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June 12, 2017

Mr. Dean Tagliaferro
EPA Project Coordinator
U.S. Environmental Protection Agency
c/o Avatar Environmental
10 Lyman Street, Suite 2
Pittsfield, MA 01201

Re: GE-Pittsfield/Housatonic River Site
Rest of River (GECD850)
Baseline Monitoring Plan

Dear Mr. Tagliaferro:

In accordance with Section II.H.1.c of the Modified RCRA Permit issued by the U.S. Environmental Protection Agency (EPA) to the General Electric Company (GE) on October 24, 2016, EPA's Revised Notice of Uncontested and Severable Permit Conditions dated January 9, 2017, and GE's *Rest of River Initial Statement of Work* submitted on May 12, 2017, enclosed is GE's *Baseline Monitoring Plan* for the Rest of River. This plan addresses the requirements in Section II.B.4.b.(1)(a) of the Modified Permit and describes GE's plans for baseline monitoring of the surface water, biota, and surface sediments in the Rest of River.

Please let me know if you have any questions or would like to discuss this Baseline Monitoring Plan.

Very truly yours,

Andrew T. Silfer, P.E.
GE Project Coordinator

Enclosure

cc: Tim Conway, EPA
Christopher Ferry, ASRC Primus
Scott Campbell, Avatar (2 hard copies)

Michael Gorski, MassDEP
Mark Tisa, MassDFG
Susan Peterson, CT DEEP (1 hard copy)
Rod McLaren, GE
Kevin Mooney, GE
Michael Werth, Anchor QEA
James Bieke, Sidley Austin
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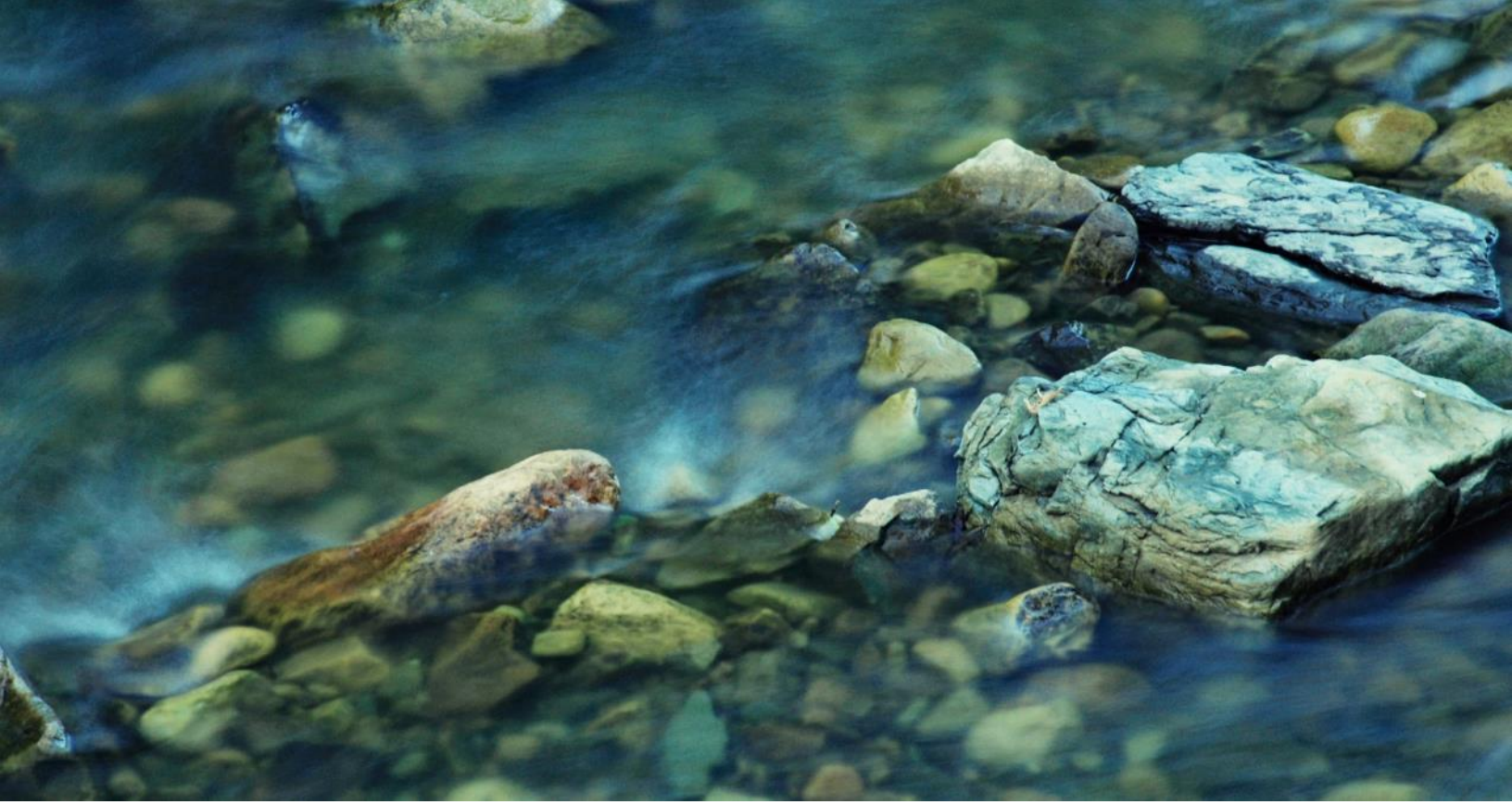

June 2017
Housatonic River – Rest of River

ANCHOR QEA

Baseline Monitoring Plan

Prepared for General Electric Company

June 2017
Housatonic River – Rest of River

Baseline Monitoring Plan

Prepared for
General Electric Company

Prepared by
Anchor QEA, LLC

Project Number: 170469-01.01
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ABBREVIATIONS

ANS	Academy of Natural Sciences of Drexel University
BDSR	Baseline Data Summary Report
BMP	baseline monitoring program
CD	Consent Decree
CDEEP	Connecticut Department of Energy and Environmental Protection
CDEP	Connecticut Department of Environmental Protection (now CDEEP)
COC	chain-of-custody
DGPS	Differential Global Positioning System
DMS	data management system
DO	dissolved oxygen
EAB	Environmental Appeal Board
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FSP/QAPP	Field Sampling Plan/Quality Assurance Project Plan
GE	General Electric Company
ID	identification
Initial SOW	*Rest of River Initial Statement of Work*
mg/kg	milligram per kilogram
mm	millimeter
MNR	monitored natural recovery
ng/L	nanogram per liter
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PRSC	Post-Removal Site Control
RCRA	Resource Conservation and Recovery Act
Revised CMS Report	*Housatonic River – Rest of River, Revised Corrective Measures Study Report*
RFI Report	*RCRA Facility Investigation Report*
QA	quality assurance
QC	quality control
SOP	Standard Operating Procedure
SOW	Statement of Work
TAT	turnaround time
TSS	total suspended solids
USGS	U.S. Geological Survey
VTSR	verified time of sample receipt
WQ	water quality
WWTP	Wastewater Treatment Plant
YOY	young-of-the-year

1 Introduction

1.1 General

Under the Consent Decree (CD) for the GE Pittsfield/Housatonic River Site (EPA/GE 2000), the Rest of River is defined as that portion of the Housatonic River and its backwaters and floodplain (excluding Actual/Potential Lawns as defined in the CD) located downstream of the confluence of the East and West Branches of the Housatonic River (the Confluence) in Pittsfield, Massachusetts. The CD was executed in 1999 by the General Electric Company (GE), the United States, the States of Massachusetts and Connecticut, and other governmental entities and was approved by the federal district court in 2000. It provided performance standards and other requirements relating to the cleanup of GE's facility in Pittsfield, the portion of the Housatonic River between GE's facility and the Confluence, and other adjacent and nearby areas.

For the Rest of River, the CD established a process for the investigation and evaluation of that area and, ultimately, for the U.S. Environmental Protection Agency (EPA) to select a Remedial Action as a modification to a pre-existing Corrective Action Permit under the Resource Conservation and Recovery Act (RCRA), subject to appeal to the EPA Environmental Appeal Board (EAB) and the U.S. Court of Appeals for the First Circuit. EPA issued that permit modification (referred to herein as the Modified Permit), setting forth the selected Remedial Action for the Rest of River, on October 24, 2016 (EPA 2016). GE and several other parties filed petitions for review of the Modified Permit in the EAB.

Paragraph 22.x of the CD requires GE to submit a Statement of Work (SOW) for the implementation of the corrective measures that comprise the Rest of River Remedial Action specified in the Modified Permit. However, most of the provisions of the Modified Permit have been stayed due to the appeals to the EAB, either as contested by those appeals or as non-severable from contested provisions. On January 9, 2017, EPA sent a letter to GE identifying the contested and non-severable conditions that are stayed and the uncontested and severable conditions that are not stayed, which became enforceable conditions of the Modified Permit on January 12, 2017 (EPA 2017). A description of those components that are uncontested and severable and a schedule for submission of work plans or other deliverables relating to the performance of those components was provided in the *Rest of River Initial Statement of Work* (Initial SOW), which was submitted to EPA on May 12, 2017 (Anchor QEA 2017). As required by Section II.H.1.c of the Modified Permit and provided in the Initial SOW, a Baseline Monitoring Plan, which is one of those uncontested and severable components, is due within 30 days after submittal of the Initial SOW. This document constitutes that plan.

This Baseline Monitoring Plan is submitted, pursuant to Section II.H.1.c of the Modified Permit and Section 3.2 of the Initial SOW, to address the requirements in Section II.B.4.b.(1)(a) of the Modified

Permit. That section of the Modified Permit provides that "PCB data in surface water, sediment, and biota (and other data) shall be collected to serve as a baseline for the evaluation of the potential impacts of the Corrective Measures and project operations as well as to inform model parameterization in the model re-evaluation plan." Further, Section II.B.4.b.(2) of the Modified Permit states that "[f]or areas where MNR [monitored natural recovery] is the Performance Standard, monitoring shall begin with baseline monitoring and shall continue throughout the Remedial Action and Operation and Maintenance." Therefore, consistent with Section 3.2 of the Initial SOW, this Baseline Monitoring Plan describes the objectives of the baseline monitoring program (BMP), provides a summary of data collected historically that were used to inform the BMP design, and describes the monitoring activities that will be performed to document baseline polychlorinated biphenyl (PCB) concentrations in the Rest of River. The monitoring described herein will be implemented in accordance with the sampling and analytical procedures set forth in the Rest of River Field Sampling Plan/Quality Assurance Project Plan (FSP/QAPP), which will be submitted to EPA, as provided in the Initial SOW, within 2 months after EPA approval of the Initial SOW.

1.2 Rest of River Setting

The Rest of River area consists of the portion of the Housatonic River and its backwaters and floodplain (excluding certain residential properties) downstream of the Confluence (located approximately 2 miles downstream from the GE facility in Pittsfield, Massachusetts). The entire Rest of River area is shown on Figure 1-1 and identified according to river reach designations established by EPA. Subreaches within Reaches 5 through 8 are shown on Figure 1-2. The Rest of River reaches and subreaches are as follows (listed from upstream to downstream):

- Reach 5, from the Confluence downstream to Woods Pond (the first significant impoundment). This reach is further divided into the following subreaches:
  - Reach 5A (from the Confluence to the Pittsfield Wastewater Treatment Plant [WWTP])
  - Reach 5B (from the Pittsfield WWTP to Roaring Brook)
  - Reach 5C (from Roaring Brook to the start of Woods Pond)
  - Reach 5 also contains several backwater areas adjacent to the Housatonic River, particularly in the more downstream portion of the reach (these backwaters are sometimes referred to as Reach 5D)
- Reach 6, Woods Pond
- Reach 7, Woods Pond Dam to Rising Pond (the next significant impoundment). This reach is further divided into the following subreaches:
  - Reach 7A, Woods Pond Dam to Columbia Mill Dam Impoundment
  - Reach 7B, Columbia Mill Dam Impoundment
  - Reach 7C, Former Eagle Mill Dam Impoundment
  - Reach 7D, Former Eagle Mill Dam to Willow Mill Dam Impoundment

  - Reach 7E, Willow Mill Dam Impoundment
  - Reach 7F, Willow Mill Dam to Glendale Dam Impoundment
  - Reach 7G, Glendale Dam Impoundment
  - Reach 7H, Glendale Dam to Rising Pond
- Reach 8, Rising Pond
- Reach 9, Rising Pond Dam to the Massachusetts/Connecticut border
- Reach 10, Massachusetts/Connecticut border to Falls Village Dam
- Reach 11, Falls Village Dam to Cornwall Bridge
- Reach 12, Cornwall Bridge to Bulls Bridge Dam
- Reach 13, Bulls Bridge Dam to Bleachery Dam
- Reach 14, Bleachery Dam to Shepaug Dam (Lake Lillinonah)
- Reach 15, Shepaug Dam to Stevenson Dam (Lake Zoar)
- Reach 16, Stevenson Dam to Lake Housatonic Dam (Lake Housatonic)

Section 2 of the *Housatonic River – Rest of River, Revised Corrective Measures Study Report* (Revised CMS Report; Arcadis et al. 2010) provides a more detailed description of the Rest of River area, including (1) characteristics and landmarks associated with the river reaches, and (2) watershed, river, and floodplain characteristics. It also provides a summary of the nature and extent of PCBs in sediment, surface water, floodplain soil, and biota, as well as a conceptual site model.

1.3 Plan Organization

The remainder of this Baseline Monitoring Plan is organized into the following seven sections:

- Section 2 presents a summary of the applicable Performance Standards and requirements set forth in the Modified Permit.
- Section 3 describes overall objectives for the BMP and provides a summary of the rationale for the program design.
- Section 4 provides a summary of previous and current monitoring of surface water, biota, and sediment, including a summary of the existing PCB data from this prior monitoring.
- Section 5 contains a summary of specific objectives for the monitoring of baseline conditions in each media and presents a description of the proposed baseline monitoring activities, including sampling locations, procedures, and frequency.
- Section 6 provides a description of field documentation and data management procedures.

- Section 7 provides a description of how the BMP data collection activities and analytical results will be reported.
- Section 8 describes the schedule for performance of baseline monitoring activities and reporting.

2 Summary of Applicable Performance Standards and Requirements

Section II.B.1 of the Modified Permit sets forth the General Performance Standards for the Rest of River remedy. These include a Downstream Transport Performance Standard and Biota Performance Standards.

The Downstream Transport Performance Standard, specified in Section II.B.1.a.(1) of the Modified Permit, establishes annual average PCB flux values for transport of PCBs over Woods Pond Dam and Rising Pond Dam, depending on the annual average daily flow rates at those locations. It provides that an exceedance of the standard will occur if the annual average PCB flux is greater than the specified value(s) at either Woods Pond or Rising Pond in any 3 or more years within any 5-year period following completion of construction-related activities.[1]

There are two Biota Performance Standards, which are specified in Section II.B.1.b.(1)(a). The first is a Short-Term Biota Standard, which is an average total PCB concentration of 1.5 milligrams per kilogram (mg/kg) wet weight, skin off, in adult fish fillets in each entire reach of the river and backwaters, to be achieved within 15 years of completion of construction-related activities for that reach (or, if the reach is subject to MNR, completion of construction in the closest upstream reach subject to active remediation). An exceedance of this standard is defined as concentrations above this level in any two consecutive monitoring periods after the 15-year period. The Long-Term Biota Standard consists of a requirement to continue to monitor biota to assess "progress towards achieving" specified long-term goals (average total PCB concentrations of 0.064 mg/kg, wet weight, in fish fillets in Massachusetts; 0.00018 mg/kg, wet weight, in fish fillets in Connecticut; and 0.075 mg/kg in duck breast tissue in all areas along the river).

In consideration of these standards, which apply following completion of remedial construction activities, the BMP design has accounted for the types of data that would be needed to help evaluate the parameters subject to these standards prior to, during, and following construction. The BMP design has also considered the requirement of Section II.B.4.b.(2), which states that, for areas subject to active remediation, an inspection, monitoring, and maintenance program must be conducted upon completion of each phase of the Remedial Action. The baseline data collected under the BMP will provide a basis for comparison in that post-construction monitoring program.

In addition, the Modified Permit establishes MNR as the Performance Standard for the flowing subreaches in Reach 7 (Reaches 7A, 7D, 7F, and 7H) and for Reaches 9 through 16 (Section II.B.2.h). It provides, in Section II.B.4.b.(2), that, "[f]or areas where MNR is the Performance Standard, monitoring

[1] The provisions of this standard and the Short-Term Biota Standard described below regarding the actions to be taken in the event of an exceedance have been contested in the EAB and are currently stayed.

shall begin with baseline monitoring and shall continue throughout the Remedial Action and Operation and Maintenance." Further, Section II.B.2.h provides that, "[t]o achieve and maintain this Performance Standard, GE shall conduct monitoring of PCB concentrations in affected media (including surface water, sediment, and biota) in these Reaches to see if recovery is occurring at the expected rate, maintain institutional controls, and perform all other related activities." Therefore, design of the BMP has considered factors such as data comparability over a long-term record to facilitate future evaluations of natural recovery.

3 Baseline Monitoring Program Objectives and Design

3.1 Programmatic Objectives

Based on the requirements for Inspection, Monitoring, and Maintenance set forth in Section II.B.4 of the Modified Permit, the following programmatic objectives have been established for the BMP:

1. Collect data to support future evaluations of the impacts of the Remedial Action on the Rest of River, both during and after implementation of the remedy.
2. Collect data to evaluate the effectiveness of MNR in those areas of the Rest of River where MNR is the Performance Standard.
3. Provide data to establish baseline conditions to assist in post-construction assessments of the General Performance Standards described in Section II.B.1 of the Modified Permit (and summarized in Section 2 above)—specifically, the Downstream Transport Performance Standard and the Biota Performance Standards.
4. Collect data "[t]o inform model parameterization in the model re-evaluation plan" (as provided in Section II.B.4.b.(1)(a)), as necessary.[2]

More specific objectives for monitoring of baseline conditions in each of the various media are provided in Section 5.

3.2 Rationale for Baseline Monitoring Program Design

Assessing remedy impacts/effectiveness, including MNR (in applicable reaches), as described under programmatic objectives 1 and 2, requires monitoring of pre-remedy (i.e., baseline) PCB concentrations. The Modified Permit defines MNR as "a remedy for contaminated sediment that typically uses ongoing, naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment, and requires monitoring the natural processes and/or concentrations of contaminants in surface water, sediment, or biota to see if recovery is occurring at the expected rate." As such, evaluation of the rate of recovery will require characterization of current, or baseline, PCB concentrations, in conjunction with collection of data to document future PCB concentrations.

The relevant Performance Standards described under programmatic objective 3 relate only to post-remedy conditions. Therefore, achievement of these standards will be established solely using post-remedy monitoring data; that is, baseline data are not necessary. However, baseline data combined with longer-term trend analysis may be useful to assist in post-construction assessments

[2] Although the Modified Permit identifies the need for a Model Reevaluation Plan (Section II.H.2.16), it is not possible at this time to identify specific objectives for that plan that would require baseline sampling.

of the relationship between PCB fluxes or fish concentrations and the Performance Standards or long-term goals.

In addition to collection of data to meet the programmatic objectives described in Section 3.1, design of this BMP also considers the following:

- GE, EPA, and the States of Massachusetts and Connecticut have collected numerous data sets measuring PCB concentrations in surface water, sediment, and biota over the last several decades. Some of these data can be used to support development of baseline conditions for long-term trend analysis. Thus, the design of the BMP for Rest of River has taken past and current monitoring activities and sampling locations into consideration. A description of prior and current sampling activities is provided in Section 4.
- Section II.B.4.b.(1)(b)i of the Modified Permit requires the establishment of measures to assess the adverse impacts of remedial construction activities, such as notification and action levels for PCBs measured in surface water during construction. The design of the BMP has taken into consideration the potential need for characterization of baseline conditions in setting such levels.

4 Summary of Historical Monitoring Data

Extensive sampling of surface water, sediment, and biota within the Housatonic River has been conducted by GE, EPA, the States of Massachusetts and Connecticut, and other parties since the 1970s. This section provides an overview of those data sets, with a focus on those that provide a more recent characterization of conditions at the site, which is most relevant to the design of the BMP.

4.1 Surface Water

4.1.1 Sampling Summary

Numerous surface water investigations have been conducted since the late 1970s to study relevant surface water characteristics as well as the presence, extent, and transport of PCBs and other chemical constituents in the water column of the Housatonic River. Early surface water studies (late 1970s through 1988) were conducted at a few sampling stations spread over large sections of the river, both in Massachusetts and in Connecticut. However, since 1988, surface water sampling investigations have focused primarily on the Massachusetts portion of the river, where PCBs were most routinely detected and found at the highest concentrations. Details regarding these earlier surface water sampling efforts are described in Section 3.2 of the *Housatonic River – Rest of River RCRA Facility Investigation Report* (RFI Report; BBL and QEA 2003).

The most comprehensive and consistent sampling of surface water in the Housatonic River began in 1996. Since that time, GE has conducted monthly monitoring of surface water PCBs (and various other water quality constituents) at as many as 15 locations between Coltsville and Great Barrington in Massachusetts, with most locations occurring upstream of Woods Pond Dam. Since 2000, this monthly surface water sampling program has been, and continues to be, conducted at 10 locations in this stretch of the river. Six of those locations are located in or just upstream of the Rest of River; they are summarized from upstream to downstream in Table 4-1.[3]

[3] The other four sampling locations consist of a station at Hubbard Avenue Bridge, which is a background station upstream of the GE facility, and stations at the Newell Street and Lyman Street Bridges and the Silver Lake Outfall, all of which are located within the 2 miles of the East Branch that were previously remediated. Under the requirements applicable to the latter three areas, sampling is required at these locations as part of the Housatonic River monthly sampling program until that program is discontinued. As noted in Section 5.1.2, by letter dated June 6, 2017, GE has proposed to discontinue that monthly sampling program and replace it, in part, with the surface water BMP described herein. Under that proposal, GE will discontinue sampling at the Hubbard Avenue, Newell Street, and Lyman Street locations, but will continue sampling at the Silver Lake Outfall on a quarterly basis as part of the Post-Removal Site Control program for the Silver Lake Area.

