from the figures. Since erosion is a primary concern, it would be useful to develop a figure that layers both data sets and indicates where the LOE indicates erosion (e.g., greater than a foot) and where there’s agreement between the LOEs. It would also be useful to outline the SMA’s on these diagrams, so we could see what’s happening in the areas that matter.

Response: The RP has been revised.

c. It might be useful to combine the differential bathymetry from year pairs as layers that depict those areas exhibiting erosion and then using that to compare to the model output. That would be more similar to the model output that shows max eroded depth over the period of time. The conclusion of “dynamic equilibrium” indicates that lumping 2009-2012 differential bathymetry will obscure some areas of scour.

Response: The RP has been revised.
d. A greater analysis of the output from the 22 year simulation would be helpful. Does it show “dynamic equilibrium” or deposition over its 22-year simulation? What are the predicted bed elevation changes?

Response: The RP has been revised.

e. 2nd para – The qualitative similarity described in the 4th sentence is not obvious. It would help to use the same color scale in the two plots. More discussion of specific areas that are qualitatively similar should be added to the text to make it easier for the reader to understand this point.

Response: The RP has been revised.

39. TEQ Transport Model Section 3.3.5 – On page 33, Sec 3.3.5, 3rd para: Explain in more depth the technical justification for stating that “the TEQ transport model provided a reliable method for simulating TEQ transport in the Tittabawassee River.” The reason given at the beginning of the sentence that includes this quote does not necessarily support the conclusion. Please provide additional discussion for not modeling the transport of the dissolved phases of furans and dioxins and for not modeling the sorption/desorption processes than the fact that these chemicals are hydrophobic. The transport and fate of all three phases as well as sorption and desorption of hydrophobic chemicals at other superfund sites are frequently modeled. This may be a comment best resolved between the modelers, and separate from the Segment 2 RP.

Response: No change to the RP. This comment will be discussed between the Dow and EPA modeling teams separate from the Segment 2 RP, as suggested.

40. Section 3.4.1 – This section focuses on be benthic invertebrates. Should other biota be discussed or considered?

Response: No change to the RP. The SCOI screening process involved comparing the concentrations of SCOIs detected in Segment 2 sediment samples to concentrations known to be protective of benthic organisms because sediment dwelling organisms are the biota most exposed to sediment concentrations. Other potential receptors and food web exposures are considered in Section 3.6.3 (Bioaccumulation and Food Web Exposures) which refers to the Fish Monitoring Plan submitted in April 2012.

41. Section 3.4.2 – It would be useful to expand the discussion here. Discuss riparian zones and their unique ecological significance.

Response: The RP has been revised.

42. Section 3.4.3, p.38: Threatened and Endangered Species - general comments

Comment: The species list provided in Tables 3-5, 3-6 & 3-7 should be reviewed to ensure that it includes recent updates. For example, the status of snuffbox mussel (Epioblasma triqueta) needs to be updated. It is now federally listed as endangered. Also, eastern massasauga rattlesnake (Sistrurus catenatus) is a candidate species that occurs in Saginaw
County, and a pair of piping plovers (*Charadrius melodus*) nested in Bay County in 2010. Occurrences of eastern prairie fringed orchid (*Platanthera leucophaea*) are known in Bay and Saginaw counties. Records of recent occurrences of eastern prairie fringed orchid are known on the north side of Saginaw River (Bay Co) at the Essexville Prairie...at the Dow Chemical Tank Farm.

Indiana Bats (*Myotis sodalis*) are included on both the federal and state endangered species list and are vulnerable to disturbance with loss of summer habitat. The U.S. Fish and Wildlife Service consider Saginaw County as being within the potential range of the species. This may need to be taken into consideration during remedy implementation.

**Response: The RP has been revised.**

43. Section 3.5, p. 39 and 40: Cultural and Historic Resources: **Comment:** In a November 20, 2012, letter to EPA the Saginaw Chippewa Indian Tribe outlined Tribal concerns for culturally significant sites within the Tittabawassee River, Saginaw River & Bay Site and provided historic maps and an inventory of culturally significant sites relevant to the Tittabawassee River area from the Ziibiwing Cultural Center. Dow and MDEQ were copied on this letter. This information should be considered during the development of the Accidental Discovery Plan.

**Response: Comment noted. No change to the RP.**

44. Section - 3.6.1 Potential Pathways of Exposure and Risk in Segment 2 – Section 3.6.4 clarifies that the RP is not intended to address all of the potential exposures and risks from the bank soils and that further work to address other exposure pathways such as human direct contact and terrestrial ecologic risk will be conducted as part of the upcoming floodplain response proposal. However, because this section is an overview of the pathways in Segment 2, it would be useful to clarify this here, as well.

**Response: The RP has been revised.**

45. Section 3.6.2.2 – Segment 2 SCOI Screening Process for Sediments and Bank Soils.

a. Please see earlier comments on the sediment and soil SCOI screening processes.

   **Response: Comment noted. No change to the RP. Also see response to Comments 27.a through 27.g.**

b. Page 44, 1st paragraph of the section – This section states that the SCOI screening process “focused on the upper 1 ft interval of the sediment column, as this is the most likely portion of the sediment column that comprises the biologically active zone and the active bed depth.” The Agencies have not accepted this statement. Conclusions about the active bed depth and likely exposure will be further refined by the ongoing SEDA. However, since the Segment 2 SCOI screening included a sensitivity analysis looking at a 2 foot depth, the conclusions are not likely to change. It may be useful to
mention here that a sensitivity analysis for the 2 ft depth was conducted and is available in the Appendix.

Response: The RP has been revised.

46. Section 3.6.2.3 - SCOI Screening Results for In-Channel Sediments and Bank Soils

a. See major comment 11 above. Based on comments herein, the Agencies are not ready to fully agree with the conclusions of this section. Comments about the screening process should be addressed. However, these comments do not hinder the development and selection of response options for the identified SMAs and BMAs, but may result in additional Segment 2 analysis/work, post-construction monitoring, and/or Task 10 analysis/work.

Response: Comment noted. No change to the RP.

b. The last bullet on page 46 (which carries over to page 47) and the 2nd full bullet on page 47 are confusing and seem to draw inconsistent conclusions.

Response: The RP has been revised.

47. Section 3.6.3

a. page 47 – The Task 4 monitoring does not preclude that additional monitoring (including SCOIs) may be needed to complete Task 10 risk assessments.

Response: Comment noted. No change to the RP.

b. The Agencies are still reviewing the Fish Monitoring Plan. The work outlined in this section may change based on the Agencies’ forthcoming review. The RP will not need modification, but fish monitoring will be driven by the approved Fish Monitoring Plan.

Response: Comment noted. No change to the RP.

48. Section 4.1, Conceptual Site Model (CSM) and Figure 4-1. The CSM is fundamentally important and the Agencies are willing to discuss how best to represent this in the revised Segment 2 RP.

Response: Comment noted. No change to the RP.

a. page 54 – The CSM is described in the 2nd paragraph of Section 4 as “The CSM summarizes the sources and the status of their control. The CSM also summarizes the nature, extent, fate, and transport characteristics of the chemical constituents associated with a site and also identifies potential exposure pathways that may contribute to unacceptable risks.” Section 4.1 does not provide this information. Either add new sections 4.1.1 and 4.1.2 that address sources and nature and extent or refer to the appropriate portions of Sections 2 and 3 that cover these areas.
**Response:** The RP has been revised.

b. Section 4.1.1, page 54 – “The CSM contains two pathways of potential concern associated with sediment-bound constituents: 1) a pathway to fish and consumers of fish; and 2) a pathway to benthic organisms. These pathways are shown on Figure 4-1 and are discussed below.”

   i. This section refers to two pathways of potential concern. The text that follows and the figure only discuss the fish pathway. Please update the discussion on benthos.

**Response:** The RP has been revised to reflect the changes in the CSM.

ii. Please also add a discussion of the transport pathways related to the floodplain and downstream to Segment 3.

**Response:** The RP has been revised.

iii. As noted in the RP, this CSM is broadly the basis for action for the identified SMAs and BMAs. The Agencies recognize that other receptors (i.e., birds and mammals), other possible exposure pathways (e.g., direct contact), and other species with advisories may need to be evaluated as part of the Floodplain Response Proposal and/or the Task 10 assessment.

**Response:** Comment noted. No change to the RP.

iv. PCOI Pathway to Fish and Fish Consumers. This text indicates that the PCBs are not site-related. The Agencies are not necessarily in agreement with this, given that DEQ and Dow sampling of DNAPL in 2011 and 2012 from several of the Segment 1 SMAs has shown the presence of coplanar PCBs.

**Response:** Comment noted. No changes have been made to the RP, Dow does not believe that the PCBs detected in fish are related to the site.

v. Check whether this section needs to be numbered as a sub-section.

**Response:** The RP has been revised.

c. Figure 4-1 – Please consider the following changes:

   i. Consider using terminology recently proposed for the floodplain CSM – “primary pathway.”

**Response:** The RP has been revised.
ii. On the left hand side, please clarify that “Operation Controls” have controlled sources to the river.

Response: The RP has been revised.

iii. Indicate by a hatched box that Segment 1 cleanups (including Reach B and D) are acting as source controls.

Response: The RP has been revised.

iv. Change the PCOI pathway from in-channel sediment to the floodplain soils from “historical” to “current” pathway.

Response: The RP has been revised.

v. Neither Figure 4-1 nor the text on page 54 addresses the pathway of floodplain soils eroding back into in-channel sediments. The magnitude and significance of this pathway is not currently known and should be assessed.

Response: Floodplain transport to the river represents a minor pathway that does not form a basis for action. Additional text was added to Section 4, conceptually describing the low potential for floodplain soils to be transported back into in-channel sediments.

vi. To the right hand side, add Segment 3 and indicate that Segment 2 in-channel sediment is a known pathway to Segment 3 in-channel sediment.

Response: The RP has been revised.

49. Section 4.2, Remedial Action Objectives – The RAOs should relate to the CSM. The single RAO currently proposed is overly broad. The RAOs are fundamentally important and the Agencies are willing to discuss how best to represent these in the revised Segment 2 RP.

Response: The RP has been revised.

a. Please review Section 8.3 of the SOW regarding RAOs.
   i. Section 8.3.1 of the SOW includes example General Response Objectives. Please evaluate how these will be addressed – either under this response proposal or under the upcoming floodplain response proposal.

Response: The RP has been revised.

ii. In accordance with the SOW, as appropriate, please indicate short vs. long-term RAOs.

Response: The RP has been revised.
b. A separate RAO for the fish and fish consumer pathway should be considered related to reduction of potential TEQ uptake into fish and potential unacceptable exposures to fish consumers. The performance objective related to TEQ SWAC is appropriate for fish uptake. However the measurable metrics should consider both in-channel SWAC levels and fish tissue levels over time.

**Response:** The RP has been revised.

c. Please include a separate RAO for reducing transport of TEQ downstream and into the floodplain. As presented, the proposed measurable metric for reducing transport is decreased TEQ SWAC concentration, which may or may not relate to transport. Other direct measurements may be more appropriate.

**Response:** The RP has been revised.

d. Measurable metrics specific to banks should be considered (e.g., measured erosion rates via bank pins, measurement of establishment of vegetation, etc.)

**Response:** The RP has been revised.

50. Section 4.4

a. 1st paragraph – Statement “As discussed in Section 2.7, between 2007 and 2009, Dow completed early actions in upstream areas of Segment 1 (Reaches B and D) that reduced the sediment TEQ SWAC throughout Segment 1 by approximately 60 percent.” A quantitative assessment of remedial effectiveness such as the 60% TEQ SWAC decline is not mentioned in Section 2.7. This is an important statement that shouldn’t be buried so late in the document.

**Response:** The RP has been revised.

b. last paragraph on page 59 – The end of this paragraph should be revised to reflect changes to the RAoOs. Also the statement is made “Ongoing monitoring continues to demonstrate the protectiveness of these early response actions.” The word “protectiveness” should be evaluated – see major comment 10 above.

**Response:** The RP has been revised.

51. Section 5.1 - Common Elements, Page 61

a. Source Control. This section needs to be clarified to indicate that control of primary sources of hazardous substances, pollutants, or contaminants from the Dow facility has been completed. Significant secondary sources of contamination are being addressed as part of these remedial actions. Also, the effectiveness of the previous response actions is being monitored under appropriate plans.

**Response:** The RP has been revised.

b. Site-Wide Monitoring. The introductory bullet may remain as written, but the sub-bullets need to be removed. See comments 4.b and 5.d above.
Response: The RP has been revised.

c. “In-water construction” is discussed in the 4th bullet. Construction on banks may not be in-water. Please just refer to the construction timeframe.

Response: The RP has been revised.

52. Section 5.2 - SMA Response Alternatives – Please remove the 2nd paragraph. See comments 4.b and 5.d above. However, some of the information in this paragraph can be included other parts of the document. For example the statement “The in-channel deposits in Reaches J and K (i.e., SMA 2-1 and 2-2, respectively) are currently being addressed by ongoing CCS pilot studies to confirm the effectiveness of the CCS remedy (see Section 2.6 and Section 3.7).” The correspondence between SMA 2-1 and 2-2 to earlier actions needs to be made clear earlier in the document. Sections “3.7.2.1 SMA 2-1 – Reach J” and “2.7.3.5 Reach J Capping Pilot Study (2010)” do not mention that the proposed SMA 2-1 is actually the 2010 CCS area. Similarly, the description of SMA 2-2 (3.7.2.2) does not mention that it was a CCS area (more strange is that section concludes “the elevated TEQ deposit is stable and is beneath the active bed layer”). Figures 3-27B and 3-28B also do not indicate a pilot cap.