Table 4-1
Summary of Relevant Monthly Surface Water Monitoring Locations

Surface Water Location	Reach	Location Description
Pomeroy/Dawes Avenue Bridge	East Branch	Downstream end of 2 miles subject to previous remedial actions, representative of water flowing into the Rest of River from the East Branch
Holmes Road Bridge	Reach 5A	Approximately 1 mile downstream of Confluence
New Lenox Road Bridge	Reach 5B	Approximate midpoint of Reach 5B
Woods Pond Headwaters	Reach 5C	Approximately 3/4 mile upstream of Woods Pond
Schweitzer Bridge	Reach 6	Approximately 1/4 mile downstream of Woods Pond Dam
Division Street Bridge	Reach 8	Approximately 1¼ miles downstream of Rising Pond Dam

Most of the samples collected during this period were collected during low to moderate flows because higher flows occur during a small fraction of the time and, in some cases, high flows are avoided due to safety concerns. PCBs in surface water samples collected during this period were quantified as Aroclors using EPA Method 8082. The detection limit at all stations was 22 nanograms per liter (ng/L) per Aroclor until May 2007 (following completion of the 1½-Mile Reach remediation), when the detection limit at Pomeroy Avenue was lowered to 5.5 ng/L. The detection limit at the remaining five locations was lowered to this same level beginning in April 2014. These detection limits were used for the samples collected through November 2016. In December 2016, the laboratory previously used by GE for analysis of water samples closed; and the samples collected in December 2016 through February 2017 were sent to a laboratory that was not able to achieve the same low detection limit. In addition, the samples collected in March and April 2017 were archived at the laboratory for potential future PCB analysis, and the May 2017 sampling event was cancelled with EPA concurrence. As noted in Section 5.1.2, GE has proposed to discontinue the Housatonic River monthly sampling program; and as part of that proposal, it proposed to discard the archived samples collected under that program.

In addition to the monthly monitoring of surface water PCBs conducted by GE since 1996, EPA collected surface water samples between 1998 and 2002. This sampling included (but was not limited to) the routine monthly collection of surface water samples for approximately 1 year (1998 to 1999) at eight Rest of River locations, many of which are the same locations monitored by GE. EPA's monitoring program also included collection of surface water samples from the West Branch.

4.1.2 PCB Data Summary

Time series of PCB concentrations observed at the six monthly surface water monitoring locations listed in Table 4-1 from 1996 to 2016 are presented on Figures 4-1a-c. These figures show that there has been a thorough characterization of surface water PCB levels in Reaches 5 through 8 over the

last 20 years. The monthly sampling frequency provides a robust means of quantifying differences in PCB concentrations among sampling stations and demonstrates a relatively strong seasonal pattern in surface water PCB concentrations (i.e., higher PCB concentrations in summer and lower concentrations in winter), particularly at the more downstream locations exhibiting higher PCB concentrations, likely due to temperature effects on release of PCBs from sediment porewater. As such, these data (primarily the more contemporary data collected during the last several years) provide a robust foundation to inform the design of the BMP.

Table 4-2 presents a summary of contemporary PCB concentrations at these six locations over the period from April 2014 through November 2016, which represents the period over which the detection limit was 5.5 ng/L at all stations.

Table 4-2
Summary of Contemporary Surface Water PCB Concentrations

Location	Number of Samples	Surface Water PCB Concentration (ng/L)[a,b]			
		Minimum	Average	Median	Maximum
Pomeroy/Dawes Avenue Bridge	32	ND	24	19	1,400
Holmes Road Bridge	32	ND	31	22	370
New Lenox Road Bridge	32	7.9	100	76	1,040
Woods Pond Headwaters	26	ND	125	120	1,090
Schweitzer Bridge[c]	32	ND	119	106	550
Division Street Bridge	32	ND	48	48	171

Notes:
Statistics shown are based on samples collected between April 2014 and November 2016.
a. Statistics assume half the method detection limit for non-detect samples.
b. Statistical test (Grubb's Test) of the data indicated that the maximum value at each location was a statistical outlier and was, therefore, removed from the data set for the calculation of the average and median.
c. Statistics exclude field duplicates that are routinely collected at this location.
ND: non-detect

The first of these locations (Pomeroy/Dawes Avenue Bridge) is located just upstream of the Rest of River in the East Branch and is representative of PCB concentrations entering the Rest of River from the East Branch. As described in the RFI Report, the West Branch of the Housatonic River also contributes to the PCB mass entering the Rest of River; however, historical monitoring data have shown that contributions from the West Branch are substantially lower than those of the East Branch. As noted in the previous section, no monitoring of West Branch surface water PCBs has been conducted since the early 2000s.

Within the Rest of River, only a small increase is observed in average PCB concentration between Pomeroy Avenue and Holmes Road (i.e., the upstream-most location in the Rest of River); however, the largest increase is observed between Holmes Road and the next downstream station (New Lenox

Road), increasing by a factor of 3 between these two locations. PCB concentrations continue to increase between New Lenox Road and the next downstream location at Woods Pond Headwaters, but then they level off across Woods Pond (as measured at Schweitzer Bridge). PCB concentrations then decrease by a factor of about 2.5 between Schweitzer Bridge and Division Street.

This robust surface water data set provides a foundation upon which to design the BMP and can be used to supplement future data collection to establish baseline conditions in the Rest of River.

4.2 Fish

4.2.1 Sampling Summary

Fish sampling and analysis programs have been conducted on the Housatonic River since the late 1970s. These studies have targeted a range of species and size classes and have used several sample preparation methods and analytical procedures. Fish species representing a range of trophic levels have been collected, including top predators (e.g., largemouth bass in Massachusetts and smallmouth bass and brown trout in Connecticut), mid-level predators (e.g., bluegill, pumpkinseed, and yellow perch), bottom-feeding species (e.g., brown bullhead and white suckers), and small forage fish (e.g., fallfish, golden shiner, and bluntnose minnow). Target size classes have included adult fish, juveniles, and fish in their first year of life, known as "young-of-the-year" (YOY). Sample preparation types have included various fillet types (e.g., skin-on or skin-off), offal (i.e., the remaining carcass after the fillet tissue is removed), ovaries, and individual or composite whole body samples. These various species, trophic levels, and tissue preparations reflect diverse intended uses of the data to support site characterization, risk assessments, and trend evaluation. In addition, a variety of analytical methods have been used; analyses for PCBs have included both Aroclor-based and congener-based methods, depending on the program.

Within the Massachusetts portion of the river, several fish studies were conducted beginning in 1980, as described in Section 6 of the RFI Report. However, the most comprehensive fish sampling effort in this portion of the river was conducted by EPA in 1998 (with additional sampling in 1999 and 2000), as part of the Supplemental Investigation of the Rest of River (Weston 2000). More than 1,000 fish samples were collected in 1998; species collected included yellow perch, pumpkinseed, bluegill, largemouth and smallmouth bass, brown and yellow bullhead, and others. Tissue types included skin-off fillet, offal, and whole body. Sample locations included areas upstream of the Confluence in the East and West Branches, the Confluence to Woods Pond (in Reaches 5A and 5B/5C), Woods Pond, and Rising Pond. Additional fish were collected by GE in 2002, 2008, and 2011 to support continued evaluation of PCB trends in adult fish, including: (1) largemouth bass from Reaches 5B/5C, Woods Pond, and Rising Pond; and (2) yellow perch from Reach 5A (2011 only). Most of these samples were analyzed for PCB congeners; however, some limited analysis for PCB Aroclors was conducted in 1999.

Within the Connecticut portion of the river, fish sampling has primarily been conducted under two programs: one historical program by the Connecticut Department of Environmental Protection (CDEP) (now the Connecticut Department of Energy and Environmental Protection [CDEEP]) between 1977 and 1990, and the other by the Academy of Natural Sciences (ANS) of Drexel University (formerly ANS of Philadelphia), which has been conducting a biennial fish tissue sampling program on behalf of GE from 1984 through 2016. The ANS program has primarily targeted the collection of adult smallmouth bass fillets from the same four locations sampled historically by CDEP (West Cornwall, Bulls Bridge, Lake Lillinonah, and Lake Zoar) and adult brown trout fillets from West Cornwall. Samples collected by ANS have been analyzed for PCB Aroclors for the duration of the program and PCB congeners since 1992.

In addition to the adult fish sampling described above, GE has conducted a biennial YOY fish sampling program in Massachusetts since 1994, with the most recent samples collected in 2014. Whole body composite samples of YOY largemouth bass, yellow perch, bluegill, and pumpkinseed have been collected and analyzed for PCB Aroclors. These samples have been collected at four locations in the Massachusetts portion of the river, including a location between the Pittsfield WWTP and Roaring Brook (station designated "HR2" in Reach 5B), Woods Pond, the Glendale Dam impoundment (i.e., Reach 7G), and a location near the Massachusetts/Connecticut border (station designated "HR6").

4.2.2 PCB Data Summary

4.2.2.1 Adult Fish

Time series of wet-weight and lipid-normalized PCB concentrations in adult fish collected within the Massachusetts portion of the river (beginning with the comprehensive sampling conducted by EPA in 1998, and including the supplemental data sets collected by GE in 2002, 2008, and 2011 described above) are shown on Figures 4-2a and 4-2b, respectively. Prior analysis of data comparability has indicated that the sample sizes, species, and locations in these data sets are generally comparable and, therefore, provide a good basis for evaluating temporal trends over this 13-year timeframe (Arcadis and Anchor QEA 2012). Also, previous analysis of these data sets concluded there are observable decreases in PCB concentration from 1998/2002 to 2011 (in both fillet and reconstituted whole-body concentrations that were calculated from PCB concentrations measured in fillet and offal samples) and these decreases are statistically significant in Reach 5 and Woods Pond (Figure 4-2; Arcadis and Anchor QEA 2012). Together, these data sets showed that fish in the Rest of River were responding to remediation and source control projects completed in the East Branch in the 2000s as well as ongoing natural recovery processes. Average wet-weight total PCB concentrations in the most recent Massachusetts adult fish samples (collected in 2011) are summarized in Table 4-3.

Table 4-3
Summary of 2011 Wet-weight Total PCB Concentrations in Massachusetts Adult Fish Fillets

Location	Species	Number of Samples	Wet-weight PCB Concentration (mg/kg)			
			Minimum	Average	Median	Maximum
Reach 5A	Yellow Perch	15	4.0	5.6	5.2	9.6
Reach 5C	Largemouth Bass	15	2.0	6.2	6.8	10.4
Woods Pond	Largemouth Bass	15	0.9	7.0	7.3	21.2
Rising Pond	Largemouth Bass	15	0.1	3.6	3.4	11.1

These locations and species provide a foundation upon which to design the BMP and supplement future data collection to establish baseline conditions in the Rest of River.

Time series of wet-weight and lipid-normalized PCB concentrations in adult smallmouth bass collected within the Connecticut portion of the river from 1984 to 2014 are shown on Figures 4-3a and 4-3b, respectively. These figures depict a thorough characterization of PCBs in fish over the last 30 years within the large impoundments in Connecticut (West Cornwall, Bulls Bridge, Lake Lillinonah, and Lake Zoar). PCB concentrations in fish in these areas closely track one another and show a decrease in concentration since 1992 and prior years (see ANS 2016; Figure 2). Arithmetic average wet-weight PCB concentrations at these four locations have generally ranged from 0.5 to 2 mg/kg beginning in the mid-1990s. However, fish PCB concentrations observed at West Cornwall and in the Bulls Bridge impoundment are similar to one another and tend to be somewhat higher than those observed at Lake Lillinonah and Lake Zoar, which are located farther downstream and are also similar to one another. A summary of wet-weight total PCB concentrations in the most recent Connecticut adult smallmouth bass samples (collected in 2014) are summarized in Table 4-4.

Table 4-4
Summary of 2014 Wet-weight Adult Smallmouth Bass Total PCB Concentrations in Connecticut

Location	Reach	Number of Samples	Wet-weight Smallmouth Bass PCB Concentration (mg/kg)			
			Minimum	Average	Median	Maximum
West Cornwall	Reach 11	10	0.82	2.0	2.1	3.0
Bulls Bridge	Reach 12	10	0.38	1.5	1.3	3.3
Lake Lillinonah	Reach 14	10	0.30	1.9	0.86	7.1
Lake Zoar	Reach 15	9	0.29	1.9	1.3	4.6

The brown trout data from West Cornwall have likewise shown a decline from 1992 and the preceding years, with mean wet-weight concentrations since that time in the general range of 1 to 2 mg/kg (ANS 2016; Figure 3).

4.2.2.2 Young-of-the-Year Fish

Time series of PCB concentrations in YOY largemouth bass, yellow perch, and bluegill/pumpkinseed collected within the Massachusetts portion of the river from 1994 to 2014 are shown on Figures 4-4a (wet weight) and 4-4b (lipid-normalized). These figures depict a thorough characterization of PCBs in YOY fish for over 20 years at the four YOY sampling locations described above (HR2, Woods Pond, Glendale Dam impoundment, and HR6). These figures show that both wet-weight and lipid-normalized PCB concentrations for all species generally decrease from upstream (HR2) to downstream (HR6) in the Rest of River. Also, while trends in YOY fish PCB data can be confounded by year-to-year variability in environmental conditions, such as hydrologic conditions and water temperature, the YOY fish data show a general decline in PCB concentrations over time. The overall trends and rates of decline observed in the YOY fish are similar to those observed in the adult fish in Massachusetts, as described above.

4.3 Surface Sediment

4.3.1 Sampling Summary

Numerous investigations have been conducted since the mid-1970s to study the presence and extent of PCBs in sediments within the Rest of River. In addition to the historical sediment sampling, EPA conducted the most current and comprehensive sampling of sediments in the Rest of River between 1998 and 2002. This study included systematic and discrete sediment sampling programs along the entire Rest of River as part of EPA's Supplemental Investigation to further delineate the nature and extent of PCBs in sediment and to facilitate EPA's human health and ecological risk assessments and modeling study. Specifically, the systematic sampling consisted of the collection of samples at regular intervals, and the discrete sampling consisted of "random, judgmental, or focused samples collected at distinct locations" to support specific sampling objectives (Weston 2000). Table 4-5 provides a summary of the number of locations where sediment PCB samples were collected as part of this program.

Table 4-5
Number of Sediment Locations Sampled by EPA between 1998 and 2002

	Reach Summary							
	5A	**5B**	**5C**	**6**	**7**	**8**	**9**	**CT**
Number of Locations	357	167	238	106	178	23	53	25
	Reach 7 Subreaches							
	7A	**7B**	**7C**	**7D**	**7E**	**7F**	**7G**	**7H**
Number of Locations	11	15	14	53	12	39	9	25
	CT Reaches							
	10	**11**	**12** (Bulls Bridge Impoundment)	**13**	**14** (Lake Lillinonah)	**15** (Lake Zoar)	**16** (Lake Housatonic)	
Number of Locations	3	5	4	5	1	1	6	

Table 4-5 shows that EPA conducted the most extensive characterization of PCBs in sediments within the Massachusetts portion of the river (particularly within Reaches 5 and 6), where historical sediment sampling showed the highest PCB concentrations. Sampling density was reduced by EPA with increasing distance from the former GE facility in Pittsfield due to the substantial decreases in PCB concentrations with distance, as described in the next subsection.

4.3.2 PCB Data Summary

As described in Section 5, one of the primary objectives behind the collection of baseline sediment data is to facilitate an evaluation of MNR. To meet this objective, collection of sediments under the BMP will focus solely on surface sediments. Summary statistics for PCB concentrations in surface sediments (0 to 6 inches) are shown in Table 4-6 (these statistics are from Table 4-8 in the RFI Report[4]).

[4] One exception is that the PCB statistics for Reach 7, which were presented for the entire reach in Table 4-8 in the RFI Report, have been separated into two groups—impoundments (i.e., subreaches 7B, 7C, 7E, and 7G) and flowing portions (i.e., subreaches 7A, 7D, 7F, and 7H) within Reach 7.

Table 4-6
Summary of Surface Sediment (0 to 6 inches) Total PCB Concentrations

Reach	Surface Sediment PCB Concentration (mg/kg)			
	Minimum	Average	Median	Maximum
Reach 5A	ND	20	11	290
Reach 5B	ND	6.5	3.3	165
Reach 5C	ND	22	6.1	294
Reach 6 (Woods Pond)	ND	32	17	210
Reach 7 (flowing portions)	ND	0.50	0.25	4.7
Reach 7 (impoundments)	ND	5.0	1.2	38
Reach 8 (Rising Pond)	ND	2.7	2.2	11
Reach 9	ND	0.27	0.25	0.73
Connecticut	ND	0.062	0.067	0.47

Table 4-6 shows that the highest average surface sediment PCB concentrations are observed in Reach 5 and Reach 6 (Woods Pond). Considerably lower average PCB levels are observed downstream of Woods Pond Dam, particularly in Reach 7, downstream of Rising Pond Dam in Reach 9, and in Connecticut. Within the portions of the river where MNR is the Performance Standard (i.e., the flowing portions of Reach 7, Reach 9, and the Connecticut reaches), PCB concentrations are the lowest observed within the Rest of River. For example, surface sediment PCB concentrations in Reaches 5 and 6 averaged between approximately 20 and 30 mg/kg, while PCB concentrations in the flowing portions of Reach 7 and in Reach 9 averaged less than 1 mg/kg, and PCB concentrations in the Connecticut reaches of the river (Reaches 10 through 16) averaged less than 0.1 mg/kg.

These data provided a robust characterization of sediment PCB concentrations in the Rest of River and provide a foundation upon which to design the sediment component of the BMP.

5 Baseline Sampling and Analysis

5.1 Surface Water

5.1.1 Media-Specific Objectives

Programmatic objectives for the BMP are specified in Section 3.1. Media-specific objectives for the baseline surface water monitoring include the following:

- Establish baseline surface water PCB concentrations using locations and sampling methods generally consistent with the monitoring approach anticipated to be used during and after construction and in consideration of the following:
  - Measure potential PCB loading entering the Rest of River from the previously remediated East Branch, as well as from the West Branch, to understand their potential contribution to the PCB loads passing Woods Pond Dam and Rising Pond Dam (which ultimately will be subject to the Downstream Transport Performance Standard).
  - Measure PCB loading at the two locations where the Downstream Transport Performance Standard will apply (Woods Pond Dam and Rising Pond Dam).
- Collect data at a frequency sufficient to characterize the anticipated range of river flow rates and seasonal variability in surface water PCB concentrations.
- Provide data to support long-term surface water PCB concentration trend analysis.
- Provide baseline data at some stations that may be used in subsequent evaluation of potential impacts of construction activities in the river on water column PCB concentrations.

5.1.2 Program Design

The baseline surface water monitoring program has been designed to satisfy the programmatic and media-specific objectives presented in Sections 3.1 and 5.1.1. The approach for this program has been developed in consideration of the historical and current sampling methods and locations (described in Section 4.1), as well as the anticipated scope of future monitoring activities both during and after construction. Additional considerations for the design of the baseline surface water monitoring include the physical characteristics of the river at each location, as well as reducing potential health and safety concerns during higher flows and inclement weather. For example, existing surface water monitoring locations that require wading into the river (which can present a potential safety hazard during elevated flow conditions) or sample collection from bridges without sidewalks have been avoided for the BMP.

In general, the baseline sampling program will consist of collecting depth-integrated surface water samples (where water depths permit) or grab samples collected by either manual or automated means, depending on the conditions and data needs at each station. Samples will be collected from

the approximate center of the channel at most stations; however, sampling from one or both shorelines will be performed at some locations. A description of the rationale for selection of each station and a summary of the sampling approach at each are provided in the subsections that follow.

The BMP surface water monitoring has been designed in accordance with the considerations discussed above. It is anticipated that the surface water data collected as part of the BMP will be generally comparable to historical surface water data collected at nearby locations, and therefore, the two datasets can be used in conjunction to assess long-term trends as needed. As BMP data are collected, both datasets will be compared to identify any potential confounding factors that may need to be considered as part of long-term trend analyses.

This baseline surface water monitoring program will replace the pre-existing Housatonic River monthly sampling program, which GE has proposed to discontinue by letter dated June 6, 2017 (GE 2017).[5]

5.1.2.1 Sampling Locations and Approach

As described in Section 4.1, GE has conducted monthly monitoring of surface water PCBs at several locations upstream of and within the Rest of River since 1996. This sampling has provided a thorough characterization of surface water PCBs at these locations and was, therefore, used as a basis of design for the surface water BMP. Table 5-1 lists the locations included in that monitoring program and those to be included as part of the BMP, including the rationale for discontinuation or selection of each location listed (and, for each BMP location, the sampling method to be used and the rationale for it). In summary, surface water samples will be collected at the following locations (listed in upstream to downstream order) as part of the BMP:

- East and West Branches Above Confluence
- New Lenox Road
- Woods Pond Dam
- Rising Pond Dam

Surface water monitoring will not be conducted downstream of Rising Pond Dam. GE's monthly surface water monitoring shows that PCB concentrations decline significantly between Woods Pond and Rising Pond (i.e., by a factor of 2 to 3; see Section 4.1.2). Also, PCB concentrations in other media (sediments and fish) show evidence of substantial declines in PCB concentrations downstream of Rising Pond Dam. This, combined with the large dilution that occurs downstream of Rising Pond

[5] In that letter, GE proposed to discontinue the monthly Housatonic River monthly surface water sampling program and to replace that program with the surface water BMP for the Rest of River. In addition, GE proposed to continue sampling at the Silver Lake Outfall and the Pomeroy Avenue Bridge on a quarterly basis as part of the Post-Removal Site Control (PRSC) programs for the Silver Lake Area and the 1½-Mile Reach, respectively.

Dam, indicates that contemporary surface water PCB levels in this area are likely low. Therefore, it is anticipated that surface water data collected at the downstream-most location at Rising Pond Dam will be an adequate indicator of trends in PCB concentrations farther downstream. Also, the only Performance Standard specified in the Modified Permit for areas downstream of Rising Pond Dam, apart from MNR, is associated with PCB concentrations in fish, which will be monitored throughout the Rest of River (including Connecticut) to assess compliance with the short- and long-term biota standards (see Section 5.2.2). MNR in areas downstream of Rising Pond Dam will be evaluated through both fish and sediment sampling (see Sections 5.2.2 and 5.3.2).

The subsections that follow provide a description of each BMP surface water sampling location, including the rationale for its inclusion in the BMP and the general sampling method to be used, as summarized in Table 5-1 (attached to the end of this plan). Figure 5-1 is a map showing the location of BMP surface water sampling locations, and Figure 5-2 is a series of maps showing more detailed information at each individual location.

5.1.2.1.1 East and West Branches Above Confluence

PCB concentrations at the downstream end of the East Branch (entering the Rest of River) are currently being characterized at the Pomeroy Avenue Bridge as part of GE's monthly monitoring program. There is currently no characterization of surface water PCB levels entering the Rest of River from the West Branch. Therefore, the sampling location at Pomeroy Avenue will be discontinued for the BMP,[6] and two new stations will be established (one on the East Branch and one on the West Branch) adjacent to Fred Garner Park. Surface water samples collected at these stations, located immediately upstream of the Rest of River, will be composited on an equal-volume basis into a single sample to facilitate estimation of baseline PCB loading entering the Rest of River[7] and may be useful for any post-remediation assessment of PCB loads contributing to those measured at Woods Pond Dam. A single sampling station located downstream of the Confluence in Reach 5A is not considered feasible for the BMP both due to access limitations associated with river morphology and because such a station would be located within a Rest of River remediation area. While the river is generally shallow and narrow in this area (which would promote vertical and horizontal mixing), it is anticipated that a mixing zone extending a few hundred feet downstream of the Confluence may be required for water from the two branches to fully mix, depending on flow conditions.

[6] As noted above, GE will continue sampling at the Pomeroy Avenue Bridge on a quarterly basis as part of the PRSC program for the 1½-Mile Reach.

[7] Given the similarity in the size of the watersheds of the East and West Branches, compositing on an equal-volume basis is equivalent to compositing on an equal-flow basis, which is appropriate for long-term characterization of loads.

Additional information for each of the two proposed stations that will be used to form the composite sample is provided below:

- *East Branch*: Surface water samples collected at this location, situated in the East Branch at a point immediately upstream of the Rest of River (Figures 5-1 and 5-2a), will be composited with surface water samples collected from the West Branch (described below) on an equal-volume basis to characterize PCB loads entering the Rest of River from upstream. The river in this area of the East Branch is approximately 50 feet wide with a mixed bottom type and is typically 2 to 3 feet deep under low to moderate flow conditions. Under these conditions, little (if any) variability in PCB concentrations in surface water (vertically or horizontally) is expected. Therefore, the sampling at this location will consist of the collection of a surface grab sample from the west bank of the river, using an extendable pole to collect a sample approximately 20 feet from shore, near the approximate center of the river channel. Collection of a depth-integrated sample is not practical or necessary at this station due to the shallow water depths; therefore, a mid-depth grab sample will be collected.
- *West Branch*: Surface water samples collected at the East Branch station (described above) will be composited with surface water samples collected at the West Branch station, located just upstream of the Confluence (Figures 5-1 and 5-2a). The river in this area of the West Branch is approximately 40 feet wide with a mixed bottom type and is typically 2 to 3 feet deep under low to moderate flow conditions. Consistent with the characteristics described above for the East Branch, little (if any) variability in PCB concentrations in surface water (vertically or horizontally) is expected at this West Branch location. Therefore, the sampling at this station will consist of the collection of a surface grab sample from the east bank of the river, using an extendable pole to collect a sample approximately 20 feet from shore, near the approximate center of the river. Collection of a depth-integrated sample is not practical at this location due to the shallow water depths; therefore, a mid-depth grab sample will be collected.

5.1.2.1.2 New Lenox Road

As noted in Section 4.1.2, PCB concentrations do not vary greatly between the Confluence of the East and West Branches of the river and Holmes Road (the current upstream-most surface water monitoring location in Reach 5A). However, a consistent and substantial increase in PCB concentration is observed between Holmes Road and the next downstream station (New Lenox Road, located within Reach 5B), increasing by a factor of 3 between these locations. In consideration of this increase, the New Lenox Road station will be sampled to provide baseline surface water data at the approximate midpoint of Reaches 5 and 6 (Figures 5-1 and 5-2b). Data from this location may be useful for comparison to data collected during construction as an assessment of remedial operations, as well as to identify where PCB loads measured at Woods Pond Dam originate after

remediation is completed. Sampling at other historical stations in Reach 5, including Holmes Road and Woods Pond Headwaters, will not be included in the BMP.

The river at the New Lenox Road station is approximately 70 feet wide with water depth generally greater than 4 feet under low to moderate flow conditions. Due to the deeper water depth and wider river channel at this location, horizontal and vertical gradients in PCB concentrations may be present; therefore, a composite sample will be collected. This sample will be made up of depth-integrated aliquots obtained from 2 sub-sampling points located approximately 1/3 and 2/3 of the way across the channel (see Figure 5-2b). The depth-integrated aliquots will be collected from the bridge and composited at a ratio of 1:1 to form the composite sample.

5.1.2.1.3 Woods Pond Dam

As described in Section 2, the Downstream Transport Performance Standard specifies flow-dependent flux values for PCB transport over Woods Pond Dam (location shown on Figures 5-1 and 5-2c). As described in Section 3.2, baseline data at this location are not required to evaluate post-remedy achievement of this standard. However, data collected from this location may be important for monitoring operations during construction. Monitoring at the existing sampling station at Schweitzer Bridge (located approximately 1/4 mile downstream of Woods Pond Dam) was evaluated; however, for the BMP, a new automated sampling station will be established at Woods Pond Dam for the following reasons:

- The Downstream Transport Performance Standard specifies Woods Pond Dam as a measurement point.
- An automated sampling station will allow collection of samples (including temporal composites) throughout a wide range of environmental and operational conditions, if desired.
- The hydrology and layout of the area around Woods Pond Dam are more amenable to installation of an automated station than those at Schweitzer Bridge.
- Installation of an automated station will eliminate wading in the river or working from a bridge without a sidewalk, reducing health and safety concerns during elevated flows and inclement weather.

A schematic of the automated station configuration is presented in Figure 5-3. The automated station will include two sample intake points. One intake will be fastened to the eastern wing wall, and the second intake will be fastened to the western wing wall of Woods Pond Dam (Figure 5-2c). The elevation of the intakes will be placed at the approximate mid-depth of the water column under low to normal flow conditions in the river. The intake tubing will be run inside a protective outer pipe to a lockable enclosure that will contain a programmable automated sampler, such as an ISCO 6712 or equivalent. The automated sampler will be battery-operated; the batteries will be maintained

using solar panels. Equal volume aliquots collected from each intake location will be combined manually to form a station composite sample.

5.1.2.1.4 Rising Pond Dam

As at Woods Pond Dam, the Downstream Transport Performance Standard specifies flow-dependent flux values for PCB transport over Rising Pond Dam (location shown on Figures 5-1 and 5-2d), and it is anticipated that data collected from this location will likely be important for monitoring upstream operations during construction. Monitoring at the monthly sampling station located at Division Street (located approximately 1¼ miles downstream of Rising Pond Dam) could potentially meet these objectives; however, it was decided to establish an automated sampling station at Rising Pond Dam for similar reasons to those discussed above for Woods Pond Dam. The configuration of the automated station will be consistent with that of the automated station at Woods Pond Dam (Figure 5-3). Like the latter, this automated station will include two sample intake points. One intake will be fastened to the eastern wing wall and the second intake will be fastened to the western wing wall of Rising Pond Dam (Figure 5-2d). The elevation of the intakes will be placed at the approximate mid-depth of the water column under low to normal flow conditions in the river.

5.1.2.2 Sampling Frequency

Initially, surface water sampling will be conducted quarterly (i.e., in March, June, September, and December) at each BMP station. Given that the existing long-term data set shows that the most prominent variability in surface water PCB concentrations is on a seasonal basis (some of which is related to differences in flow; see Figure 4-1), quarterly sampling will be sufficient to continue to track and monitor conditions for the purposes of establishing a baseline. During winter months, the automated stations at Woods Pond Dam and Rising Pond Dam will be shut down to avoid equipment damage due to freezing; instead, manual surface grab sampling will be performed during the December sampling event, subject to weather constraints, as described in Section 5.1.2.3.1.

During the last 2 years of the BMP (i.e., last 2 full years prior to the start of construction), the sampling frequency will be increased to monthly at each station.

5.1.2.3 Sampling Procedures

5.1.2.3.1 Manual Sample Collection

Standard Operating Procedures (SOPs) for manual water sampling will be presented in the Rest of River FSP/QAPP and are briefly summarized herein. As noted in the previous section, surface water samples collected at the East and West Branches above the Confluence will be surface grab samples collected near the center of the river using an extendable pole (e.g., painter's pole) and composited on an equal-volume basis. During winter, as noted above, the automated stations at Woods Pond and Rising Pond Dams will not be operated and surface grab samples will be collected instead,

subject to weather constraints, by lowering a collection vessel from each wing wall of Woods Pond Dam and Rising Pond Dam.

At the New Lenox Road station, depth-integrated composite samples will be collected from the walkway on the bridge at two points approximately 1/3 and 2/3 of the width of the river. Prior to the first round of sampling, the distance from the bridge to the riverbed will be determined at each aliquot collection location. Depth-integrated aliquots will be obtained by collecting a subaliquot from three depth intervals: one near the surface of the water column, another at the approximate mid-depth of the water column, and the third approximately 1 foot above the bottom.

5.1.2.3.2 Automated Sample Collection

SOPs for automated water sampling will also be presented in the Rest of River FSP/QAPP and are briefly summarized herein. Sample collection procedures will be consistent at both automated sampling stations (at Woods Pond Dam and Rising Pond Dam). The automated samplers for the intakes on each wing wall of the dams will be set at an elevation that corresponds to the approximate mid-depth of flow under low to moderate flow. The samplers will be programmed to collect a 24-hour composite sample on the selected sampling date. The composite samples will be made up of equal-volume aliquots collected at 1-hour intervals.

5.1.2.4 Laboratory Analysis

Surface water samples will be analyzed for PCBs using EPA Method 8082, which is an Aroclor-based method, with sufficiently low detection limits to meet the objectives of the baseline surface water monitoring program. In addition, the samples will be analyzed for total suspended solids (TSS) using Standard Method (SM) 2540D/ASTM D3977-97.

The specific laboratory analytical methods and SOPs, as well as detection and reporting limits, will be presented in the Rest of River FSP/QAPP. Analytical results will be provided to GE in accordance with standard laboratory turnaround time (TAT) of 20 business days from verified time of sample receipt (VTSR). Measurement performance criteria for precision, accuracy and bias, representativeness, comparability, completeness, and sensitivity, as well as analytical quality assurance (QA)/quality control (QC) procedures, will also be presented in the Rest of River FSP/QAPP.

5.1.2.5 Water Quality Monitoring

Water quality (WQ) parameters, including dissolved oxygen (DO), pH, temperature, conductivity, and turbidity, will be measured at each station every time the station is sampled. These data will be collected using a handheld sonde, such as a YSI EXO2 or equivalent, in accordance with a surface water quality monitoring SOP to be presented in the Rest of River FSP/QAPP.

5.1.2.6 Flow Monitoring

Assessment of the load-based post-construction Downstream Transport Performance Standard for PCBs at Woods Pond Dam and Rising Pond Dam will require not only collection of surface water PCB concentration data but also measurement of river flow rates. The U.S. Geological Survey (USGS) currently maintains a flow gauging station a short distance downstream of Rising Pond Dam (USGS Gauge #01197500; Housatonic River near Great Barrington). As required by the Modified Permit (Section II.B.1.a.(2)(a)), a similar flow gauging station will be established at Woods Pond Dam at an appropriate time (see schedule for establishment of this flow gauge in Section 8). This gauging station will be similar in design to the USGS gauge at Great Barrington. The exact location of the gauging station will be determined based on field reconnaissance. Input from USGS pertaining to the location, design, and construction of the station will be solicited prior to placement.

5.1.2.7 Decontamination

Equipment that contacts river water, such as sample collection vessels and automated sampler collection jars, will be decontaminated prior to reuse in accordance with decontamination procedures to be presented in the Rest of River FSP/QAPP. Disposable materials used during sampling activities, such as personal protective equipment (PPE), will be collected and stored prior to appropriate off-site disposal.

5.1.2.8 Equipment Inspection, Maintenance, and Calibration

Water sampling equipment will be inspected on a routine basis and maintained appropriately. General routine maintenance practices for field equipment will be presented in the Rest of River FSP/QAPP, and will include the following:

- Removal of surface dirt and debris from exposed surfaces of equipment
- Storing equipment out of the elements
- Inspection of equipment for possible problems (e.g., damage or weak batteries) before mobilizing to the field
- Checking instrument calibrations
- Charging equipment batteries when they are not in use
- Inspecting automated station intake tubing for debris, biofouling, or other damage and replacing as needed
- Confirmation that solar charging systems are operating properly
- Confirmation that automated samplers are operating in accordance with the program

Field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be kept on hand to minimize downtime during the monitoring program.

Maintenance activities will be documented in field logs. Specific equipment that will be inspected, tested, and maintained on a routine basis includes the following:

- Sondes for measuring water quality parameters
- Sample collection vessels
- Telescoping poles
- Kemmerer Bottle sampler
- Automated sampling station intakes
- Automated samplers
- Automated station power supply

Field instruments will be calibrated as described in the Rest of River FSP/QAPP, which will take the manufacturer's recommendations into consideration. Personnel performing instrument calibrations will be trained in its proper operation and calibration. Instrument calibration activities will be noted in a field logbook.

5.1.2.9 Field Data Entry

Procedures for managing field data are presented in Section 6 and will be in accordance with the provisions of the Rest of River FSP/QAPP. Field data will be recorded using an electronic device that is equipped with applications that support sample generation and the recording of field information. Field data to be collected and recorded during surface water monitoring will include the following:

- Location ID
- Program ID
- QC samples collected, including the location of blind duplicate samples
- Sample date and time
- Sample ID
- Number of containers
- General description (observations, comments)
- Sampler initials
- DO, pH, water temperature, turbidity, and specific conductivity

5.2 Biota Monitoring

As described in Section 2, Section II.B.1.b.(1) of the Modified Permit specifies both short- and long-term post-construction Performance Standards for biota. The short-term standard consists of a

criterion for fish tissue, while the long-term standard requires monitoring to evaluate progress toward long-term goals for fish tissue and duck breast tissue. Biota sampling efforts under the BMP will focus solely on fish tissue. Monitoring of baseline conditions in ducks will not be conducted as part of the BMP due to the complications associated with establishing baseline conditions. Because ducks are migratory, they may be subjected to a wide range of exposures to PCBs depending on the time of year and amount of time spent in or near the Housatonic River or other areas. Therefore, PCB concentrations in duck tissue may be highly variable. As the remedy is implemented, overall trends in PCB concentrations in duck tissue are expected to track decreases achieved in water, sediment, and fish. Progress toward the long-term goal for ducks will, therefore, be assessed as part of post-construction monitoring program under Section II.B.4.b.(2) of the Modified Permit.

5.2.1 Media-Specific Objectives

Programmatic objectives for the BMP are specified in Section 3.1. Media-specific objectives for the baseline fish monitoring include the following:

- Establish baseline fish PCB concentrations using sampling locations and techniques consistent with those anticipated to be used for evaluating post-construction achievement of the Short-Term Biota Performance Standard and progress toward achieving the fish tissue goals specified in the Long-Term Biota Performance Standard.
- Provide data to support the analysis of long-term post-construction trends in fish PCB concentrations, including assessment of long-term trends in MNR areas.
- Provide baseline data to be used in subsequent evaluation of potential impacts of construction activities in the river on fish tissue PCB concentrations.

5.2.2 Program Design

The baseline biota monitoring program has been designed to satisfy the programmatic and media-specific objectives presented in Sections 3.1 and 5.2.1 above. The design of this program has considered the relatively robust sampling of fish that has been conducted in the Rest of River to date (described in Section 4.2), as well as the scope of future monitoring activities anticipated to occur during and after construction. Fish will be collected at a location or locations within a reach based on habitat availability and will be used to provide reach-wide average PCB levels. Because the Biota Performance Standards specified in the Modified Permit are based on PCB exposure in adult fish, baseline fish sampling will consist of the collection and analysis of adult fish. A description of the sampling approach for the collection of fish samples is provided in the subsections that follow, and the baseline fish sampling program is summarized in Table 5-3 (attached to the end of this plan).

5.2.2.1 Sampling Locations and Approach

As described in Section 4.2, a considerable number of fish samples have been collected at various locations throughout Rest of River, including six locations in Massachusetts and four locations in Connecticut. This prior sampling has provided a thorough characterization of PCBs in fish tissue at these locations; therefore, prior sampling results were used as the basis of design for the fish component of the BMP. All 10 of these previously sampled locations were selected for inclusion in the BMP to provide sufficient spatial coverage in the Rest of River. Table 5-2 below lists the 10 BMP fish sampling locations along with the rationale for their selection. Figures 5-4a and 5-4b are maps showing the BMP fish sampling locations in Reaches 5 through 8 (Figure 5-4a) and downstream of Reach 8 (Figure 5-4b).

Table 5-2
Summary of BMP Fish Sampling Locations

Reach	Location Description	State	Rationale
Reach 5A	Vicinity of Pittsfield WWTP	MA	Prior adult fish sampling location
Reach 5C	Roaring Brook to upstream of Woods Pond	MA	Prior adult fish sampling location
Reach 6	Woods Pond (along west shore)	MA	Prior adult fish sampling location Corresponds with load monitoring location
Reach 7	Glendale Dam Impoundment	MA	Prior YOY fish sampling location
Reach 8	Rising Pond (along west shore)	MA	Prior adult fish sampling location Corresponds with load monitoring location
Reach 9	End of reach near MA/CT border (near Rt. 341 bridge)	MA	Prior YOY fish sampling location (HR6)
Reach 11	West Cornwall	CT	Prior adult fish sampling location
Reach 12	Bulls Bridge Impoundment	CT	Prior adult fish sampling location
Reach 14	Lake Lillinonah	CT	Prior adult fish sampling location
Reach 15	Lake Zoar	CT	Prior adult fish sampling location

As shown in Table 5-2, baseline monitoring of adult fish PCB concentrations will be conducted at the prior adult fish monitoring locations in Reaches 5 through 8, as well as at the previous YOY fish sampling location in Reach 7 (Glendale Dam Impoundment). These are the reaches that will be subject to active remediation; therefore, they will likely serve as post-construction monitoring locations. Downstream of Reach 8, where MNR is the Performance Standard, the historical YOY sampling location near the end of Reach 9 and all four of the locations sampled historically for adult fish in Connecticut were included in the BMP for the sampling of adult fish.

Sampling locations and collection methods will generally be consistent with those used in past sampling events to facilitate evaluation of long-term temporal trends. Specific sampling areas at each location (shown as a discrete point on Figure 5-4) may be adjusted or expanded as needed

based on fish availability and habitat conditions within a reach. Reasonable attempts will be made to maintain sample location integrity throughout the program. To achieve this objective, sampling events will initially target locations sampled previously within each reach. If there is a lack of availability of fish at historical locations, the target locations will be expanded or moved within a reach. For example, the sampling location in Reach 7 (Glendale Dam Impoundment [Reach 7G]) has historically been sampled only for YOY fish; sampling may be expanded to other subreaches in Reach 7, as necessary, to acquire target numbers of fish.

5.2.2.2 Target Fish Species and Size

As indicated in Table 5-2 above, the BMP will include the collection of adult fish at all 10 sampling locations. The species to be collected will be generally consistent with those targeted historically and will include largemouth bass (*M. salmoides*), yellow perch (*Perca flavescens*), and bullhead (brown bullhead [*Ameiurus nebulosus*] and/or yellow bullhead [*Ameiurus natalis*]) at the Massachusetts locations and smallmouth bass (*Micropterus dolomiueu*), yellow perch, and bullhead (brown and/or yellow) at the Connecticut locations, as summarized in Table 5-3 (attached to the end of this plan). Since the Biota Performance Standards for fish apply to the edible portion for humans (i.e., fillets), collection of these fish will target the legal or edible size, which are fish greater than 305 millimeters (mm) for bass, 200 mm for bullhead, and 170 mm for yellow perch.[8]

These species are representative of trophic levels in the river for top-feeding piscivorous species (bass), mid-level foraging species (yellow perch), and bottom-feeding species (bullhead). Species such as northern pike and trout will not be targeted because they share a similar trophic level in the ecosystem with the largemouth and smallmouth bass. Also, trout are stocked annually in the Housatonic River by the CDEEP, which could impact PCB levels.[9]

5.2.2.3 Number of Samples

A total of 10 fish per species (or trophic level) will be targeted within each of the 10 reaches, which is generally consistent with the numbers of fish collected historically.

5.2.2.4 Sampling Frequency

One round of fish sampling will be conducted during the BMP. This sampling event will occur during the last full field season prior to the start of construction. Consistent with the historical sampling programs, these fish samples will be collected in the summer (June to August).

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[8] Largemouth and smallmouth bass are the only fish in the States of Massachusetts and Connecticut that have a minimum legal size requirement (305 mm in both states). Minimum sizes specified for bullhead and yellow perch are based on an evaluation of sizes of adult fish collected previously.

[9] Trout stocking information is found at the CDEEP website: http://www.ct.gov/deep/cwp/view.asp?a=2696&q=467456&deepNav_GID=1630.

5.2.2.5 Sampling Procedures

5.2.2.5.1 Sample Collection

SOPs for fish sampling will be presented in the Rest of River FSP/QAPP and are summarized herein. Standard sampling methods, including netting and electroshocking, will be used to collect target species. Methods of collection will vary depending on the sampling location and the targeted species, although electrofishing is the preferred sampling method (as site conditions allow), consistent with historical sampling events. If electrofishing proves ineffective, gill nets may be set to collect the desired number of fish. If fish are not present and target numbers cannot be collected after a reasonable effort, sampling may be discontinued in that reach; this decision will be agreed upon by GE and EPA field representatives. For each sampling event prior to the start of sampling, water quality data will be collected with a YSI 6000 series sonde (or equivalent).

5.2.2.5.2 Sample Preparation

For the fish collected, the edible portions for humans will be analyzed. Fish will be prepared for analyses in accordance with the fish sample preparation SOP to be provided in the Rest of River FSP/QAPP. Fish samples will be prepared by removing the left fillet, excluding the rib cage, and removing the skin for analysis; the right fillet will be included only if needed for sufficient sample mass.

5.2.2.5.3 Sample Handling and Preservation

Fish will be handled and preserved in the field according to the procedures in the fish sample preparation SOP in the Rest of River FSP/QAPP. Each fish will be weighed (to the nearest 1.0 gram), and total length will be measured (to the nearest mm) and recorded. These measurements will be made as soon as possible following collection. In addition, observed external abnormalities will be noted in the field log. Samples will be shipped to the analytical laboratory, where they will be prepared for analysis. If samples are held longer than 24 hours from collection, they will be frozen prior to shipment.

5.2.2.6 Analytical Procedures

5.2.2.6.1 Chemical Analysis

Fish samples will be analyzed for PCB as Aroclors using EPA Method 8082 and for lipid content.[10] The specific analytical procedures, SOPs, and detection and reporting limits for the baseline fish sampling program will be presented in the Rest of River FSP/QAPP. Analytical results will be provided to GE in

[10] Prior analyses of fish have included use of the congener-based Green Bay Method for adult fish in recent sampling in Massachusetts and the ANS analytical methods for both Aroclors and congeners for adult fish in Connecticut. The Green Bay Method is no longer commercially available, and GE is not proposing to use the ANS for the baseline fish sampling program. The analysis of fish for PCB Aroclors using the standard method (8082) is sufficient to meet the objectives of the baseline fish sampling program (Section 5.2.1).

accordance with standard laboratory TAT of 20 business days from VTSR. Measurement performance criteria for precision, accuracy and bias, representativeness, comparability, completeness, and sensitivity, as well as analytical QA/QC procedures, will also be presented in the Rest of River FSP/QAPP.

5.2.2.6.2 Physical Analysis

As noted in Section 5.2.2.5.3, the total length and weight of the fish collected will be recorded in the field in accordance with procedures to be specified in the Rest of River FSP/QAPP. Fish otoliths will be collected in the field and archived in the event that it is necessary to determine the age of fish collected. Sex of fish will be determined in the field, if possible, prior to shipment to the analytical laboratory. In addition, the sex of each individual fish will be determined by the laboratory regardless of the field determination, and this result will be reported in the fish monitoring database. Any observed external abnormalities will be noted.