Response: The RP has been revised.

53. Section 5.2.1
a. 1st paragraph of section –
   i. The definition of MNR should indicate that it relies on continued effectiveness of upstream source control in combination with dilution and mixing with relatively cleaner sediments from upstream of the site.

Response: The RP has been revised.

   ii. Please reference the source of the data regarding the entry of about 89,000 metric tons per year. Is this statement based on direct observations or models?

Response: The RP has been revised.

b. Page 63, 3rd paragraph and Figure 5-1
   i. This analysis only related to the in-channel SMAs. Please consider a similar analysis for BMA responses and/or all responses within Segment 2.

Response: No change to the RP, it is too early to conduct this type of analysis as proposed BMAs have just been identified. Such an evaluation could be done once a set of BMAs have been agreed upon.

   ii. It is not clear if the “no further actions” analysis includes the effectiveness from the CCS caps at SMAs 2-1 and 2-2 (or somehow factors in bank work at Reaches M and O). If the analysis had been done prior to those actions,
would there have been a bigger differential between MNR and active responses?

Response: The RP has been revised.

iii. To assist in interpreting the results plotted in Figure 5-1 as well as the statement made in the last sentence in this paragraph, the uncertainty band associated with each model simulation should be shown.

Response: No change to the RP. A discussion of model uncertainty has been added to various sections of the RP. However, the uncertainty in the model predictions has not been quantified nor included on the figure as requested. Sensitivity and uncertainty analyses will be considered as refinements/improvements are made to the modeling framework.

iv. Review of Figures 3-29A, 3-30A, and 3-31A show that in many cases, the actual observed minimum bed elevation is lower than the modeled 50 year flood depth of scour. In the case of Figure 3-30A (SMA 2-4) the measured depths of scour are less than the 50 year flood depth of scour in 20 of the 38 core vertical profiles shown, suggesting that the model is under predicting the potential scour depths.

Response: No change to the RP. The strength and consistency of the stability lines of evidence are being evaluated in the SEDA report.

c. Page 63, 5th paragraph
   i. Statement “Consistent with MNR guidance (Magar et al. 2009), stability of sediments in the Segment 2 in-channel SMAs was evaluated using a weight-of-evidence approach that considered a range of site characterization and sediment stability data.” Magar et al 2009 focuses on documenting that MNR processes have occurred and are anticipated to occur in the future. Here, bathymetry as a line of evidence would be neutral as it does not show that burial as an MNR mechanism is ongoing. Core chemistry suggests MNR has occurred, but ongoing burial is not evident or consistent with the concept of “dynamic equilibrium.” The analysis in this report should be a stability analysis, to evaluate whether buried deposits in the SMAs will stay that way.

Response: The RP was revised in section 5.2.1 in conjunction with addressing the comments 53a.i and 53a.ii.

   ii. This paragraph discusses natural armoring of the sediment bed with “relatively coarse gravel materials that enter from upstream.” What documentation or evaluation of the presence of armoring is available for the SMAs? In general, the Tittabawassee is not a gravel bottom river.

Response: The RP has been revised.
54. Section 5.2.2. Statement “These caps would supplement the existing natural sediment deposits that overlie subsurface TEQ deposits, as summarized above.” To be accurate, add “, where they exist,” after “sediment deposits”.

Response: The RP has been revised.

55. Section 5.2.3 – Removal – The basis for the depth of the removal prisms is not clear and requires additional explanation. The associated figures show that in some cases the bottom of the dredge prism(s) could expose high concentration TEQ at the proposed finish elevation. The depth of the prisms should completely encompass the high TEQ deposits. Please assess how this might change the estimated volumes.

Response: The RP has been revised.

56. Sections 5.3.2 and 5.3.3, Table 5-3, and Appendix E
   a. Because bank stabilization is a relatively new approach for contaminated bank management, it would be useful to expand the discussion to explain more of the bioengineering aspects and benefits. The Army Corps of Engineers has extensive experience in bank stabilization for stream management purposes. The Corps discusses that vegetation on banks can aid erosion control through five mechanisms: reinforce soil through roots; dampen or dissipate water energy; intercept water and sediment; enhance water infiltration; and deplete soil water by uptake and transpiration.

Response: The RP has been revised.

b. Section 5.3.3
   i. Please discuss that the In-Place Stabilization option also includes elements of the Enhanced Natural Stabilization option.

Response: The RP has been revised.

   ii. This refers to “a CCS layer” for bank stabilization. The term “CCS” should be used only for in-channel capping.

Response: The RP has been revised.

c. Table 5-3 does not include the Envirolok green wall, Enkamat, jute mats, BioD70 blanket, silt socks, or pre-vegetated sod as potential process options for In-Place Stabilization. Please consider their inclusion. Also, it would make sense to reorder the In-Place Stabilization list to have all of the overlapping Enhanced Natural Stabilization options together followed by the new options.

Response: The RP has been revised.
Response to Agencies’ October 6, 2012 Review Comments on the
Draft Tittabawassee River Segment 2 Response Proposal
March 29, 2013

d. Appendix E, Table E-1 – Please add additional bioengineering references that reflect work by the Army Corps of Engineers to stabilize banks (not for contaminant purposes, but for system management). At a minimum, please include: Bioengineering for Streambank Erosion Control, Allen and Leach, April 1997; and Stream Management, Fischenich and Allen, March 2000.

Response: The RP has been revised.

57. Section 5.4.1 The RAOs described here are different than the RAO presented section 4.2.1.

Response: The RP has been revised.

58. Section 5.5
   a. Add a discussion that the same alternative need not be selected for each SMA, and those individual conditions at each of the SMAs will weigh into which alternative is proposed and selected.

Response: The RP has been revised.

   b. In general, the discussion of effectiveness and implementability does not distinguish between the SMAs – please add relevant details.

Response: The RP has been revised.

   c. The numbering of the sub-sections of this section is off – should be 5.5.1, 5.5.2, etc.

Response: The RP has been revised.

59. Section 5.5.1.1 – Effectiveness, Protection of Human Health and the Environment. The discussion in this section should link more clearly to the RAOs.