5.2.2.7 Decontamination

Equipment that contacts fish samples, such as measuring boards, buckets, and scales, will be decontaminated prior to reuse, following decontamination procedures to be presented in the Rest of River FSP/QAPP. Disposable materials used during sampling activities, such as PPE, will be collected and stored prior to appropriate off-site disposal.

5.2.2.8 Equipment Inspection, Maintenance, and Testing

Field sampling equipment maintenance will be documented in the applicable field logs. Specific equipment that will be inspected, tested, and maintained includes the following:

- Sampling vessels used during fish sampling activities
- Electrofishing equipment
- Nets
- Scale(s) for weighing fish
- Measuring board for measuring fish length
- GPS
- WQ sonde (to measure water temperature, conductivity, pH, DO, and turbidity)
- Decontamination supplies
- Investigation-derived waste containers
- Sample coolers and ice

Field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be transported to the field to minimize downtime.

5.2.2.9 Field Data Entry

The following data will be recorded for each location sampled:

- Location ID
- Sample collection method
- Collection date and time (start and end)
- Water quality measurements (temperature, conductivity, pH, DO, and turbidity)
- GPS coordinates for the beginning and end of each sampling reach (northing and easting)
- Weather conditions

The following data will be recorded for each fish collected and retained for analysis:

- Sample ID
- Sampling date
- Species
- Sample total length and weight
- Sample type (e.g., individual)
- Sample preparation (e.g., fillet)
- Fish scales or spines collected (yes/no)
- Fish sex
- General description, comments (including noting observed external abnormalities), number, total length, and weight of individuals in composite samples
- Sampler initials

5.3 Surface Sediment Monitoring

5.3.1 Media-specific Objectives

Programmatic objectives for the BMP are specified in Section 3.1. Media-specific objectives for the baseline surface sediment monitoring include the following:

- Establish baseline surface sediment PCB concentrations in representative MNR reaches, for use as a basis of comparison to post-remediation surface sediment concentrations to assess recovery in those reaches.
- Provide data for use in subsequent evaluation of potential impacts of the Remedial Action on sediment PCB concentrations.
- Collect surface sediment data to support fish exposure assessment in regions of the river where MNR is the Performance Standard.

5.3.2 Program Design

The baseline surface sediment monitoring program has been designed to satisfy the objectives presented in Sections 3.1 and 5.3.1. Unlike the Downstream Transport and Biota Performance Standards, there are no General Performance Standards in the Modified Permit setting numerical values for future sediment concentration. However, Section II.B.2.h of the Modified Permit states that monitoring of affected media, including sediment, shall be conducted in portions of the Rest of River where MNR is the Performance Standard (beginning with baseline). Fish data will be used as the primary line of evidence in the assessment of long-term trends in the MNR portions of the Rest of River; however, surface sediment data will be collected and used as another line of evidence in this assessment.

5.3.2.1 Sampling Approach and Locations

As described in Section 2, the MNR portions of the Rest of River include the flowing subreaches in Reach 7 (Reaches 7A, 7D, 7F, and 7H) and throughout Reaches 9 through 16. As noted in Section 4.3.1, the historical characterization of sediment was conducted 15 to 20 years ago (i.e., from 1998 to 2002). Because of their proximity to the portions of the river subject to active remediation (i.e., Reach 5; Woods Pond; subreaches 7B, 7C, 7E, and 7G; and Rising Pond), baseline sediment samples will be collected in all four of the MNR subreaches of Reach 7 and in Reach 9. In Connecticut, sampling will include all four of the reaches selected for baseline monitoring of fish (i.e., Reach 11 [West Cornwall], Reach 12 [Bulls Bridge Impoundment], Reach 14 [Lake Lillinonah], and Reach 15 [Lake Zoar]).

As shown in Table 4-5, the number of locations sampled by EPA between 1998 and 2002 within these reaches/subreaches decreased with distance from the former GE facility, consistent with the observed

decreases in PCB concentrations. As shown in Section 4.3.2, PCB concentrations in the MNR reaches are low. Given the already low sediment concentrations in these reaches, it is anticipated that reductions in the future will occur slowly and may be difficult to quantify. Based on the historical number of sample locations in these reaches as well as professional judgment, baseline sampling of sediments will target collection of 12 samples per river mile in each of the MNR subreaches of Reach 7 and in Reach 9, and 6 samples per river mile in the four Connecticut reaches. This sampling density was deemed appropriate for the monitoring of baseline sediment conditions within these reaches and exceeds the density of historical sampling used by EPA to make remedial decisions in these reaches. The samples collected from each river mile will be composited equally by volume for chemical analysis.

Because sediment data will be used as a line of evidence in the evaluation of natural recovery, sediment sampling will focus solely on surface sediment (i.e., approximately the top 2 inches). Historically, the surface sediment layer sampled by EPA was the top 6 inches; this depth was selected by EPA as a conservative definition of the surface layer to assess the risk to humans and ecological receptors. However, 6 inches is not the best thickness to assess natural recovery. Mixing by benthic invertebrates and deposition are key processes controlling the rate of natural recovery, and literature (e.g., as embodied in recent EPA [2015] guidance) indicates that the most substantial extent of benthic mixing in freshwater rivers typically occurs within the top 5 cm (approximately 2 inches) or less of sediment. Given that the goal of MNR sampling is to detect changes over time, sediment sampling should focus on a surface layer thickness from which changes occur more quickly (e.g., a thinner layer) and thus can be more easily detected. As such, baseline sampling will focus on the top 2 inches (approximately 5 cm) of sediment to facilitate a more rapid assessment of post-remedy natural recovery.

Table 5-4 provides a summary of the number of target samples and chemical analyses by reach.

Table 5-4
Summary of Sediment Sampling Locations and PCB Analyses by Reach

Reach	Reach Length (miles)	Number of Sediment Locations	Number of PCB Analyses
Reach 7A	1.6	20	2
Reach 7D	5.4	64	5
Reach 7F	6.1	75	6
Reach 7H	2.7	33	3
Reach 9	22.5	272	23
Reach 11	11.8	71	12
Reach 12 (Bulls Bridge)	12.4	74	13
Reach 14 (Lake Lillinonah)	12.5	75	13
Reach 15 (Lake Zoar)	10.3	62	10
Total	**85.3**	**746**	**87**

Selection of specific sediment sampling locations was achieved by splitting each river mile within the subject reaches into quarter-mile (four) sections in Reaches 7 and 9 and half-mile (two) sections in the Connecticut reaches, and randomly selecting three individual sample locations within each of those sections using ArcGIS software. This approach allows for random (i.e., unbiased) spatial distribution of target sample locations within a given reach. The free-flowing subreaches within Reach 7 and Reach 9 are relatively shallow and swift-flowing reaches; based on past sampling in these reaches, it is anticipated that sediment may not be present at all the randomly selected locations. To account for this, three backup locations were also selected within each quarter- or half-mile section.[11] The randomly selected sediment sample locations, as well as the backup locations, are shown on Figures 5-5a through 5-5d (Reach 7), Figure 5-5e (Reach 9), Figure 5-5f (Reach 11), Figure 5-5g (Bulls Bridge Impoundment), Figure 5-5h (Lake Lillinonah), and Figure 5-5i (Lake Zoar).

As part of the sampling, the field crew will access each location and determine if there is sufficient sediment for sampling within 10 feet of the target coordinates. Sufficient sediment is defined as an area with at least 2 inches of sediment with a grain size fine enough to allow for laboratory analysis (i.e., excluding bedrock, cobbles, or gravel), as will be detailed in the Rest of River FSP/QAPP. Criteria regarding the maximum grain size that can be analyzed will be established based on input from the analytical laboratory. At locations without sufficient sediment, river bottom conditions (i.e., bedrock, cobbles, or gravel) will be recorded. It should be noted that, while these procedures will be followed at all locations, the issue of insufficient sediment is not anticipated in the Bulls Bridge impoundment, Lake Lillinonah, and Lake Zoar.

5.3.2.2 Sampling Frequency

One round of sediment sampling will be conducted during the BMP. This sampling will be conducted in the year prior to the start of remediation.

5.3.2.3 Sampling Procedures

SOPs for surface sediment sample collection will be presented in the Rest of River FSP/QAPP and are summarized herein. The sampling crew will navigate to within approximately 10 feet of the target sampling location using a Differential Global Positioning System (DGPS). Depending on access and water depth, sediment samples will be collected from a flat-bottomed vessel or by personnel wearing waders. A surface sediment grab sampler will be used to collect the top 2 inches of sediment. As noted above, the discrete samples collected from each river mile will be composited equally by volume for chemical analysis. Sample processing and handling procedures will be specified in the Rest of River FSP/QAPP.

[11] Although the absence of sediment is not expected in the Connecticut impoundments, backup locations were likewise selected in those impoundments in the unlikely event that they should be needed.

5.3.2.3.1 Inaccessible Locations

In the event that one of the randomly selected sampling locations is inaccessible by the sampling vessel due to being too close to shore or too near to a dam or other in-river structure, or if the sampling crew is accessing the locations by wading and the water is too deep or other safety concerns are noted, the field crew will get as close to the location as possible and attempt to collect the sample. The actual sampling coordinates will be recorded.

5.3.2.3.2 Locations with Insufficient Sediment

Insufficient sediment is defined as a location where there is less than 2 inches of sediment or it is impracticable to analyze the materials retained by the sampler due to size (i.e., gravel-sized stones or larger). As noted above, criteria regarding the maximum grain size that can be analyzed will be established based on input from the analytical laboratory and detailed in the Rest of River FSP/QAPP. If sufficient material cannot be obtained in three attempts within 10 feet of a location, then the location will be abandoned and the crew will attempt sampling at the nearest backup location. (Only one backup location has been identified for each target coordinate.) If sufficient material cannot be retained at the backup location, the crew will abandon the location and move on to the next target location. The information on sediment collection attempts will be recorded in the field database.

5.3.2.4 Analytical Procedures

Each composite baseline sediment sample will be analyzed for PCB as Aroclors using EPA Method 8082. Each sediment sample will also be analyzed for moisture content (using Method SM 2540B) and total organic carbon (using the Lloyd Kahn Method). The laboratory analytical methods, SOPs, and detection and reporting limits for these samples will be presented in the Rest of River FSP/QAPP. Analytical results will be provided to GE in accordance with standard laboratory TAT of 20 business days from VTSR. Measurement performance criteria for precision, accuracy and bias, representativeness, comparability, completeness, and sensitivity, as well as analytical QA/QC procedures, will also be presented in the Rest of River FSP/QAPP.

5.3.2.5 Sediment Type Characterization

A brief description of the physical characteristics of each sample will be recorded in the field database. These characteristics will include the general soil type (fine sand, medium sand, coarse sand, gravel, silt, clay, and organic/other matter such as wood chips), presence of observable biota, odor, and color.

5.3.2.6 Decontamination

Equipment that contacts sediment, such as the grab sampler, mixing spoons, and mixing bowls, will be decontaminated prior to reuse following decontamination procedures to be presented in the Rest of River FSP/QAPP. Disposable materials that are used during sampling activities, such as PPE, will be collected and stored prior to appropriate off-site disposal.

5.3.2.7 Equipment Testing, Inspections, and Maintenance

Specific equipment that will be tested, inspected, and maintained by the contractor for the surface sediment sampling includes the following:

- Sediment grab sampler
- DGPS and depth sounder
- Sampling vessel
- Log sheets/book
- Sediment processing materials, including aluminum pans and stainless steel spoons or equivalent
- Camera
- Probing rod
- Decontamination supplies
- Investigation-derived waste containers
- Sample containers and coolers

Field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be supplied by the contractor and kept on hand to minimize downtime during this study.

It is not anticipated that instrumentation requiring calibration will be used during baseline surface sediment sampling; the inspection, testing, and maintenance procedures described above are expected to be sufficient to ensure that equipment is in proper working order.

5.3.2.8 Field Data Entry

The following data, at a minimum, will be recorded for each location sampled:

- Location ID
- Sample collection method
- Collection date and time
- GPS coordinates (northing and easting)
- Probing depth
- Sediment description

5.4 Sample Handling and Custody

Appropriate sample handling and chain-of-custody (COC) procedures will be followed throughout the BMP in accordance with the Rest of River FSP/QAPP. The COC records will be created when sample collection is completed. The COC record will include field logs as well as COC forms. Appropriate sample containers for each laboratory analysis will be provided by the analytical laboratory.

5.4.1 Field Procedures

Each sample collected in the field will be clearly labeled with a unique sampling ID that will be logged on both the field log and the COC form. At a minimum, the sample label will contain the following information:

- Field sample ID number
- Sampling location (except for blind duplicates)
- Sample type (e.g., grab)
- Date and time collected
- Sampler initials

Procedures for sample handling in the field and transport to the analytical laboratory will be specified in the Rest of River FSP/QAPP.

5.4.2 Laboratory Procedures

Once samples are received at the laboratory, the field COC record will be completed and signed by the individual Laboratory Sample Custodian. Procedures for laboratory sample receipt personnel to check the sample containers and paperwork for any discrepancies will be provided in the Rest of River FSP/QAPP. Any discrepancies in sample IDs or sample analysis information, any indication that samples are missing upon receipt at the laboratory, or any indication that samples were not received at the correct temperature (as specified in the Rest of River FSP/QAPP) will be communicated to project management personnel within 24 hours of sample receipt so that appropriate corrective action can be determined and implemented.

5.5 Quality Assurance/Quality Control

The types and frequency of field QC samples to be collected for each parameter, as well as laboratory QA/QC samples and procedures, will be specified in the Rest of River FSP/QAPP. QC samples will be collected in the field to allow evaluation of data quality. Field QC samples for surface water samples will include equipment blanks, blind duplicates, matrix spikes, and matrix spike duplicates. Fish sampling does not facilitate the use of field QC samples (e.g., duplicates) as part of

the design; all QC samples for the fish sampling program will be generated in the laboratory. Field QC samples for sediment samples will include equipment blanks and field duplicate samples.

5.6 Health and Safety

BMP field activities will be conducted in accordance with the Rest of River Health and Safety Plan (to be submitted concurrently with the Rest of River FSP/QAPP).

6 Data Management

Data management procedures for both field and laboratory data will be specified in detail in the Rest of River FSP/QAPP. An electronic data management system (DMS) will be used to facilitate the storage, retrieval, analysis, and reporting of field and analytical chemistry data for water, biota, and sediment samples collected during the BMP. The purposes of this data management system are to efficiently store, analyze, and generate reports based on the data generated by the monitoring program elements. Data verification and validation procedures will be presented in the Rest of River FSP/QAPP. Analytical laboratories will transmit electronic data deliverables (EDDs) for loading into the DMS. The EDDs will undergo checks to verify that the EDD adheres to structural requirements and that the valid values used by the laboratory are in accordance with project standards.

Applications associated with the DMS will include electronic data entry forms, procedures to upload field data and electronic data packages, and internal logic to provide automated QC checks of these inputs. Data collection applications will be used in the field during sampling events to record observations, generate samples, and create COCs. Automated QC checks will be performed through use of controlled data entry fields and the valid values checks. Probe-based WQ data will be collected during the BMP by manually deploying multi-probe data sondes. Parameters include DO, temperature, turbidity, specific conductivity, and pH. These data will be stored on the data logger and subsequently imported into the application.

7 Reporting

An electronic data export containing the most recent version of the BMP database will be made available to EPA on a monthly basis as part of the Monthly Progress Reports under the CD. The results of baseline monitoring will be presented in a Baseline Data Summary Report (BDSR) to be submitted to EPA on an annual basis. Each BDSR will present a summary of the work performed during the previous year, including a tabulation of results, processing data, COC forms, procedure modifications, copies of field and laboratory audits, data validation results, copies of laboratory reports, and an electronic version of the project database. Each BDSR will be submitted by March 31 of the following year.

8 Schedule

The BMP activities described herein will be initiated upon receipt of EPA approval of this plan, as well as the forthcoming Rest of River FSP/QAPP, and will continue until the construction monitoring program begins. Specifically, in the month following EPA's approval of this plan and the Rest of River FSP/QAPP (whichever is later), GE will commence the baseline surface water monitoring program described herein. Initially, surface water samples will be collected at Woods Pond Dam and Rising Pond Dam using manual techniques until the automated stations have been constructed and become operational. The schedule for construction and commencement of operation of those automated stations will be provided to and discussed with EPA. Surface water sampling as described herein will be conducted quarterly until the last 2 full years prior to the start of remedial construction activities, when the sampling frequency will be increased to monthly (subject to weather constraints in the winter months). The schedule for the construction and commencement of operation of the flow gauging station to be installed at Woods Pond Dam will be dependent on site reconnaissance, design considerations, field calibration surveys, and coordination with USGS; it is anticipated that construction and calibration of this station will be complete approximately 2 years prior to the start of construction (coincident with the increase in baseline surface water sampling frequency from quarterly to monthly).

The baseline fish and sediment sampling programs will be conducted as described in this plan. As noted above, one round of fish sampling will be conducted as part of the BMP during the last full field season prior to the anticipated commencement of remedial construction. Similarly, one round of sediment sampling will be conducted during that same year prior to construction. The specific schedules for the baseline fish and sediment sampling will be developed in consultation with EPA.

9 References

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Tables

Table 5-1
Surface Water Sampling Approach Summary

Location	Status	Rationale for Location	Description	BMP Sampling Method	Rationale for Sampling Method
Hubbard Avenue	Prior Monthly Location (Discontinued for BMP)	Background location upstream of GE Plant Site; not needed for BMP.	--	--	--
Newell Street	Prior Monthly Location (Discontinued for BMP)	Location adjacent to GE Plant Site; not needed for BMP.	--	--	--
Lyman Street	Prior Monthly Location (Discontinued for BMP)	Location adjacent to GE Plant Site; not needed for BMP.	--	--	--
Silver Lake Outfall	Prior Monthly Location (Discontinued for BMP)	Location at outfall from Silver Lake; not needed for BMP, but will continue to be sampled quarterly under Silver Lake Area Post-Removal Site Control program.	--	--	--
Pomeroy Avenue	Prior Monthly Location (Discontinued for BMP)	No longer needed for BMP due to addition of new East and West Branch stations; will continue to be sampled quarterly under 1.5 Mile Post-Removal Site Control program.	--	--	--
East and West Branches Above Confluence	New Locations **(BMP Surface Water Locations)**	Monitor PCB concentrations in East and West Branches upstream of Rest of River	Shoreline access to both branches from Fred Garner Park; water depth ~2-3 feet; mixed bottom; river width ~40 to 50 feet	Surface grabs using telescoping pole (~20 feet) to sample from shore. Sample collected from near center channel just upstream of confluence (upstream of any anticipated RoR construction activities). Individual East and West Branch samples combined into equal-volume composites.	Cross-channel and/or depth integrated samples not needed due to shallow, fast moving water. Sampling just upstream of confluence will allow identification of PCB contributions from East and West Branches. Samples will be composited into a single sample to facilitate estimation of baseline PCB loading entering the Rest of River.
Holmes Road	Prior Monthly Location (Discontinued for BMP)	Contemporary PCB concentrations do not differ greatly between Pomeroy Avenue and Holmes Road; therefore monitoring at Holmes Road will be discontinued. Post-construction trends will be monitored at Woods Pond Dam and Rising Pond Dam stations.	--	--	--
New Lenox Road	Prior Monthly Location **(BMP Surface Water Location)**	Approximate midpoint of Reaches 5 and 6. Data from this location may be useful for comparison to data collected during construction as an assessment of remedial operations, as well as to identify where PCB loads measured at Woods Pond Dam originate after remediation is completed.	Bridge with sidewalk; water depth >4 ft.; river width ~70 ft.	Depth-integrated composite at 2 locations across channel (approximately 1/3 and 2/3 of channel) to form a station composite. Access from bridge.	Collection of multiple aliquots both horizontally and vertically will reduce the potential for variability in PCB concentrations that may be present due to lower flow velocity and increased water depth compared to other stations. Sampling from bridge sidewalk avoids need to work from a boat.
Woods Pond Headwaters	Prior Monthly Location (Discontinued for BMP)	Station is located within an area to be remediated, and is traditionally difficult to access; therefore monitoring at Woods Pond Headwaters will be discontinued. Post-construction assessment of performance standards will be focused at Woods Pond Dam and Rising Pond Dam.	--	--	--
Woods Pond Dam	New Location **(BMP Surface Water Location)**	Downstream Transport Performance Standard has been established for this location in the Modified Permit.	Woods Pond Dam (GE property)	Dual intake automated station. Two solar powered ISCO samplers (one installed in enclosure on each upstream wing wall of dam; samples composited). Sampler intakes fastened to wingwalls, placed ~ mid-depth at mean flow.	Depth integrated sampling unnecessary due to distance downstream from construction activities and shallow water. Potential for cross-channel variability addressed by collecting sample aliquots at two locations. Use of automated station eliminates need for personnel to work from bridge w/o sidewalks or wading, and adds flexibility (ability to collect composite samples over various time periods).
Schweitzer Bridge	Prior Monthly Location (Discontinued for BMP)	Station no longer needed due to addition of new BMP station at Woods Pond Dam	--	--	--
Rising Pond Dam	New Location **(BMP Surface Water Location)**	Downstream Transport Performance Standard has been established for this location in the Modified Permit.	Rising Pond Dam (GE property)	Dual intake automated station. Two solar powered ISCO samplers (one installed in enclosure on each upstream wing wall of dam; samples composited). Sampler intakes fastened to wingwalls, placed ~ mid-depth at mean flow.	Same rationale as for Woods Pond Dam station
Division Street	Prior Monthly Location (Discontinued for BMP)	Station no longer needed due to addition of new BMP station at Rising Pond Dam	--	--	--

Table 5-3
Fish Sample Collection, Handling, and Analysis Summary

Sampling Location	Description	Age	Species	Number of Samples Per Species	Sampling Method	Sample Preparation	Analytes	Turnaround Time	Holding Times
Reach 5A	Vicinity of Pittsfield WWTP	Adult	Largemouth bass; Yellow perch; Bullhead (brown/yellow)	10	Electrofishing/ netting	Fillet[1]	Aroclor PCBs; lipid content	Standard (20 business days from VTSR)	1 year to extraction; 40 days to analysis
Reach 5C	Reach 5C (between Roaring Brook and upstream of Woods Pond)	Adult		10					
Reach 6	Woods Pond (along west shore)	Adult		10					
Reach 7	Glendale Dam impoundment (upstream of Glendale Dam to upstream of Glendale Middle Road Bridge)	Adult		10					
Reach 8	Rising Pond (along west shore)	Adult		10					
Reach 9	Immediately upstream of MA/CT border in vicinity of Konkapot River	Adult		10					
Reach 11	West Cornwall: Downstream of West Cornwall covered bridge and in the vicinity of Housatonic Meadows State Park	Adult	Smallmouth bass; Yellow perch; Bullhead (brown/yellow)	10					
Reach 12	Bulls Bridge impoundment: approximately 0.5 miles upstream to 1 mile downstream of Route 341 Bridge	Adult		10					
Reach 14	Lake Lillinonah: Vicinity of State Route 133 Bridge	Adult		10					
Reach 15	Lake Zoar: from Shepaug Dam to the state boat launch along both banks; lower end from Eichler Cove Marina to Kettletown State Park along both banks	Adult		10					

Notes:
1. Fillets are prepared with skin off and no ribs.

PCB: polychlorinated biphenyl
VTSR: verified time of sample receipt
WWTP: Wastewater Treatment Plant

Figures

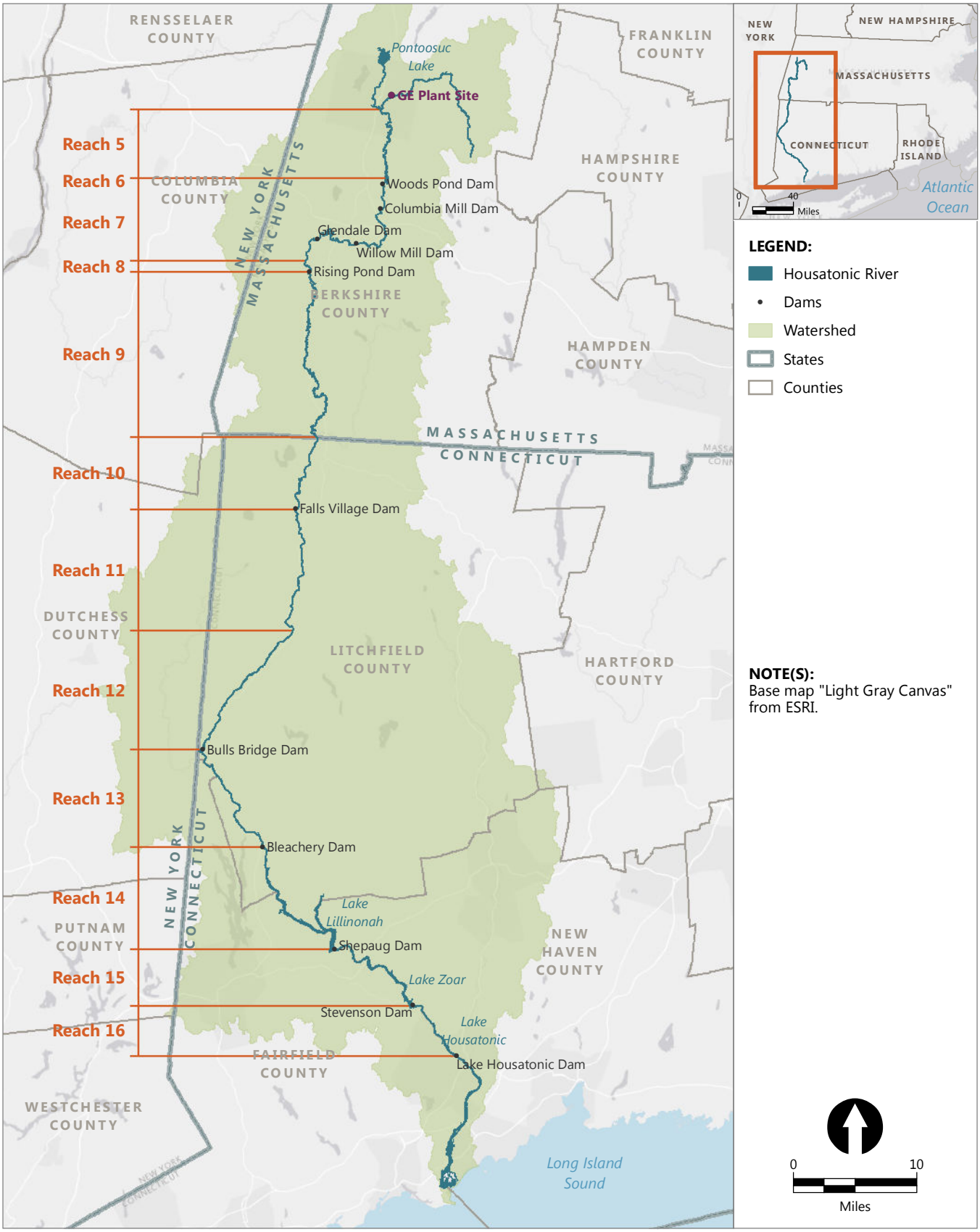

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Figure 1-1
Housatonic River Map
Baseline Monitoring Plan
Housatonic River – Rest of River

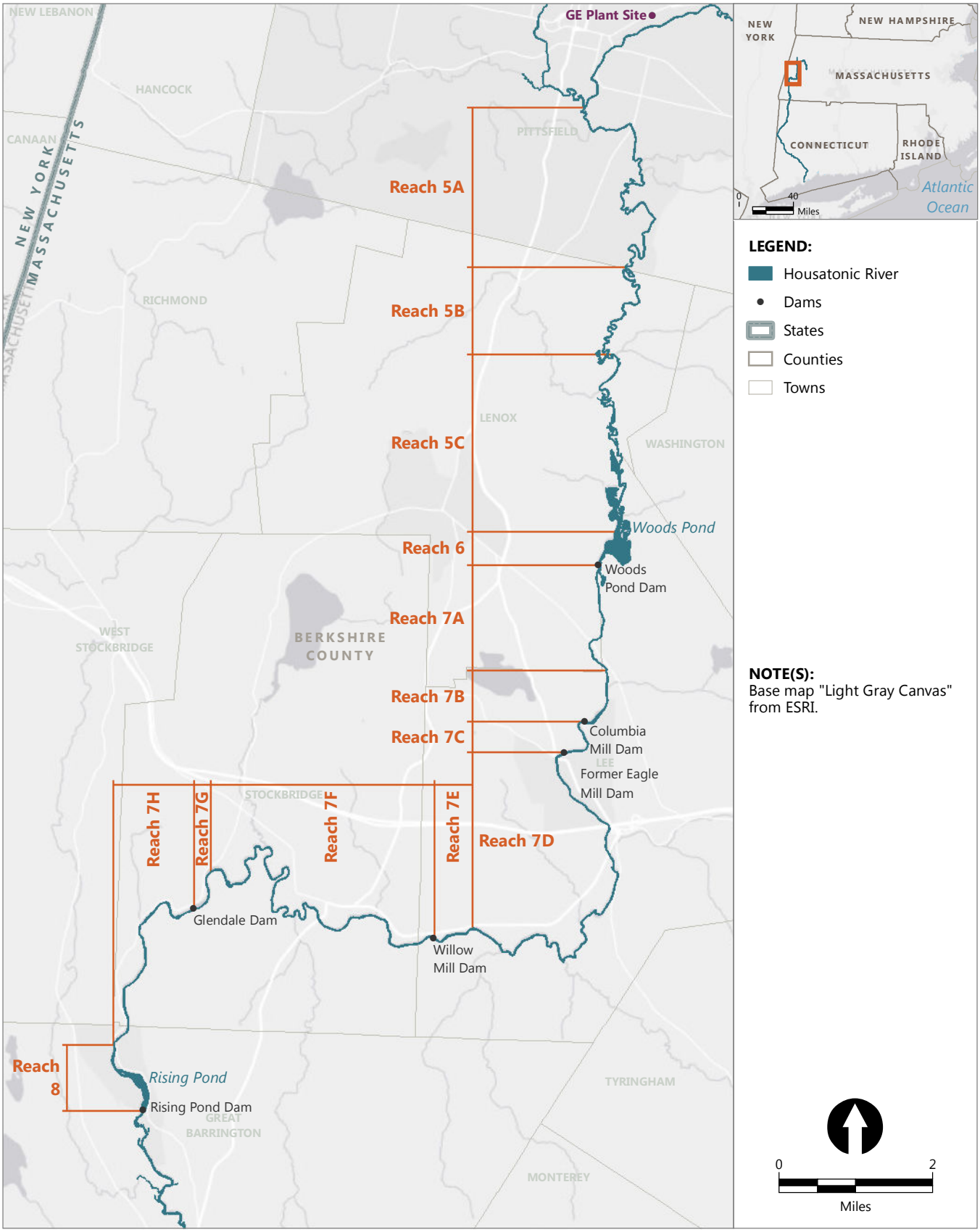

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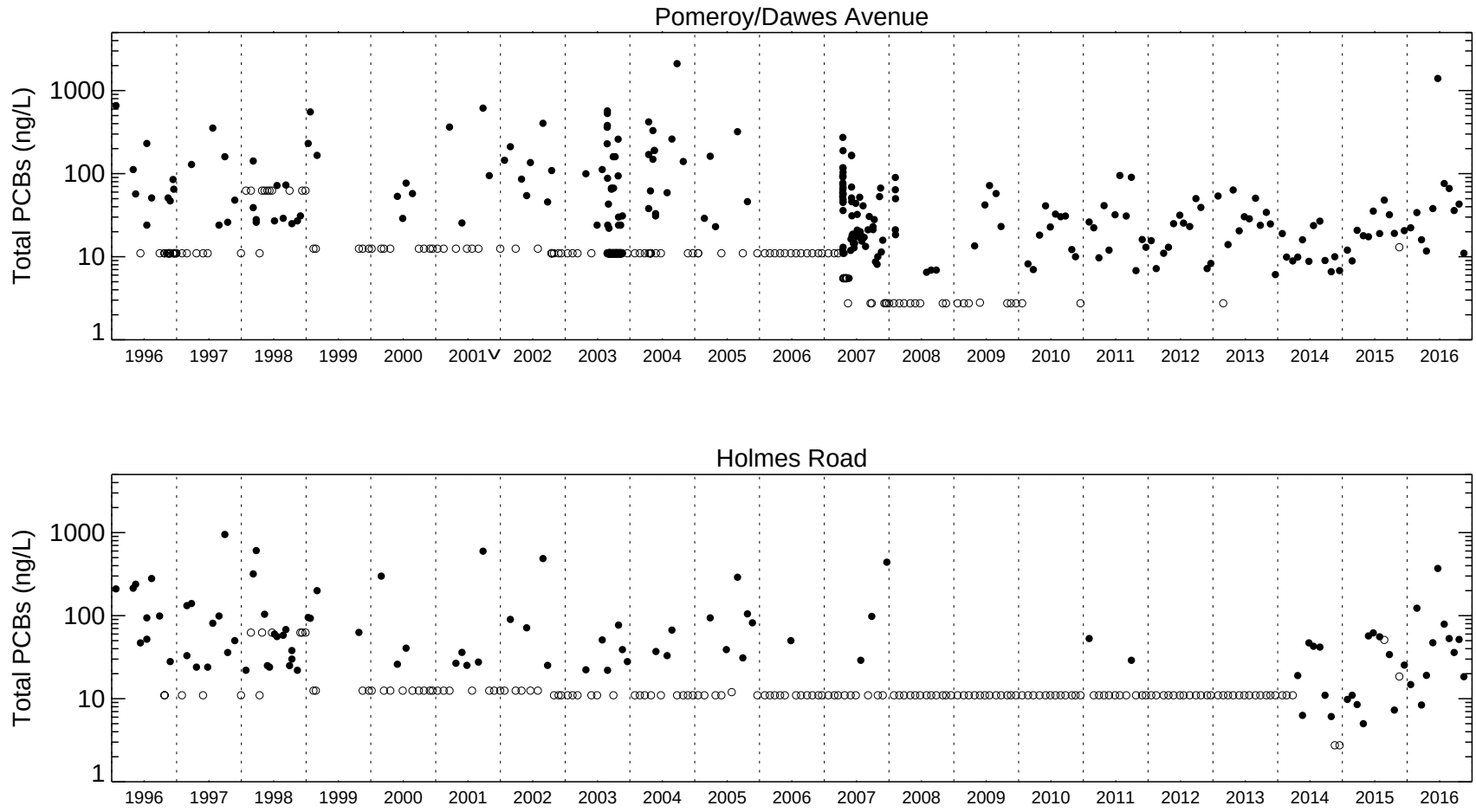
Figure 1-2
Housatonic River Map (Subreaches in Reaches 5 and 7)
Baseline Monitoring Plan
Housatonic River – Rest of River



Non-detects plotted as open symbols at half the value reported in database.
Graphic based on February 2017 data exchange
2016 only includes data collected through November.

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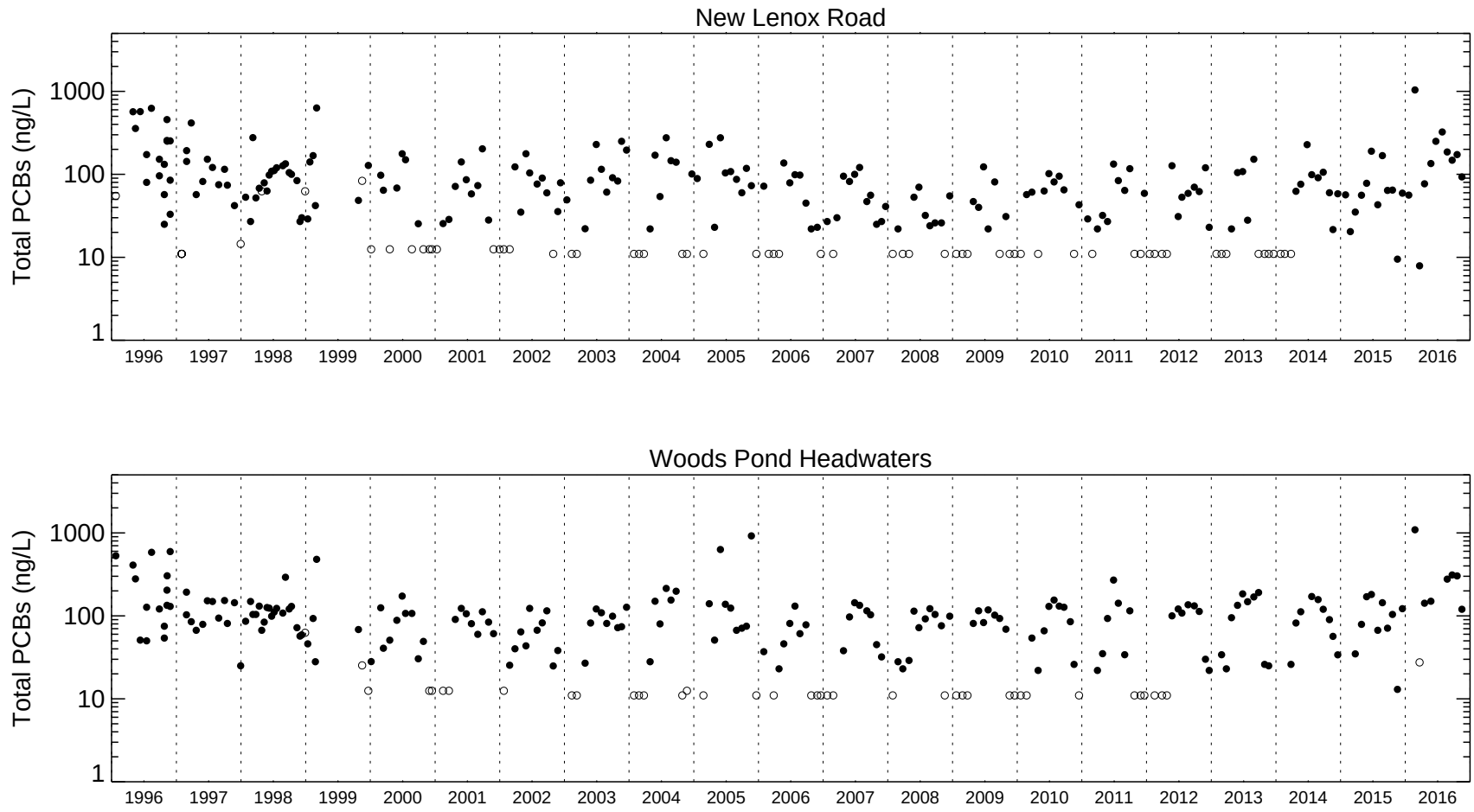
ANCHOR QEA

Figure 4-1a

Time Series of PCBs at Six Monthly Water Column Monitoring Locations from 1996 to 2016

Baseline Monitoring Plan
Housatonic River - Rest of River



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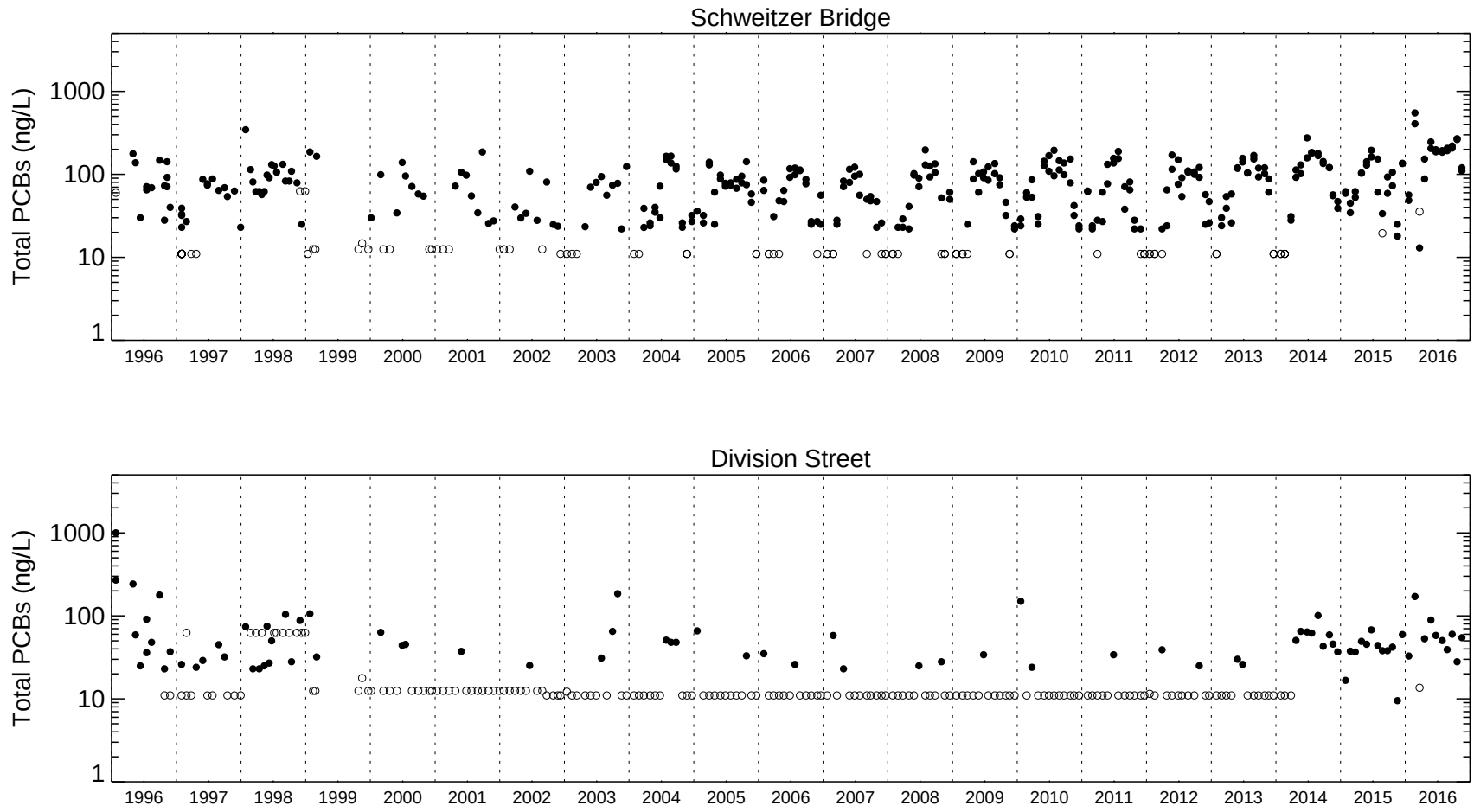
ANCHOR QEA

Figure 4-1b

Time Series of PCBs at Six Monthly Water Column Monitoring Locations from 1996 to 2016

Baseline Monitoring Plan
Housatonic River - Rest of River



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Graphic based on February 2017 data exchange
2016 only includes data collected through November.