Response: The RP has been revised.

   a. Statement “Alternative 1 (MNR) would document the continued decline of TEQ levels in active-bed sediments as a result of prior source controls and natural recovery processes (primarily sedimentation and mixing).” The continued decline of TEQ levels has not been demonstrated in this document, particularly as a function of MNR. That doesn’t mean it’s not occurring, but its occurrence has not been established in the Response Proposal. The “nature and extent” discussion doesn’t mention declines in time. If MNR is to be positioned as an alternative that reduces sediment TEQ concentrations over time, then the lines of evidence supporting that conclusion should be presented. Demonstrating stability of buried deposits (and thus stability of a potential source) is a separate issue.

Response: The RP has been revised.
b. MNR – please modify this statement “Reduced surface-sediment TEQ levels would contribute to reduced ecological exposures to PCOIs over time.” The discussion should center on the RAOs of uptake into fish and further transport.

Response: The RP has been revised.

c. Alternative 1 (MNR). Page 70. The statement that “all Segment 2 SMAs are currently stable” may overstate the case. This is a question to be evaluated in the ongoing SEDA. The vertical core profiles for SMA 2-4 and 2-5 show higher TEQ levels close to or at the sediment surface. As noted in earlier comments, questions about the sediment stability and the transport model result in more uncertainty about the MNR alternative.

Response: The RP has been revised.

d. MNR Statement “Buried SMA TEQ deposits have a relatively low likelihood of being eroded and transported downstream. Thus, the MNR alternative would likely be protective of human health and the environment.” No determination has been made that current concentrations are “protective of human health and the environment”? Perhaps say that MNR of stable deposits will contribute to protectiveness by controlling potential sources.

Response: The RP has been revised.

e. Statement “Alternative 3 (Removal) would provide protection of human health and the environment by removing approximately 5,000 cy of sediment from SMA 2-3,” This literally states that mass removal equates to protecting human health and the environment. The language surrounding “protectiveness” and what constitutes that criterion needs to be revised throughout this section and related to the RAOs.

Response: The RP has been revised.

60. Section 5.5.1.1 – Short-term Effectiveness.

a. Alternative 1 (MNR). Page 71. The analysis focuses only on the lack of short-term construction impacts. There is no discussion of the actual effectiveness or timeframe of MNR on reducing exposures to human health or the environment. Also there may be differences between the SMAs on time and effectiveness.

Response: The RP has been revised.

b. Alternative 2 does not discuss potential short term effects to workers or the community. In particular, if access for an armored cap required a temporary bridge (like Island MM) or in-channel road (like SMA 1-5) there would need to be river management safety measures. There may also be differences in worker safety between Alternatives 2 and 3, and between cap types. Finally, there may be some increase in truck traffic to bring in cap materials.

Response: The RP has been revised.
c. Alternative 3 – In the 1st sentence of the 2nd paragraph insert “always” between “not” and “effective.” The ability to reach low residuals with dredging depends on the debris and the ability to cut into a cleaner layer. These factors relative to the SMAs should be discussed. Some SMAs seem more amenable to a modified cut depth. There is no discussion of expected residuals from dry excavation. There is no discussion of short-term effects of water management for either wet or dry removal. Also, there would need to be river management safety measures during the work.

   **Response:** The RP has been revised.

61. Section 5.5.1.1 – Long-term Effectiveness – For both MNR and capping, the SEDA will further inform our understanding of the alternative’s likely long-term stability. For both, it is likely that event-driven monitoring will be required. Institutional controls are mentioned for MNR – they will also be needed for caps.

   **Response:** The RP has been revised.

62. Section 5.5.1.3 - Cost. Page 74. Dow has estimated the 30 year cost of MNA monitoring at an individual SMA to be $30,000. This seems to be low – especially if chemical monitoring is required to document the effectiveness of MNA.

   **Response:** The cost estimate is for MNR monitoring at an individual SMA includes bathymetric surveys and analyses of sediment chemistry on a 5-year cycle. The $30,000 cost is a present value calculation over 30 years.

63. Section 5.6 – Effectiveness – This introduction section notes that “evaluations of banks relative to direct human contact will be made in the Response Proposal to be developed in the future for the Tittabawassee River floodplain.” This needs to be expanded to include all other relevant pathways (e.g., ecological risk).

   **Response:** The RP has been revised.

64. Section 5.6.1 – Effectiveness, Protection of Human Health and the Environment. The discussion in this section should link more clearly to the RAOs – how does the reduction of eroding contaminated bank soil contribute to the overall goals. This section is problematic because it does not evaluate the remedies against the “protectiveness” criterion which was defined as the “ability of an alternative to eliminate, reduce, or control potential exposures to contaminants in both the short and long term.” To compare alternatives, the relative ability to achieve this criterion should be described. Based on the current text, there is nothing to distinguish the ability of alts 1-4 to provide protectiveness. At the same time, information is provided that is more relevant to other criteria. For example, Alternatives 3 and 4 both discuss access and site preparation here – that discussion is more appropriate for short-term effectiveness.

   **Response:** The RP has been revised.
65. Section 5.6.1 – Effectiveness, Long-term Effectiveness and Permanence
   a. The text doesn’t present performance of the remedies per the description of long-term
effectiveness and permanence in Section 5.4.1: “Evaluates the alternative for the
long-term effectiveness and permanence with respect to the ability to achieve RAOs.
Factors considered under this criterion include the magnitude of residual risk
remaining after implementation.” For example, there is no discussion in here about
reducing TEQ transport to the river (the RAO).

   **Response:** The RP has been revised.

   b. As discussed above, there are other mechanisms from bioengineered bank stability
measures in addition to root structure and depth.

   **Response:** The RP has been revised.

   c. Institutional control would help ensure the long-term effectiveness of the stabilization
alternatives.

   **Response:** The RP has been revised.

66. Section 6
   a. The introductory paragraph cites an EPA 1988 guidance, it should probably be 2002.

   **Response:** The RP has been revised.

   b. Section 6.1, principle #2 – Include two additional sub-bullets: “EPA opened a local
field office in Saginaw, which is highly unusual, to better serve the community. The
EPA field office participates in numerous outreach activities.” And “EPA provides
grant money to the Michigan Department of Community Health to support education
outreach to the communities about the fish consumption advisories.”

   **Response:** The RP has been revised.

   c. Section 6.1, principle #3 – Add that MDEQ is a signatory and active participant in the
2010 AOC. Add that the Trustees have been actively participating in all aspects of
the site.

   **Response:** The RP has been revised.

   d. Section 6.1, principle #4 – Add that a SEDA that will further evaluate sediment
stability is currently underway, and that the results will be used to assess whether the
CSM needs to be updated.