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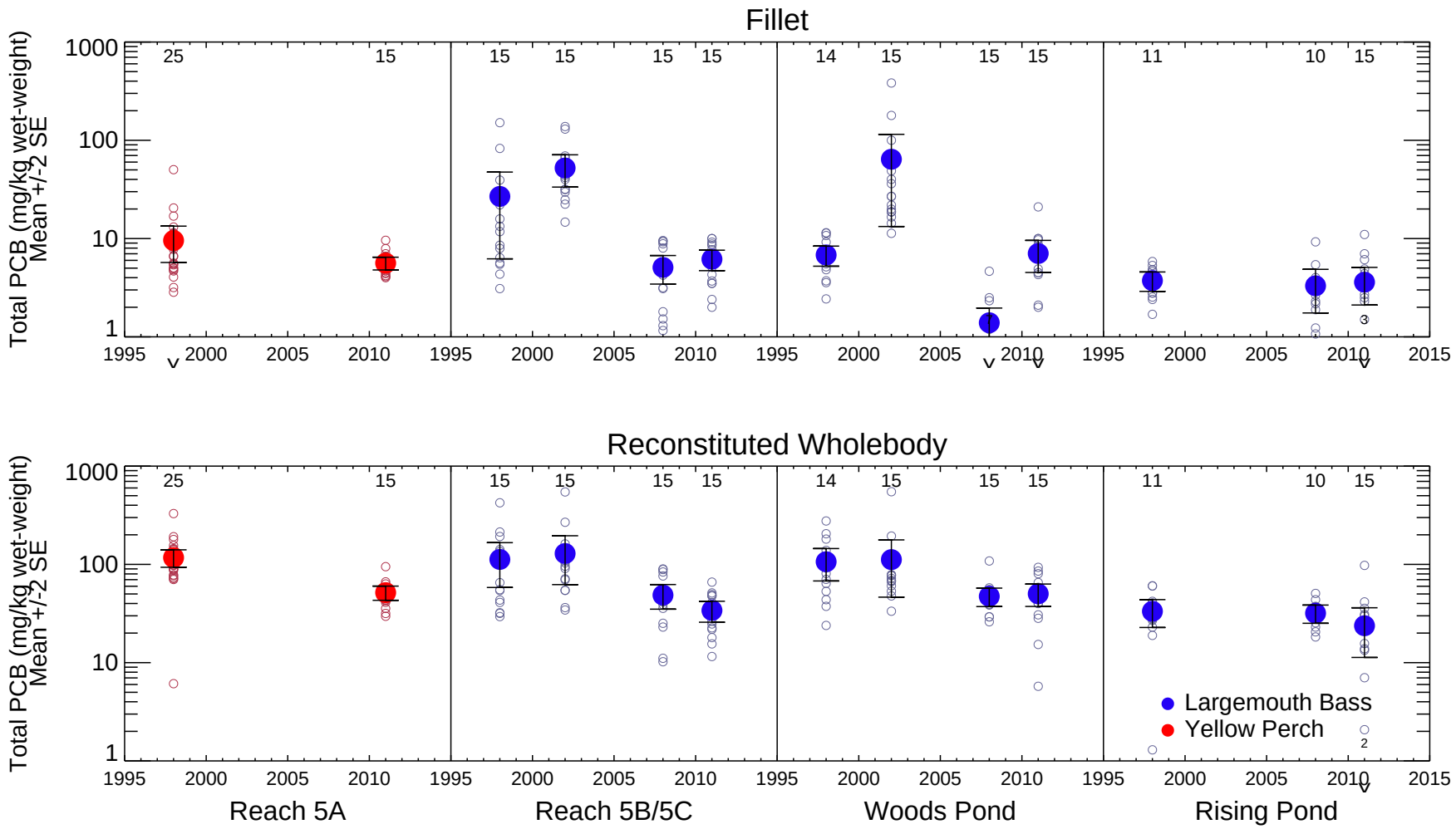
Figure 4-1c

Time Series of PCBs at Six Monthly Water Column Monitoring Locations from 1996 to 2016

Baseline Monitoring Plan
Housatonic River - Rest of River



Notes:
Posted numbers represent sample counts.
SE = standard error

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Figure 4-2a

Temporal and Spatial Trends in Adult Fish PCB Concentrations from Massachusetts Portion of Rest of River (Wet-weight)

Baseline Monitoring Plan
Housatonic River - Rest of River

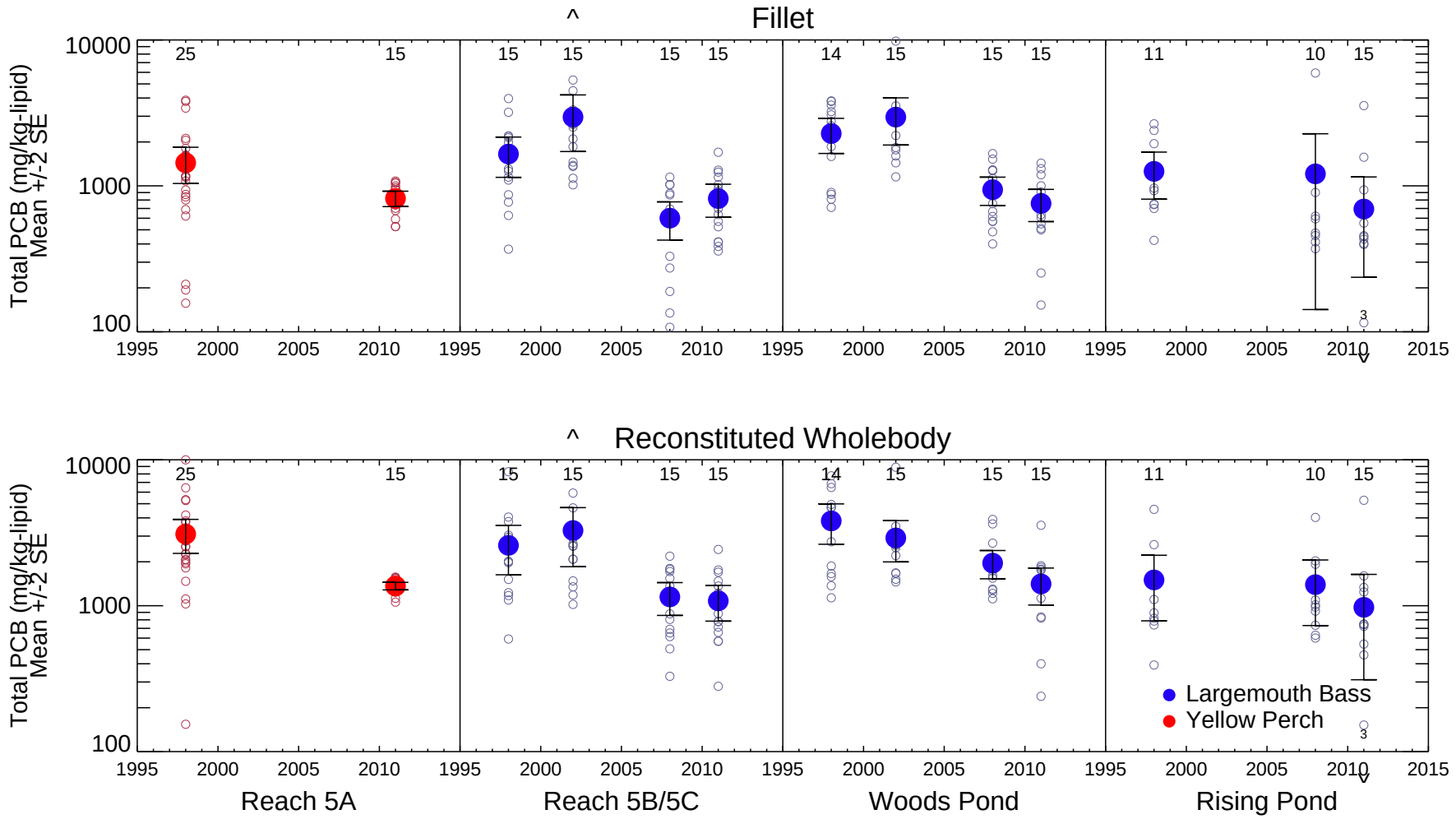

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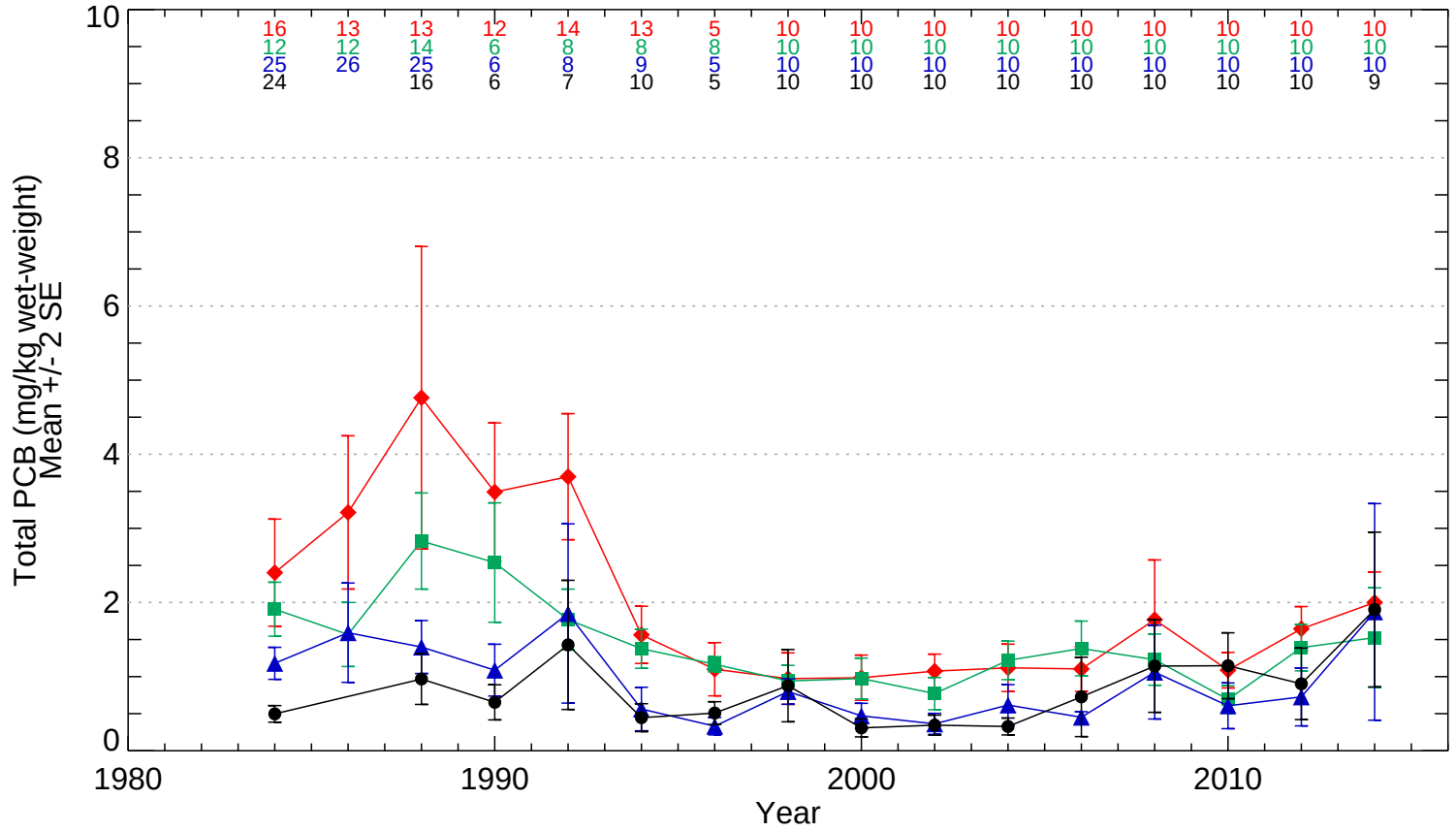
Figure 4-2b

Temporal and Spatial Trends in Adult Fish PCB Concentrations from Massachusetts Portion of Rest of River (Lipid-normalized)

Baseline Monitoring Plan
Housatonic River - Rest of River



Notes:
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SE = standard error

West Cornwall | Bulls Bridge | Lake Lillinonah | Lake Zoar

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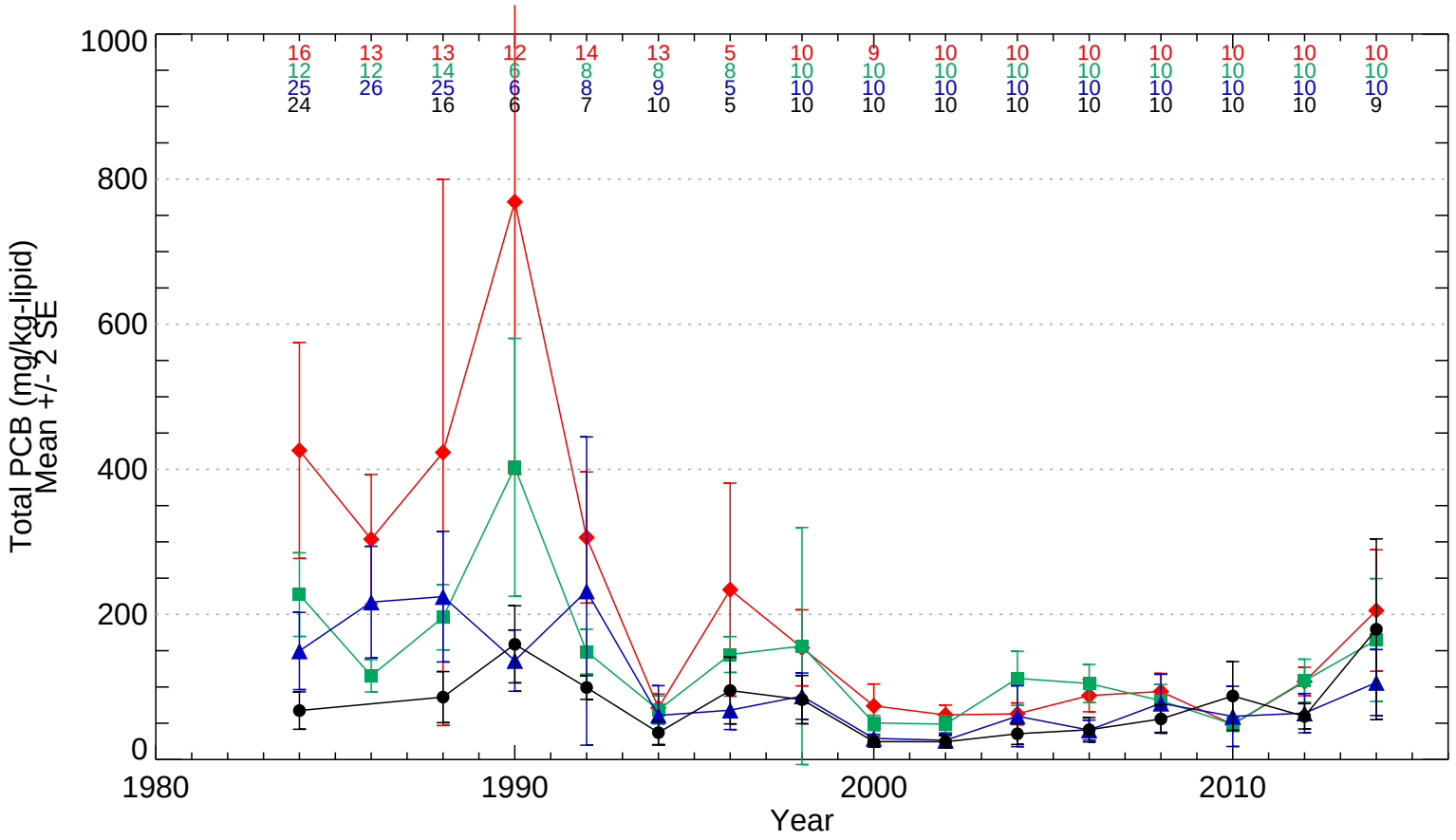
Figure 4-3a

Time Series of Annual Average Total PCB Concentrations in Smallmouth Bass Fillets Collected from Connecticut Portion of Rest of River (Wet-weight)

Baseline Monitoring Plan
Housatonic River - Rest of River



Notes:
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SE = standard error

West Cornwall | Bulls Bridge | Lake Lillinonah | Lake Zoar

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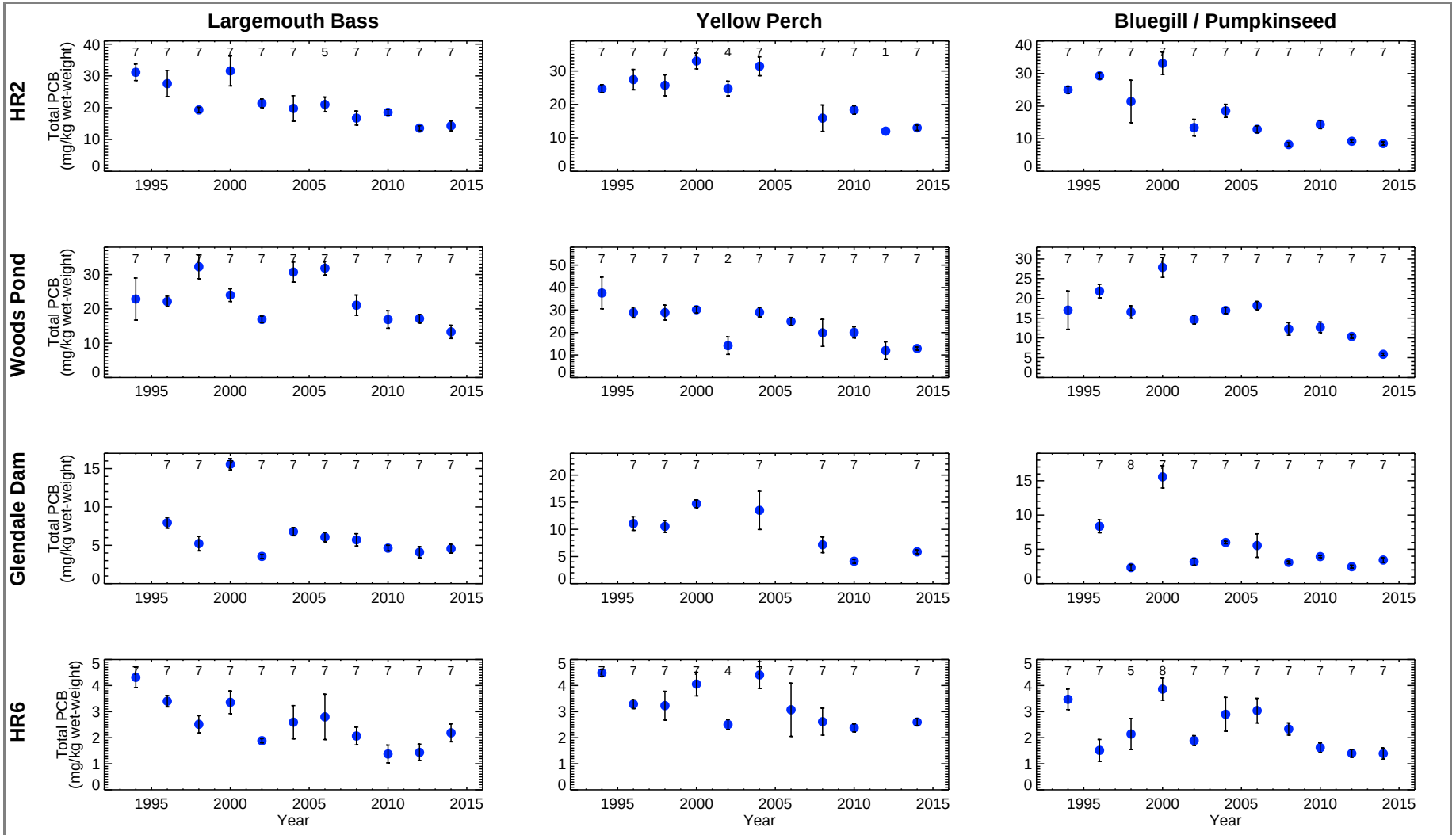
Figure 4-3b

Time Series of Annual Average Total PCB Concentrations in Smallmouth Bass Fillets Collected from Connecticut Portion of Rest of River (Lipid-normalized)

Baseline Monitoring Plan
Housatonic River - Rest of River



Note:
Data are shown as the mean +/- 2 standard errors.

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Figure 4-4a
Time Series of Annual Average Total PCB Concentrations in YoY Fish (Wet-weight)
Baseline Monitoring Plan
Housatonic River - Rest of River

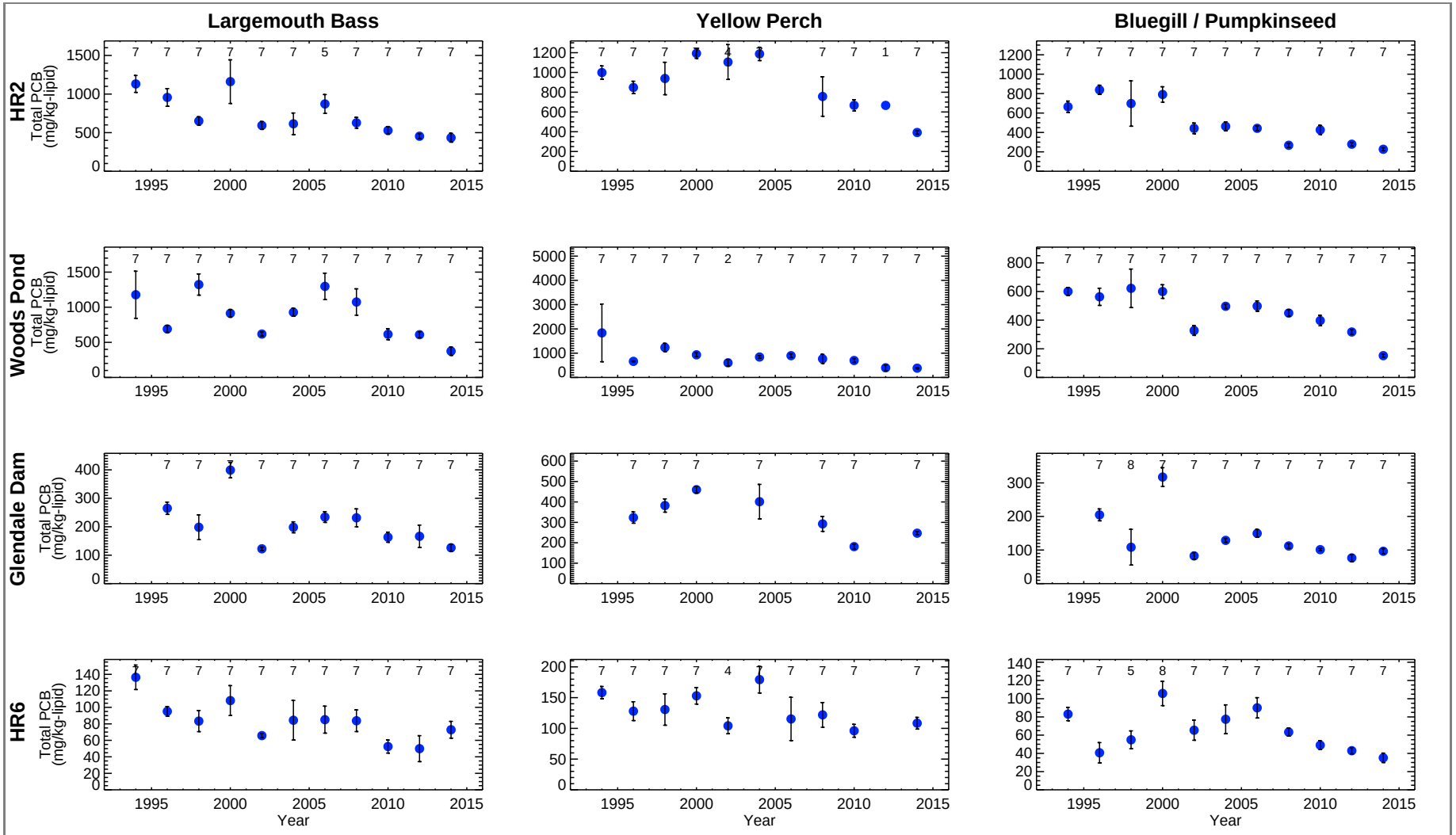

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Figure 4-4b

Time Series of Annual Average Total PCB Concentrations in YoY Fish (Lipid-normalized)

Baseline Monitoring Plan
Housatonic River - Rest of River

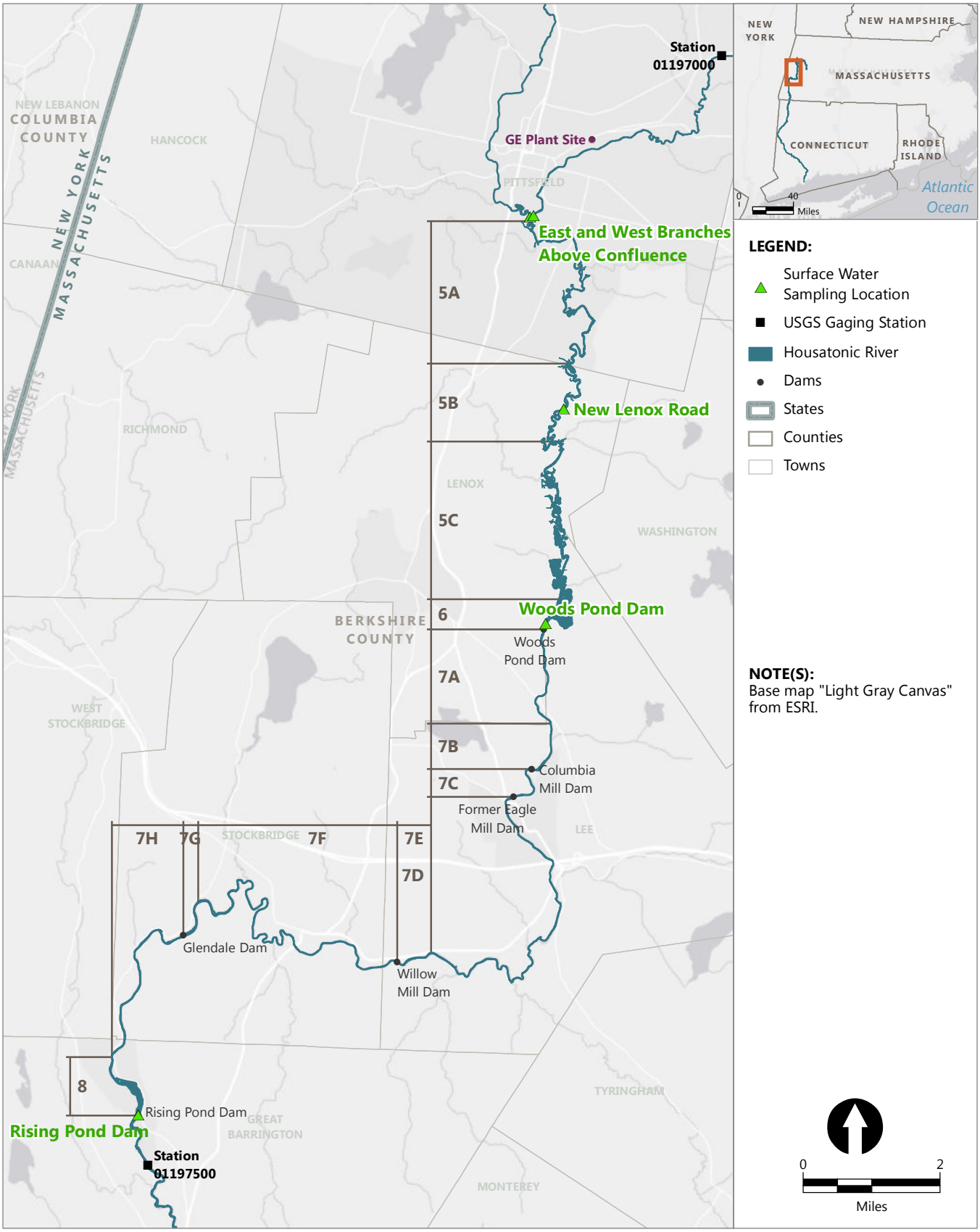

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Figure 5-1
Overview of Surface Water Sampling Locations
Baseline Monitoring Plan
Housatonic River – Rest of River

East and West Branches Above Confluence (manual surface grab, near center channel sample collected from shore, equal-volume composite)

Map Source: Bing Maps

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Figure 5-2a

Surface Water Sampling Locations (East and West Branches Above Confluence)

Baseline Monitoring Plan

Housatonic River – Rest of River

New Lenox Road (manual depth-integrated composite, two sub-sample locations collected from bridge)
Map Source: Bing Maps

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Figure 5-2b
Surface Water Sampling Locations (New Lenox Road)
Baseline Monitoring Plan
Housatonic River – Rest of River

Woods Pond (automated mid-depth composite collected from intakes at eastern and western wing walls)
Map Source: Bing Maps

Note: Flow gauging station location to be determined based on field survey

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Figure 5-2c
Surface Water Sampling Locations (Woods Pond)
Baseline Monitoring Plan
Housatonic River – Rest of River

Rising Pond (automated mid-depth composite collected from intakes at eastern and western wing walls)
Map Source: Bing Maps

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Figure 5-2d
Surface Water Sampling Locations (Rising Pond)
Baseline Monitoring Plan
Housatonic River – Rest of River

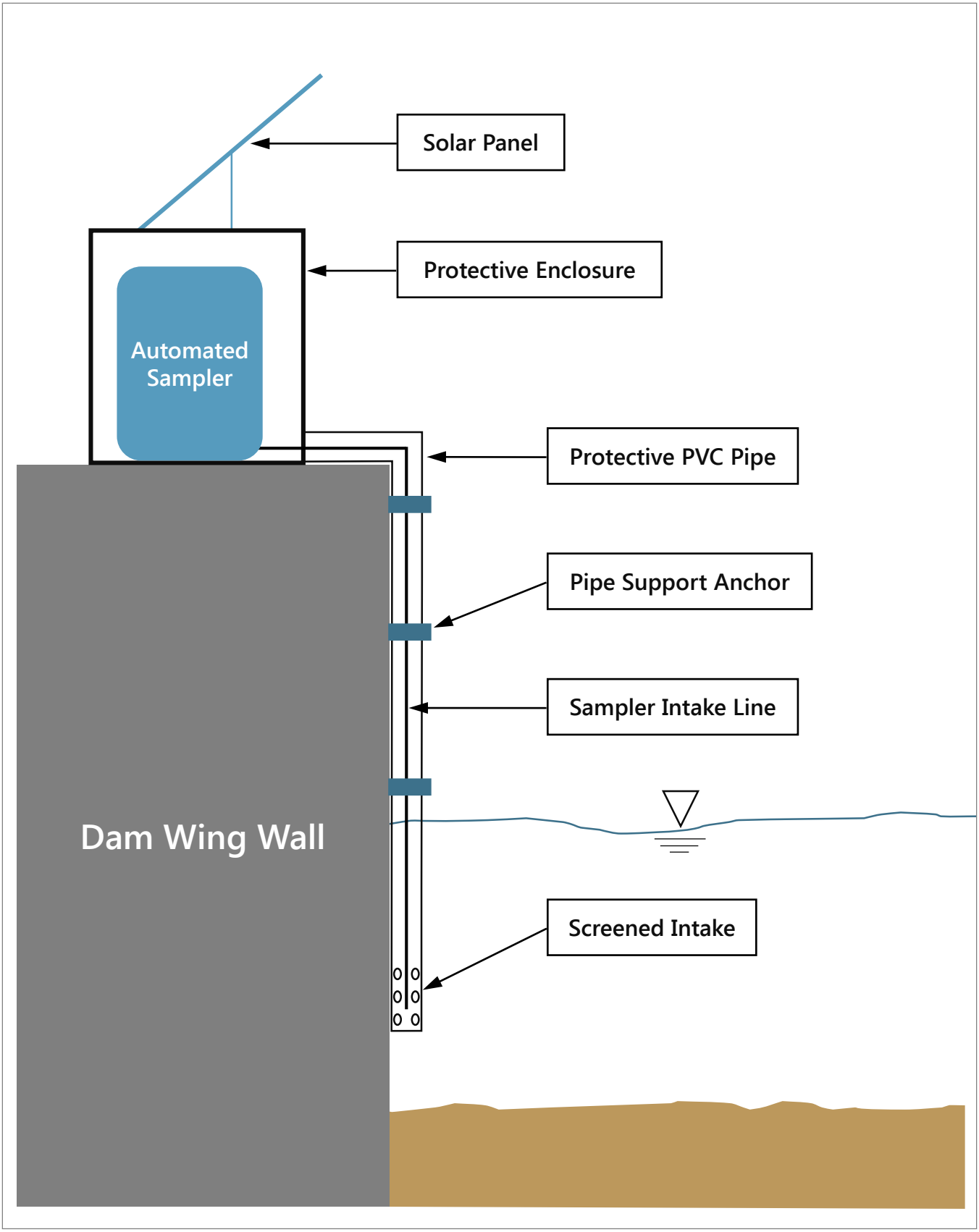

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Figure 5-3
Automated Station Schematic
Baseline Monitoring Plan
Housatonic River – Rest of River

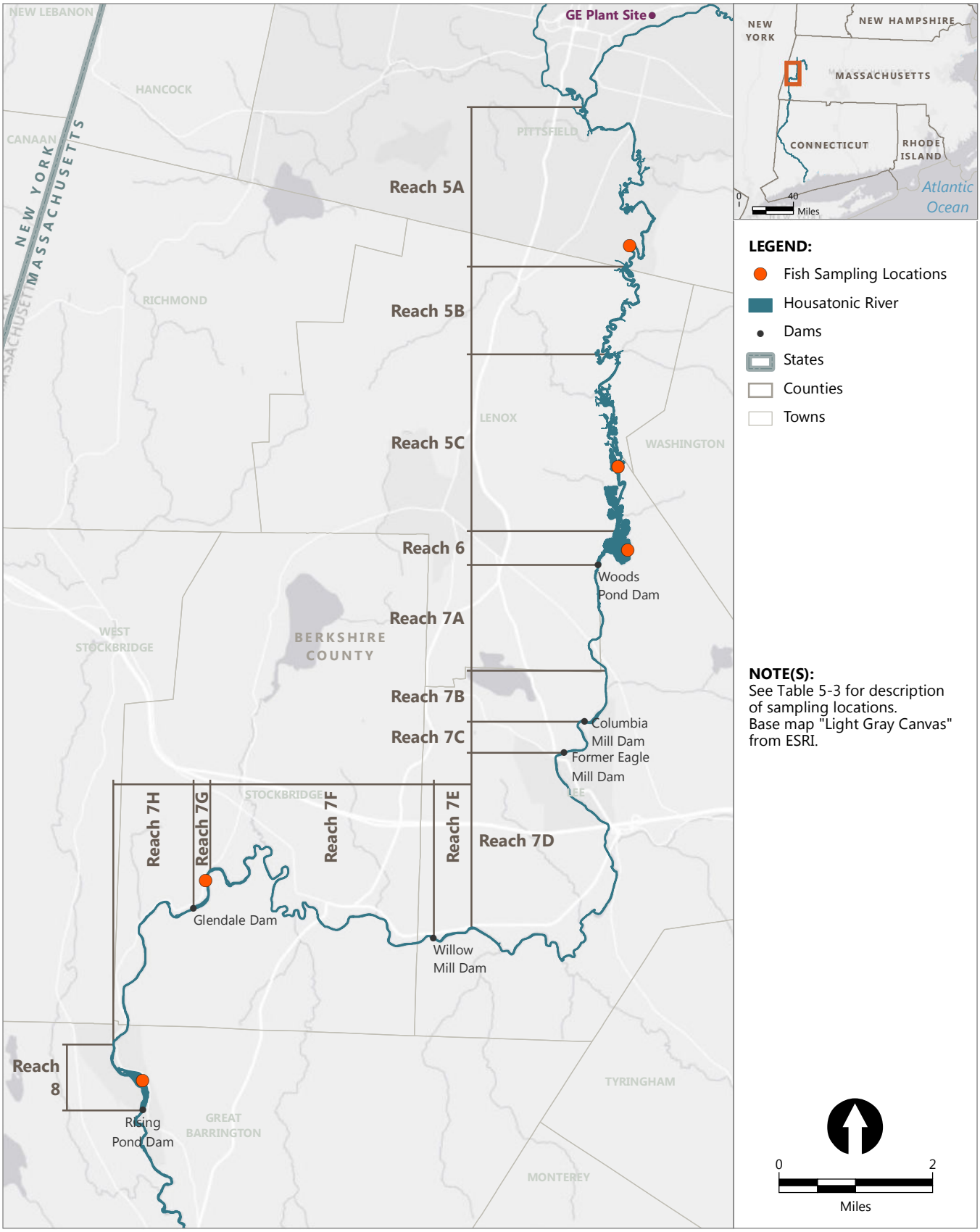

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Figure 5-4a
Fish Sampling Locations (Reaches 5 Through 8)
Baseline Monitoring Plan
Housatonic River – Rest of River

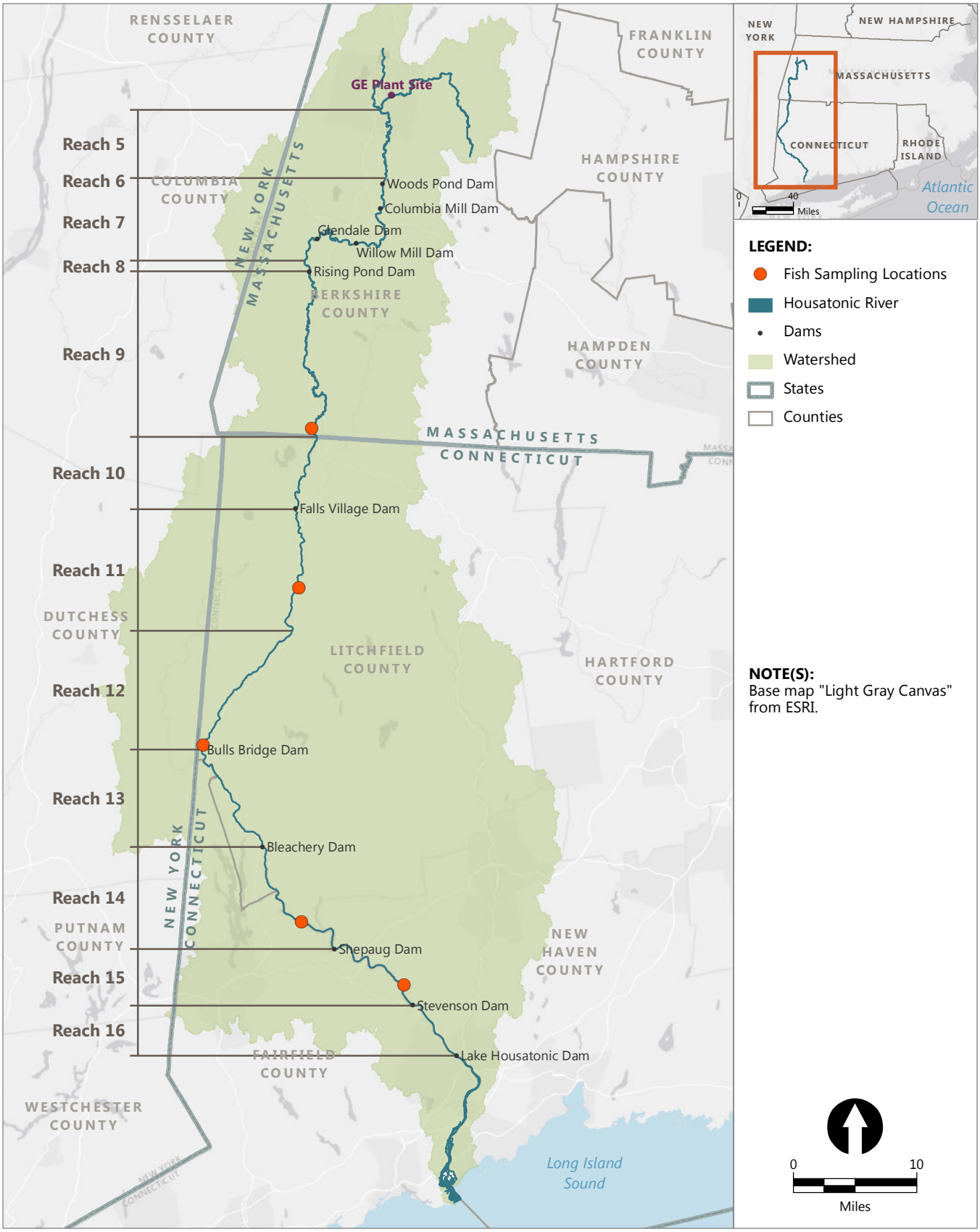

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Figure 5-4b
Fish Sampling Locations Downstream of Reach 8
Baseline Monitoring Plan
Housatonic River – Rest of River

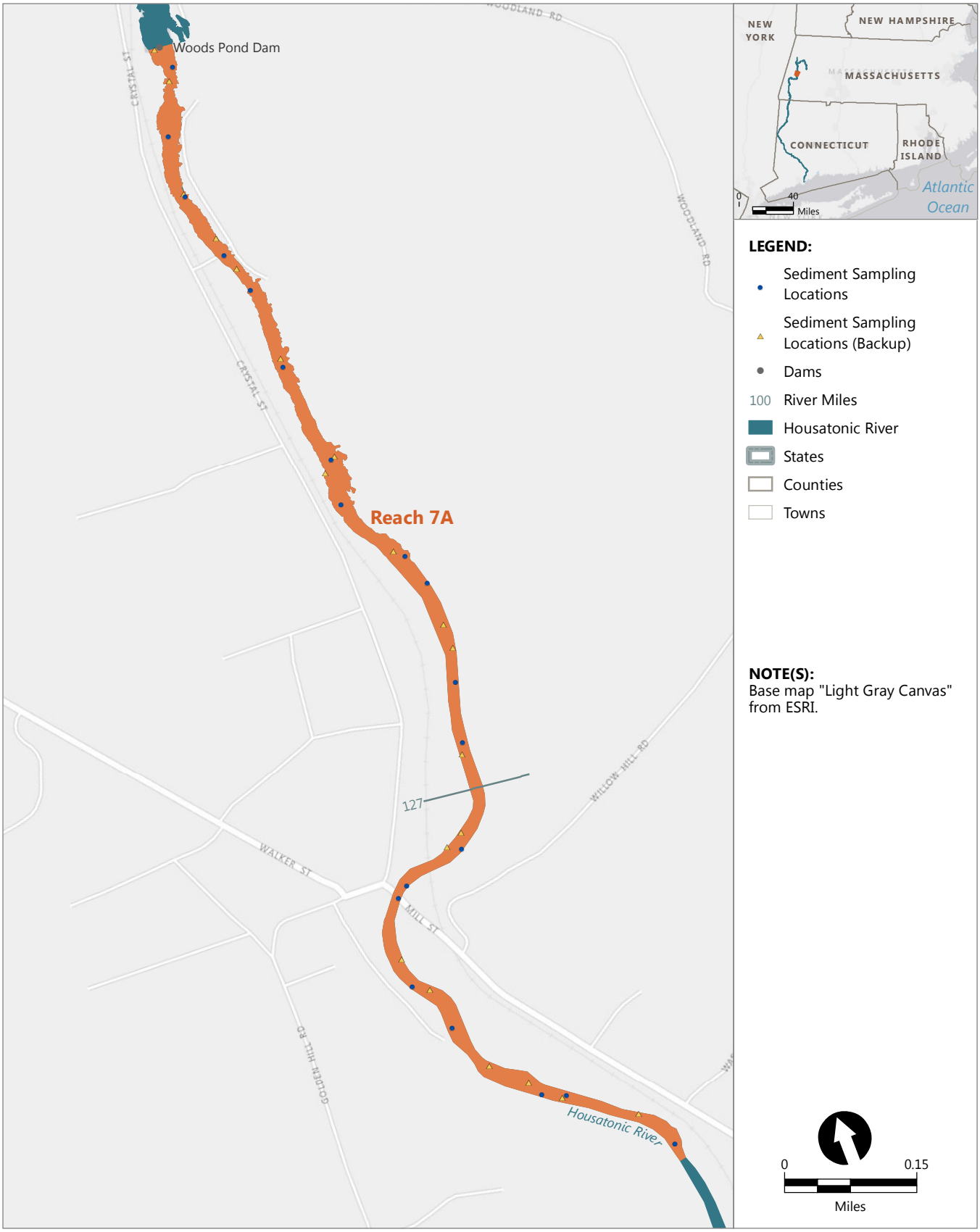

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Figure 5-5a
Sediment Sampling Locations (Reach 7A)
Baseline Monitoring Plan
Housatonic River – Rest of River

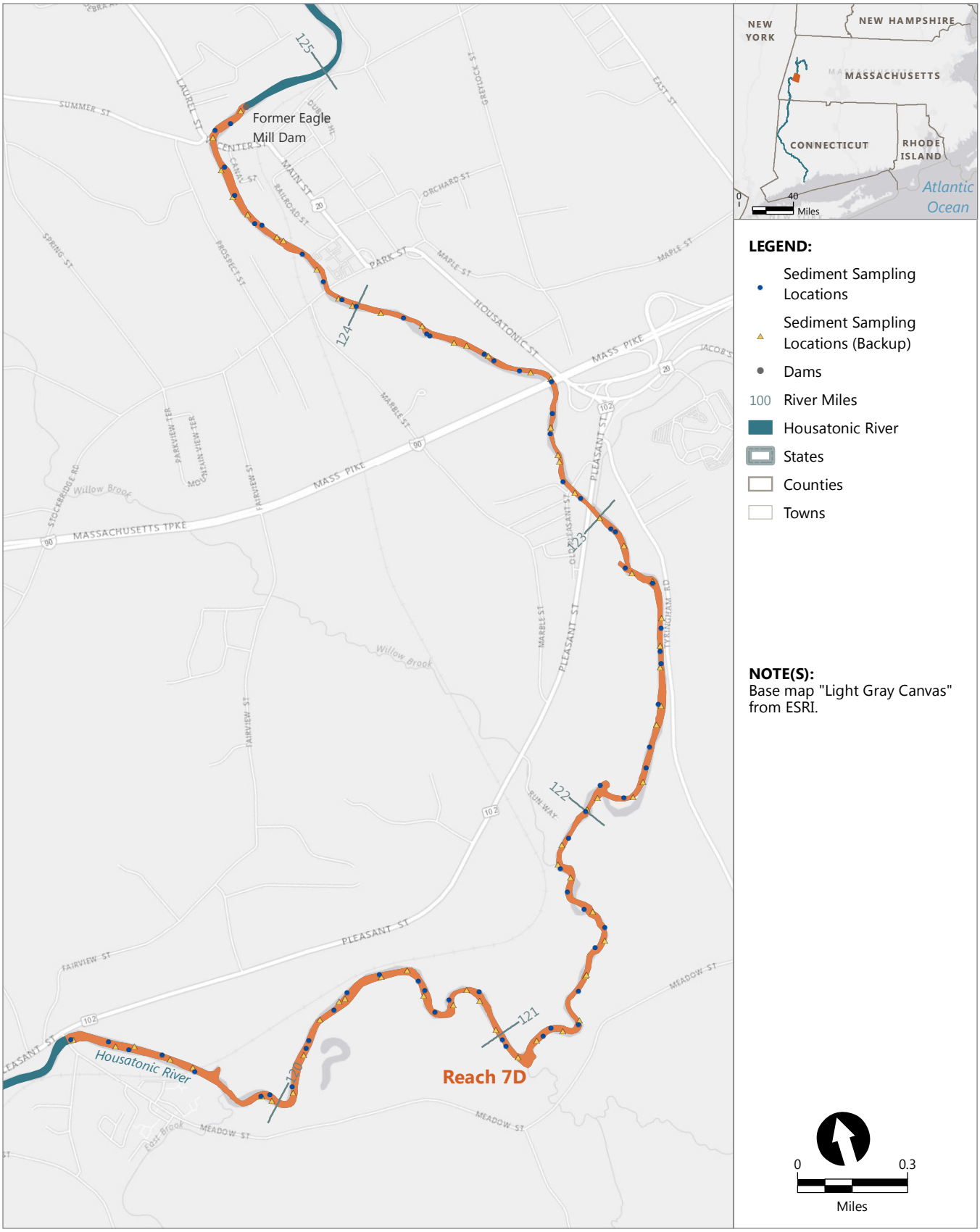

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Figure 5-5b
Sediment Sampling Locations (Reach 7D)
Baseline Monitoring Plan
Housatonic River – Rest of River