   **Response:** The RP has been revised.

   e. Section 6.1, principle #8 – Please consider re-writing as follows: No cleanup levels
have been established in this Response Proposal; instead actions are performance-
Response: The RP has been revised.

f. Section 6.1, principle #9 – Please consider re-writing as follows: Institutional controls, including non-engineered instruments such as administrative and legal controls to minimize the potential for exposure (see Section 5.1, Common Elements 5.5 of the Segment 1 Response Proposal).

Response: The RP has been revised.

g. Section 6.1, principle #10 – Please change “the fewest” in the last line to “limited.”

Response: The RP has been revised.

67. Section 7, References

a. Dow 2010d should be changed to reflect the 2012 submittal of the Reach O report.

Response: The RP has been revised.

b. Please add the Task 2.3 In-Channel Report

Response: The RP has been revised.

c. Please add the Corps bank bioengineering documents discussed in other comments herein.

Response: The RP has been revised.

68. Figure 3-21a, 1-Day Average Maximum Predicted Active Bed Depth – To appropriately convey the maximum scour depth, the maximum predicted scour depth should be reported, not a 1-day average of those values.

Response: No change to the RP. Averaging over a one day period was done to eliminate artificial changes in elevation within the model. Daily-average flow rates are used to drive the hydrodynamic model, which means that the appropriate time period for evaluating the model output is 1 day.

69. Appendix B2


Comment: Please clarify, what is meant by "based on". Were the EPA and Creel methods directly applied, or were they modified, and if so, how?
Response: No change to the RP. The guidance in the documents USEPA (1989) and Creel et al (1998) was directly applied to biological scoring of the benthic macroinvertebrate community. The scoring did not deviate from cited guidance (i.e., they were not modified).

b. Appendix B2, Some of these scores were based on ratios of reference areas
Comment: Why was a ratio used, and how does this affect site comparisons?

Response: The RP has been revised to add a footnote in Section 3.5.1 to address this comment. The ratios were used because this approach is directly from the EPA guidance (EPA, 1989, Page 6-27, Sampling and Analysis Table). Site comparisons were made using the exact EPA designation categories. The ratio provides a standard, systematic, and quantifiable metric of comparison between site observations and reference area observations in accordance with the EPA guidance. All site and reference metrics were enumerated on an individual basis. The ratios were applied after the individual enumerations, according to the EPA guidance, to integrate multiple metrics into a single statement of comparability to the reference. In short, the ratio does not affect the site comparisons; rather, the ratio allows an integrated comparison to the references according to the EPA guidance. For clarification, the DEQ guidance was not based on ratios to reference locations, as the DEQ guidance differs from the EPA guidance. In accordance with the DEQ guidance, site results were directly compared to eco-regional reference locations.

c. Appendix B2, General comments on BI sampling locations
Comment: How were BI sampling locations selected?

Response: No change to the RP. The selection of benthic community assessment locations was discussed in Section 3.5.1 of the Response Proposal. Specifically, it states the following: “The selection of sample locations was based on a two-tiered approach that considered (1) location relative to the Dow MiOps facility and (2) the availability of comparable benthic community habitat.”

d. Appendix B2, General comments on BI metrics
Comment: Metrics should be calculated for each collection method, not pooled. The pooling mixes up quantitative and semi-quantitative results (see table that shows method-specific summaries on page 203).
Comment: What were the criteria for selecting the metrics that were used? For example, why was an oligochete metric not used?

Response: No change to the RP except in Section 3.4.1 where clarity in the metric selection approach was added. Metrics were not pooled and individual metrics were provided in the 2011 Benthic Community Assessment Report. The Segment 2 Response Proposal provided an overview of those results. USEPA and DEQ multimetric scoring approaches were followed and integrated statements of “biological condition status” were made according to the guidance.
A specific oligochaete metric was not selected because there was adequate coverage of the metric categories (richness, community composition, tolerance, and functional feeding) with the 11 metrics already identified as described above, and several of these metrics inherently incorporate consideration of oligochaetes. In fact, proportional oligochaete abundance was utilized via the % dominance metric to identify a location in Segment 1 which indicated potential organic enrichment. The Benthic Community Assessment Report provides a detailed taxonomic listing of the organisms collected, so this information could be used by any reviewer to calculate additional metrics in the future.

e. General comment on BI community assessments.
Comment: How were the BI community assessment results used in the screening process? As presented there are no clear relationships between BI surveys and Segment 2 response actions, potential exposure pathways or potential receptors that may be impacted.
Comment: Why were tissue samples not collected?

Response: No change to the RP. The benthic community assessment results were not used in the screening process. Rather, these results provide quantitative and qualitative insights into the condition of the sediment dwelling community.

Tissue residue data for SCOIs in benthic organisms was not collected because the potential exposures and risks to benthos were addressed through sediment toxicity testing.

70. Appendix C2: For the differential bathymetry plots that show net erosion in excess of 2 ft, the maximum net erosion value in each reach should be given in a table.

Response: No change to the RP. The areal extent of scour in excess of 2 feet, as determined through the differential bathymetry analyses, represents only a small fraction of the overall bed area. We are not typically concerned with maximum elevation changes in these isolated areas unless they coincide with areas where SCOIs and/or PCOIs exist at levels of concern, and these areas were considered and evaluated in the RP. As such, a table with isolated areas of scour was not created.

71. Appendix C4, Figures C4.1A – Since CCS caps were placed at Reach J in 2010, please look at EP1 at J-189+50 and J-195+00 and evaluate whether the differential needs to be adjusted to reflect the new baseline formed by the cap.

Response: The RP has been revised.

72. Appendix D1 – Bank Erosion Model

a. Model Description. The bank erosion model used for the assessment is written as:

\[ E = \alpha \ast (U - U_m) \]  

(1)

Where
$E = \text{gross erosion rate [L/T]}$

$\alpha = \text{erosion potential [dimensionless]}$

$U = \text{near-bank velocity [L/T]}$

$U_m = \text{average critical velocity under bank-full condition [L/T]}$

The bank erosion model uses the numerical grid from the OU1 hydrodynamic and sediment transport models, which have average dimensions of about 50 feet (wide) by 330 feet (long). The grid cells immediately adjacent to the shorelines of the river are used to define the near bank velocity in most cases (exceptions are not well described, but are said to be about 5 percent of the cases).

The critical velocity $U_m$ was assumed to be the mean cross sectional velocity at a “bankfull” discharge, which was established as a 6000 cfs discharge at the upstream end of the study reach. This condition resulted in a critical velocity of 2 to 3 fps except for three bends where it approached 4 fps.

The bank erosion model was calibrated to gross erosion rates computed from bank pin data for the period between November 2008 and November 2009. The erosion potential $\alpha$ from Equation 1 was adjusted during model calibration such that the predicted gross erosion rates matched those estimated from the bank pins. The resulting values for erosion potential were compared with Bank Erosion Hazard Index (BEHI) values, and a relationship between BEHI and erosion potential was established.

The bank erosion model was validated against the long-term erosion rates estimated from tree root data using the measured length of root exposure and estimates of duration of exposure to compute a gross erosion rate estimate. These were then compared on the basis of BEHI values and computed erosion rates for a 10-year simulation.

The bank erosion model was used to compute the total solids load ($W_{\text{solids}}$) that enters the river during bank erosion events, as the product of the erosion rate ($E$), bank height ($H$), bank length ($L$), and the density of the bank solids ($P$), as depicted below:

$$W_{\text{solids}} = E \times H \times L \times P$$  \hspace{1cm} (2)

where:
- $H = \text{bank height [L]}$
- $L = \text{bank length [L]}$
- $P = \text{bank dry density [M/L}^3\text{]}$

The long-term simulation results from the OU1 hydrodynamic model from 1988 through 2009 were run through the bank erosion model to produce a time series of bank solids loads to the river. These loads were then used to estimate an annual average bank solids load for each model grid cell.

Annual bank TEQ loads were estimated by multiplying the annual solids loads (on a grid cell basis) by the associated layer-weighted average (LWA) TEQ concentration ($C$) assigned to that cell:

$$W_{\text{TEQ}} = W_{\text{solids}} \times C$$  \hspace{1cm} (3)
where:
\[ WTEQ = \text{bank TEQ load} \, [\text{M/T}] \]
\[ C = \text{bank TEQ concentration} \, [\text{M/M}] \]

**Response:** Comment noted. No change to the RP.

b. **Comments on Model Construct.** The general model construct is straight-forward, based on a simple mass balance analysis, and for the most part utilizes reasonable variables. The authors point out that bank retreat occurs due to several processes and the equation addresses only fluvial entrainment in principle while ignoring other contributions (e.g. bank failure, freeze thaw loss, etc.). This may be a reasonable assumption for the Tittabawassee River; a geomorphic assessment would be required to determine the relative contribution to retreat from various mechanisms and no such assessment is reported.

The use of an excess velocity \((U - U_m)\) as a fundamental basis for establishing erosion potential might be fairly criticized; most erosion models utilize excess shear stress or, less commonly, excess stream power or turbulence intensity as a basis in cases where fluvial entrainment is the primary mechanism for erosion. In addition, erosion almost certainly is not linearly related to velocity as Equation 1 suggests.

The assumption that “bankfull” discharge serves as a basis for establishing a “critical” velocity, \((U_m)\) has little basis in principle. Critical velocities would be expected to vary with the soil properties of the banks along with other bank strength characteristics. Erosion likely occurs at points along the channel at discharges well below bankfull, and the model ignores these contributions except for some accommodation through the model parameterization.

Dominant discharge theory establishes that channel geometry adjusts to a constant discharge value equivalent to a bankfull discharge (or more properly to an effective discharge) and it might be argued that the associated velocity is somehow also relevant to the channel geometry and, hence, stability of the banks. In this case, two alternative calibrations were conducted using 8,000 cfs and 10,000 cfs as the bank-full flow conditions (to define the critical velocity). The resulting changes in erosion rate predictions were reported to be minor, suggesting that erosion rates are not well correlated to bankfull discharge.

The combined effects of the assumptions related to the model form on predictions of sediment loading from the banks are uncertain. The use of a calibration parameter \((\alpha)\) serves to minimize weaknesses in the model fundamentals, but can limit the utility off the model in forecasting or evaluating alternative scenarios where conditions deviate from those used for the calibration. Comments on calibration, validation and the model application are presented below.

**Response:** The RP has been revised, as needed. The comments raised in this section were discussed during a conference call between the Dow and EPA modeling teams. To address many of these comments, text in the RP has been expanded to include
additional details to clarify the rationale for the approach that was employed or the assumption that was made (e.g., model construct, bankfull discharge, model uncertainty).

c. **Comments on Model Application.** The model was calibrated to measured erosion rates as described above. The distribution of bank pins used for calibration may not have been adequate; the majority of the bank pin transects were located in Segments 2 and 4 and no bank pin transects were located in Segment 6 or Segment 7. The report does not address the extent to which conditions varied among the segments and it might be that the data obtained from the bank pins can be extrapolated to other areas. This should be addressed.

Erosion rates for a one-year period (November 2008 and November 2009) were used for model calibration. The report does not address whether this period is representative in terms of relevant hydrologic conditions (i.e. the number, timing, duration and rate of change of flows exceeding the “critical” condition) and associated erosion rates. This should be addressed.

Figure A-7 presents a comparison of observed and modeled erosion rates as a function of BEHI class for Segment 2 and 3 and Segment 4 and 5. The model under-predicts erosion rate by an order of magnitude for BEHI class 2 in Segment 4 and 5 and by a factor of 2 for BEHI class 4 in Segment 2 and 3, but otherwise reasonably matches the mean measured erosion rate. The plots include +/- 2 standard error estimates from the models. The report should discuss uncertainty in both the measured and modeled estimates of erosion rate and the implications for model application.

The description of the model validation effort in the report is not clear. The first paragraph implies a fairly detailed validation wherein modeled erosion rates could be compared with “calculated” erosion rates based on the tree root data on a cell-by-cell basis. Instead, Figure A-8 compares model results as a function of BEHI, and only for Reach E-YY. If a more comprehensive assessment was conducted, it should be presented or other discussion is needed to support the assertion that this constitutes a model validation.

Several sources of uncertainty were discussed above, and two other sources merit some discussion in the report. First, the bank heights are not measured but, rather, estimated from the difference between the top and bottom bank elevations where the top elevation is from interpolated LIDAR and the bottom elevation from a bathymetric survey of the river bed adjusted upwards by some (unspecified) constant.

Second, a constant dry density of 1.45 g/cm³ was assumed for the bank solids and used to compute the mass of eroded solids in the model. This value was selected because it was the used for bed sediments and because it fell within the range of values obtained during bank face sampling (0.8 to 1.6 g/cm³). These and the other sources of uncertainty should be evaluated and discussed in the report and, if appropriate, incorporated into the model analyses.
Response: The RP has been revised, as needed. The comments raised in this section were discussed during a conference call between the Dow and EPA modeling teams. To address many of these comments, text in the RP has been expanded to include additional details to clarify the rationale for the approach that was employed or the assumption that was made. In some instances, the modelers agreed that additional evaluations would be performed as part of the routine updating of the model framework.

d. Comments on Model Interpretation. The authors conclude that the contribution of bank erosion to sediment loading and associated TEQ loads and concentrations is minor. However, as the discussion above highlights, the model assessment contains uncertainty that has not been adequately quantified or addressed by the authors. A more direct treatment of the uncertainty, perhaps using a simple Monte Carlo analysis, would go a long way towards substantiating the report conclusions. Additionally, bank erosion rates should continue to be monitored so that the model can be more finely calibrated and more fully verified.

Response: The RP has been revised as needed. The contribution of sediment loads from the banks are relatively minor, however, even though small, the TEQ load from the banks contribute a high % of the TEQ levels in the active bed layer.

e. Appendix D1, Figure D1-7: Why does the erosion rate decrease for BEHI Rank 6?

Response: No change to the RP. The erosion rate for BEHI rank 6 banks is due to the excess velocity term (U-Um) in these areas. It should be noted that only a handful of BEHI 6 banks exist in the river (and none have bank pins).

f. Were dry density measurements taken from the 2012 samples at Reach N? If so, how do those measurements compare with the dry densities cited here?

Response: The RP has been revised.

73. Appendix D2 – TEQ Transport Model

a. Pg D2-2: What time step is used in solving Eqs. D2-1 and D2-2?

Response: No change to the RP. A 7.5 minute time step was used for all years except 2009, where a 6 minute time step was used to ensure model stability.

b. Section 2, D2-3: "It was assumed that sediment particles released into the river via bank erosion immediately settle onto the sediment bed. In addition, it was assumed that the TEQ load from bank erosion is instantaneously mixed into the Active Bed Layer after deposition." Comment: How critical is this assumption? Since bank erosion occurs during high flow events only (> 6000 cfs), it would seem that the river would have enough transport capacity to carry bank erosion particulates as either suspended or bed load. Also, mixing the bank material into the active layer would
seem to decrease the source concentration compared to what it would be if it were released directly into the water column.

**Response:** The RP has been revised.

c. Pg D2-4, 1st para: Why was such a large, i.e., 0.5 mile, size used for the grid sizes? Was a sensitivity analysis performed to determine the maximum size that could be used before the results were significantly impacted?

**Response:** The RP has been revised.

d. Figures D2-8a through D2-8c – please provide similar figures without the 5-year moving average applied to the model results.

**Response:** The RP has been revised.

e. The model simulates 1988 – 2009. What was the magnitude of flows for this simulated period? Does it include a sufficient number of high energy/flow events?

**Response:** The RP has been revised.

f. The model uses a 15 cm (less than 6 inches) active bed depth which is not supported by the bed pin data collected from Segment 2 (see Figure 1). The empirical bed pin data from Segment 2 shows an active bed depth that ranges up to 30 inches (as determined by observation of the maximum differential at individual bed pin locations) with relatively few observations of measured active bed that is less than six inches (only 16 of 72 observations are less than six inches). Has a sensitivity analysis been conducted on the use of 15 cm active bed (and the other assigned layer thicknesses)?

**Response:** The RP has been revised.

g. The model treats the contamination like it is attached to the sand. If in reality, the bulk of the contamination is present as lower density particles that are mixed in with the sand, how would this affect the model results?

**Response:** No change to the RP. This comment will be discussed between the Dow and EPA modeling teams separate from the Segment 2 RP.

74. Appendix E, Table E-1: Bank Stabilization Case Studies – Comment: The information in this table does not provide a sufficient level of detail or clarity for the reader to fully understand the methods used, how they relate to possible actions in the Tittabawassee River, or the degree of success achieved at the case study location. Also, any evaluation of success needs to be based on clear metrics. Rather than a table with lists of treatments and equipment, a brief narrative (e.g., one paragraph to one page) for each case study that describes clearly how banks were treated, how the treatments were evaluated and what challenges or successes were observed would be much more useful and informative.
**Response:** Appendix E is intended to provide a list of additional examples from other sites where similar bank stabilization process options have been utilized. Appendix E was not intended to provide a sufficient level of detail or clarity for the reader to fully understand the methods used, how they relate to possible actions in the Tittabawassee River, or the degree of success achieved at the study location. To clarify this point, Appendix E has been renamed Bank Treatment Examples.

75. Appendix F and Section 5.4.2
   
a. Overall, Sections 5.4.2 and Appendix F contain a good baseline qualitative analysis of Green Remediation components for the proposed remedial options for Segment 2 SMAs and BMAs. However, the qualitative nature of this analysis does not provide an analysis on how each remedial option could be managed to incorporate green remediation principles. Instead what is described is a subjective analysis that places a near- and long-term “score” as to what technology is more sustainable in its current state with possible modifications offered on some options to make them more sustainable. This approach differs from the approach described in the EPA guidance documents issued on green remediation, including options for a quantitative analysis of the remedial options.

   As stated in the U.S. EPA’s August 2009 document, “Principles for Greener Cleanups,” the intention of the greener cleanup approach is to “improve the decision-making process for cleanup activities in a way that ensures the protection of human health and the environmental and reduces environmental impacts on communities. These approaches can include environmental footprint assessment, resource efficiency, best management practices, and technology innovation.” Also stated in this document is, “all cleanup approaches, and all elements of the cleanup process can be optimized to enhance their overall environmental outcome; therefore, green remediation involves more than merely adopting a specific technology or technique.”

   There are several ways to modify this section of the response proposal that would better inform about possible greener approaches to cleanup when analyzing any of these remedial options. Following are a few suggestions that could replace the qualitative analysis that is described in Section 5.4.2 and included in the tables in Appendix F:

   - Provide a brief explanation in the Response Proposal as to the intention to do a quantitative analysis, such as an environmental footprint analysis, once a remedial option is chosen (method outlined in U.S. EPA’s Methodology for Understanding and Reducing a Projects Environmental Footprint (February 2012);

      **Response:** Per direction from the Agencies, the effort to include a quantitative analysis for “green remediation” was intended to be conducted during the project design phase. The RP has been revised to provide more clarity. During subsequent Response Proposals, these efforts will also be incorporated into the alternatives evaluation process.
• Provide a brief explanation in the Response Proposal as to the intention to do an analysis of best management practices once a remedial option is chosen that would be followed to reduce the project’s overall environmental footprint in the five core elements;
  o Materials Management and Waste Reduction
  o Water Use and Impacts to Water Resources
  o Total Energy Use and Renewable Energy Use
  o Air Pollutants and Greenhouse Gas Emissions
  o Land Management and Ecosystems Protection.

Response: The RP has been revised.

• Describe the greener cleanup approach in the context of the criteria evaluation for each of the SMA and BMA alternatives. For example, the discussion that is included in the “Description of Sustainable Component Result” in the tables for Appendix F can be included under the discussion of Effectiveness, Implementability and/or Cost, where appropriate and relevant; or

Response: The RP has been revised, however the criteria evaluation will be conducted during design.

• Complete a full quantitative analysis for each of the remedial options by conducting an environmental footprint analysis (method outlined in the U.S. EPA’s Methodology for Understanding and Reducing a Projects Environmental Footprint (February 2012)) or a life cycle assessment (method outlined in the U.S. EPA’s Life Cycle Assessment: Principles and Practice (May 2006)).

Response: The full quantitative analysis will be completed during project design.

b. Section 5.4.2 states that there is a more detailed description of the identified core elements in Appendix F. In the Appendix F narrative, the core elements are restated in the paragraph, but there is no discussion of the core elements and what they represent. Please include detailed description.

Response: The RP has been revised.

c. The following core elements identified in Section 5.4.2 are not consistent with the core elements identified by U.S. EPA in guidance documents:
  • Sediment/Soil quantity and quality
  • Ecological services
  • Human Services
Sediment/Soil quantity and quality, Ecological Services, and Human Services could substitute for the U.S. EPA’s core element of Land Management and Ecosystems Protection, and a discussion would need to elaborate how these elements are similar.

- **Cost**

Cost should not be an element that is evaluated since Cost is included in the criteria evaluation for the alternatives.

Finally, the Materials Management and Waste Reduction core element is missing in this analysis or Dow equivalent not made apparent. Please include this core element or provide clarification as to where it is included.

**Response:** The RP has been revised. Appendix F was modified to align with EPA's 2012 guidance document.

**Referenced Documents**

- [EPA Principles for Greener Cleanups (August 2009)](#)
- [EPA Methodology for Understanding and Reducing a Project’s Environmental Footprint (February 2012)](#)
- [EPA Life Cycle Assessment: Principles and Practice](#)

76. Appendix G

a. SMA MNR Alternatives, Tables G-2 – Monitoring may need to be more frequent than once every five years. Please add a footnote that discusses potential additional cost if monitoring were twice as frequent.

**Response:** The RP has been revised.

b. SMA Alternatives for CCS, Tables G-3, G-7, G-11 – The footnote for each of these tables says that a 20% construction contingency is used, while the table reflects 12%. Do the costs include anticipated armor stone? Why is the cost for CCS installation $1.20 per SF in Table G-3 vs. $1.00 per SF in Tables G-7 and G-11?

**Response:** The RP has been revised. Differences in unit costs reflect the varying instillation conditions at the SMAs.

c. SMA Removal Alternatives, Tables G-5, G-6, G-9, G-10, G-13, G-14 – The footnote for O & M is not needed. Also, the later footnote numbers don’t align with the table because there is no footnote for H & S. Are there any costs for log or debris management that are not included in other costs?

**Response:** The RP has been revised.
d. Tables G-15 through G-18 – Add to the heading that these costs apply to BMAs. The cost per tree removed is $500 in G-17 and $400 in G-15 – is that because of a discount related to more trees removed? Should at risk tree management also be included in G-16?

Response: The RP has been revised.

C. Minor Comments
The following comments would not require revision, but may be worthwhile to address since other comments require document revision.

77. Consistent acronym usage – please do a global search for cellular containment/confine system and for contaminant/constituent of interest.

Response: The RP has been revised.

78. Pg 3, Sec 2.2, 1st para: The 100-year floodplain is not shown in Figure 2-2.

Response: The RP has been revised.

79. Pg 4, Sec 2.3, 3rd para, 4th line Delete the ‘of’ after ‘with’.

Response: The RP has been revised.

80. Pg 5, Sec 2.3, 4th para, 1st line Change ‘asthe’ to ‘as the’.

Response: The RP has been revised.

81. Pg 6, Sec 2.5, 2nd para Change ‘in channel’ to ‘in-channel’.

Response: The RP has been revised.

82. Section 2.6, page 7 – This section refers to a Figure 2.3, which was not included in the figures. The remaining figure descriptions in the text do not match the figure numbers. Please include Figure 2-3 or:
   a. Pg 7, Sec 2.6, 3rd para, 4th line Change ‘Figure 2-4’ to ‘Figure 2-3’.

Response: The RP has been revised.

b. Pg 9, Sec 2.7.3, 5th line Change ‘Figure 2-5’ to ‘Figure 2-4’.

Response: The RP has been revised.

c. Pg 10, Sec 2.7.3.1, last sentence Change ‘Figure 2-6’ to ‘Figure 2-5’.

Response: The RP has been revised.
83. Section 2.7.2.1 – It might be useful to add the date of Reach B work to the heading, similar to the other sections that follow.

**Response:** The RP has been revised.

84. Section 2.7.3 – The ordering of the previous actions is confusing. The prior Segment 2 actions could be ordered by bank vs. sediment responses, chronologically, or up to downstream (or a combination of these). The organization here seems to follow no logic. Also, the dates in the Reach D heading don’t match the text.

**Response:** The RP has been revised.

85. Section 3.2.2.1, Pg 20, 1st para, 4th line Delete ‘from’ between ‘collected’ and ‘at’.

**Response:** The RP has been revised.

86. Section 3.2.2.2, Pg 23, 1st para, 2nd line Insert ‘in’ between ‘presented’ and ‘Figure 3-11’.

**Response:** The RP has been revised.

87. Section 3.3.1, 1st paragraph – This section lists an EPA reference from 2012, but no such reference is included in the Reference section. Is this intended to be the SEDA guidance? If so, that is an Army Corps of Engineer reference from Aug 2012. Also the EPA 2005 reference should probably be to 2005a.

**Response:** The RP has been revised.

88. Section 3.3.1.1 – The 2nd full paragraph on page 26 refers twice to Figure 3-12. The correct figure is 3-15.

**Response:** The RP has been revised.
89. Pg 30, Sec 3.3.2, next to last para: Change ‘affects erosion of suspended sediment’ to ‘affects erosion of deposited sediment’.

**Response:** The RP has been revised.

90. Section 3.3.5, page 33, last para, 6th line Change ‘is not’ to “are not.”

**Response:** The RP has been revised.

91. Section 3.6 – Use the following NCP reference “40 C.F.R §300.415(b)(2).”

**Response:** The RP has been revised.

92. Figures 2-4, 2-6 and 2-8 – Might it make sense to depict the Reach M and O bank work with similar shapes? The rectangles currently used to depict O make it seem more like J/K. Also, does it make sense to show the areas along the Reach O bank that were addressed by the in-channel work?

**Response:** The RP has been revised.

93. Figure 2-9 – Add “Reach K” to the figure title. Also, this refers to the work at J as a “Capping Pilot Study” and the work at K as a “CCS” – these could imply different activities.

**Response:** The RP has been revised.

94. Figure 3-7 – Why are PAHs included in the legend when they are not depicted in the figure?

**Response:** The RP has been revised.