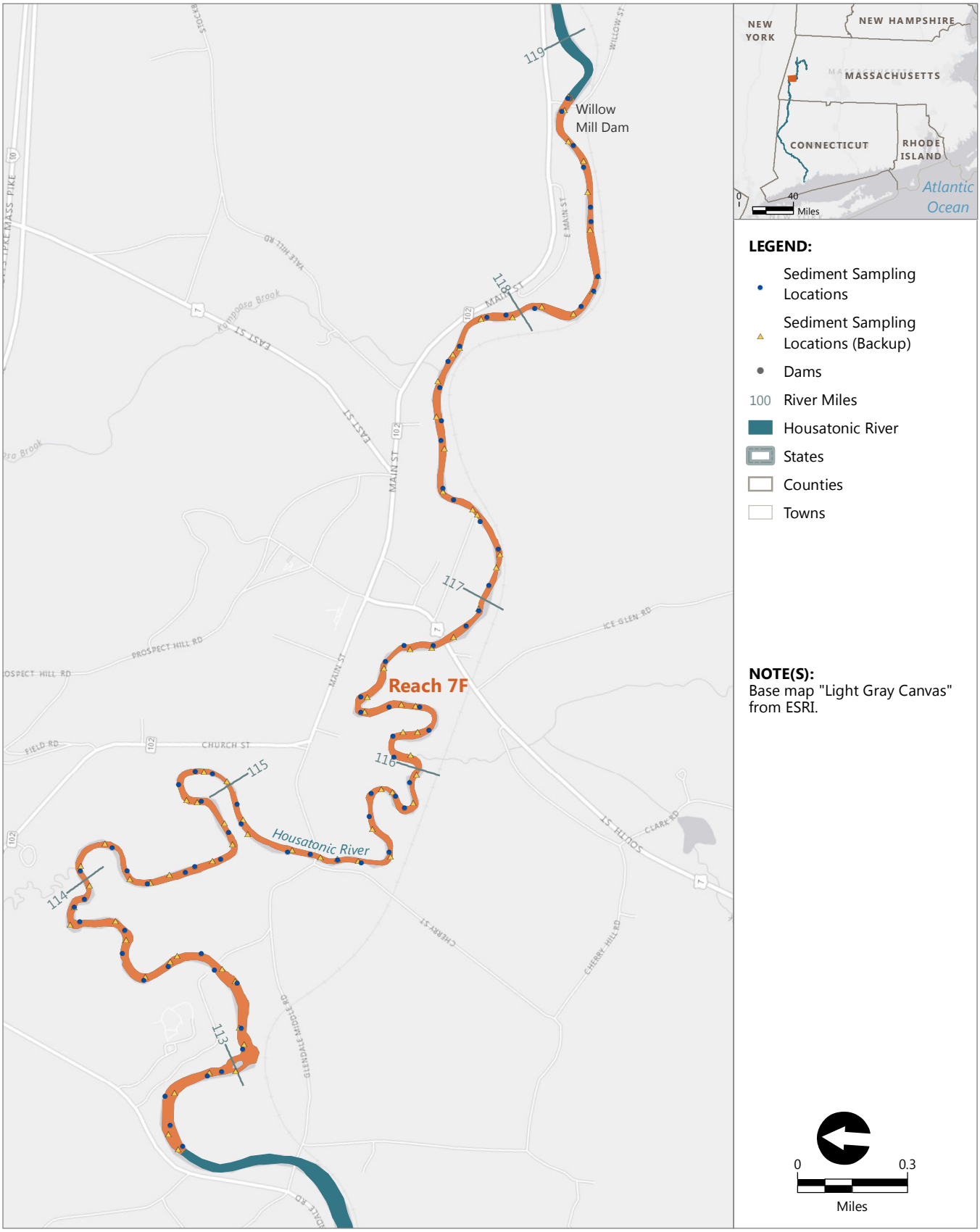

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Figure 5-5c
Sediment Sampling Locations (Reach 7F)
Baseline Monitoring Plan
Housatonic River – Rest of River

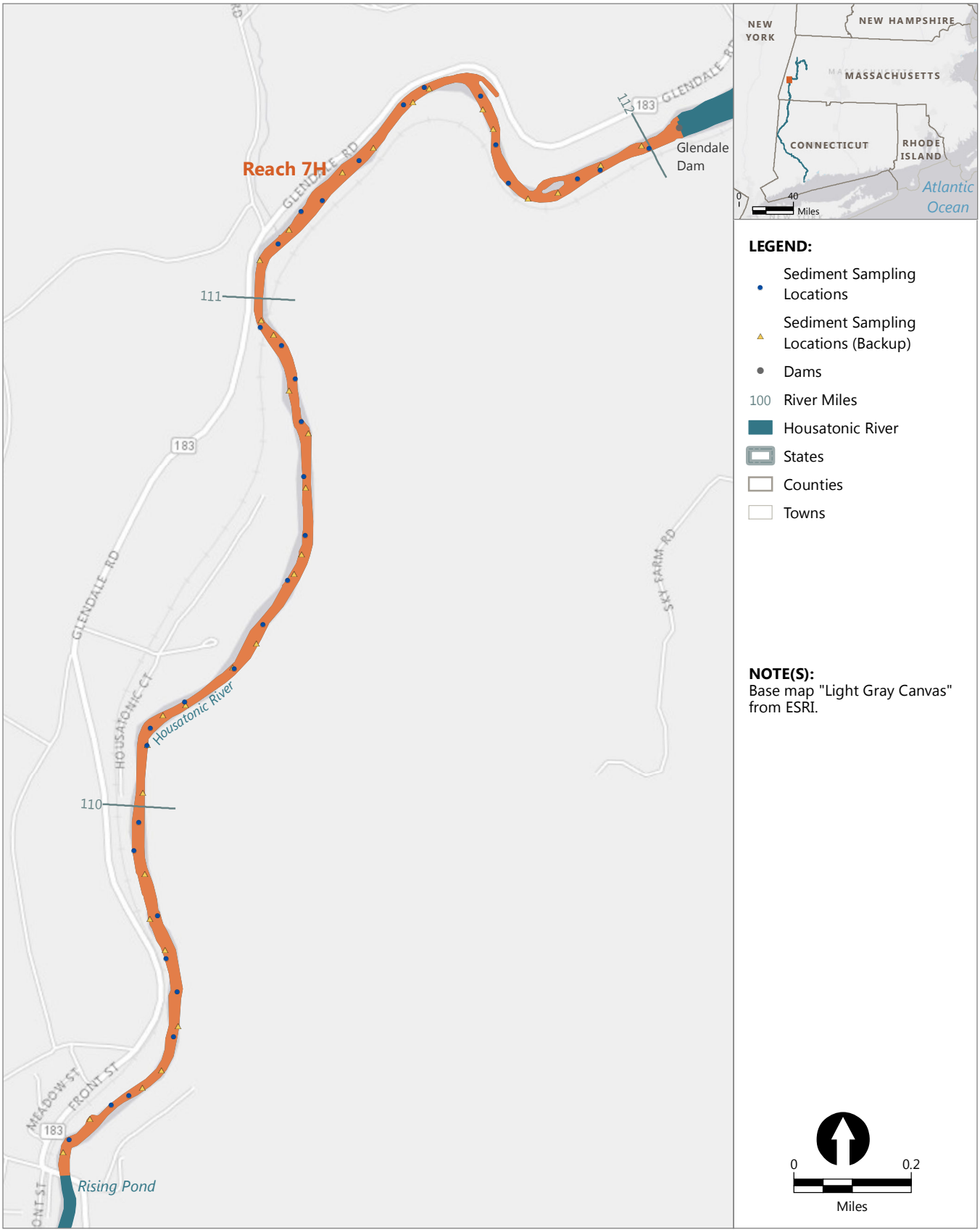

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Figure 5-5d
Sediment Sampling Locations (Reach 7H)
Baseline Monitoring Plan
Housatonic River – Rest of River

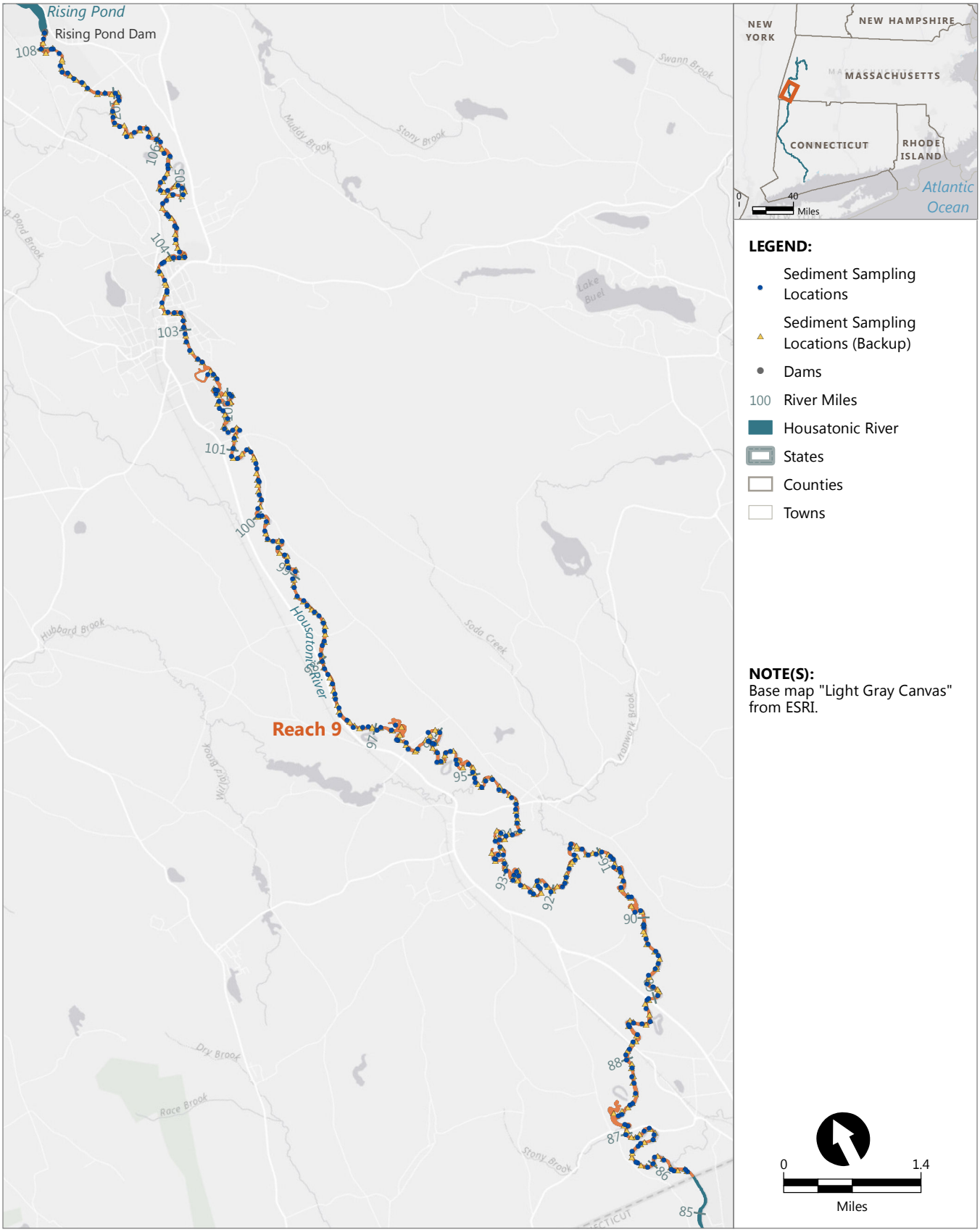

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Figure 5-5e
Sediment Sampling Locations (Reach 9)
Baseline Monitoring Plan
Housatonic River – Rest of River

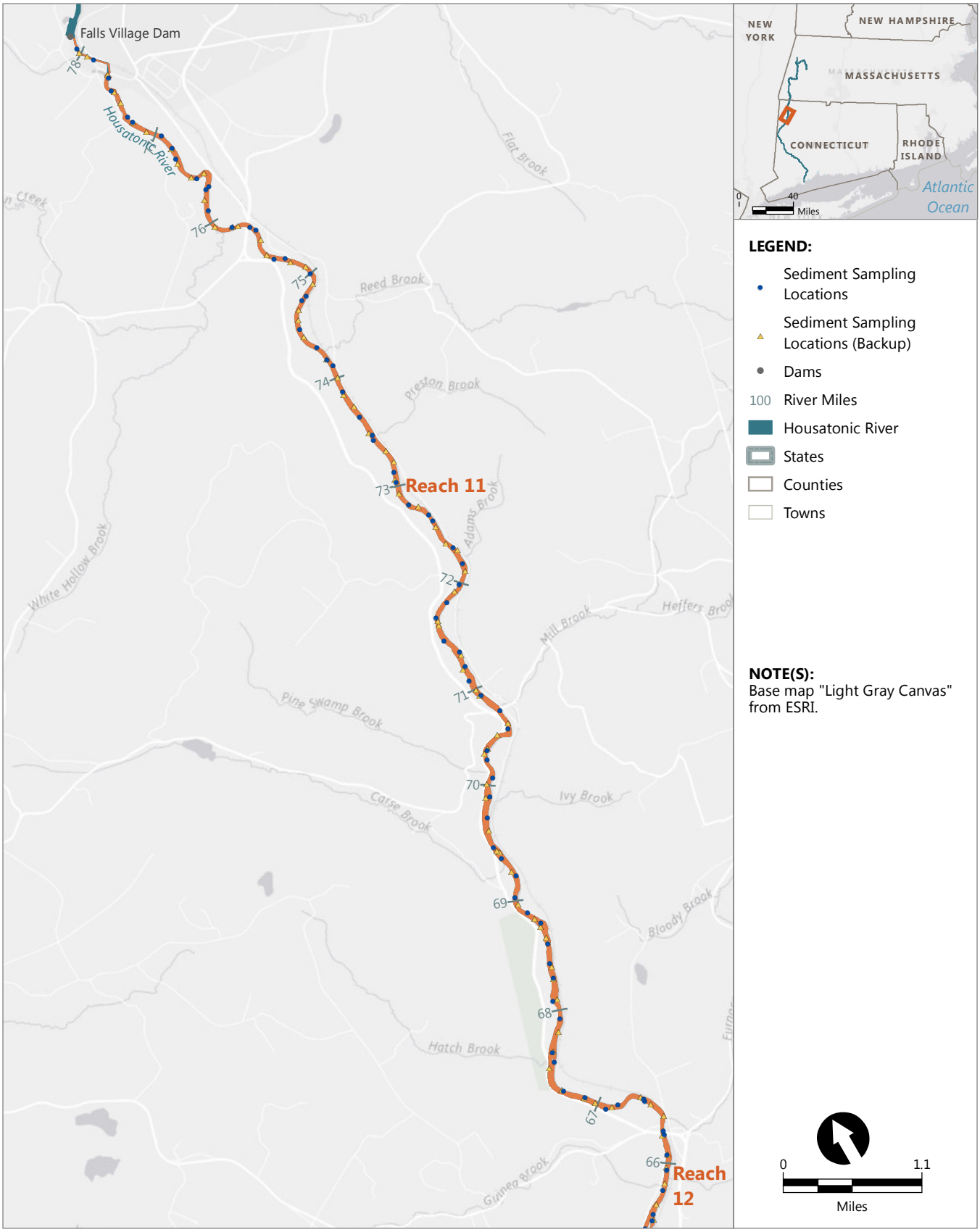

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Figure 5-5f
Sediment Sampling Locations (Reach 11)
Baseline Monitoring Plan
Housatonic River – Rest of River

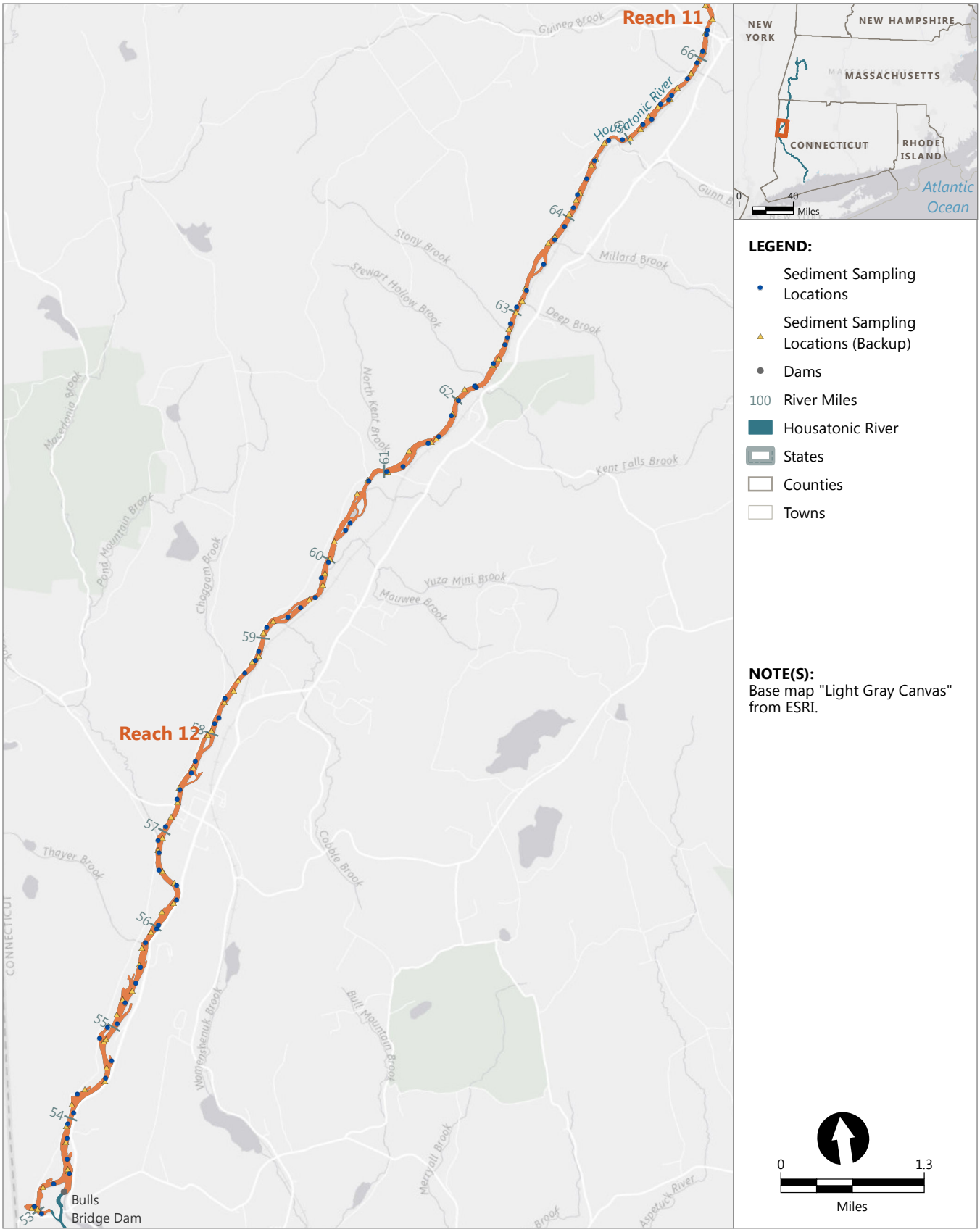

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Figure 5-5g
Sediment Sampling Locations (Bulls Bridge)
Baseline Monitoring Plan
Housatonic River – Rest of River

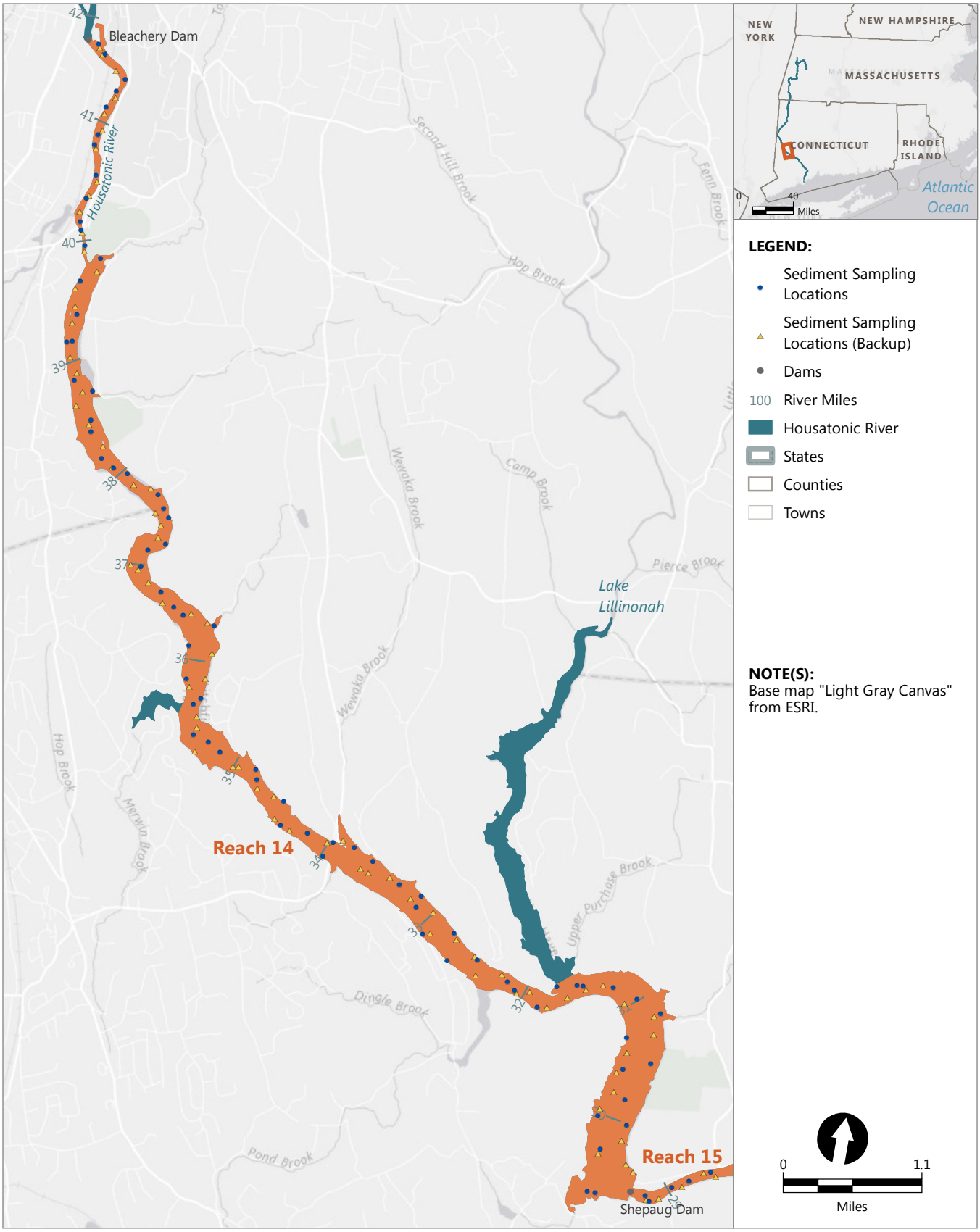

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Figure 5-5h
Sediment Sampling Locations (Lake Lillinonah)
Baseline Monitoring Plan
Housatonic River – Rest of River

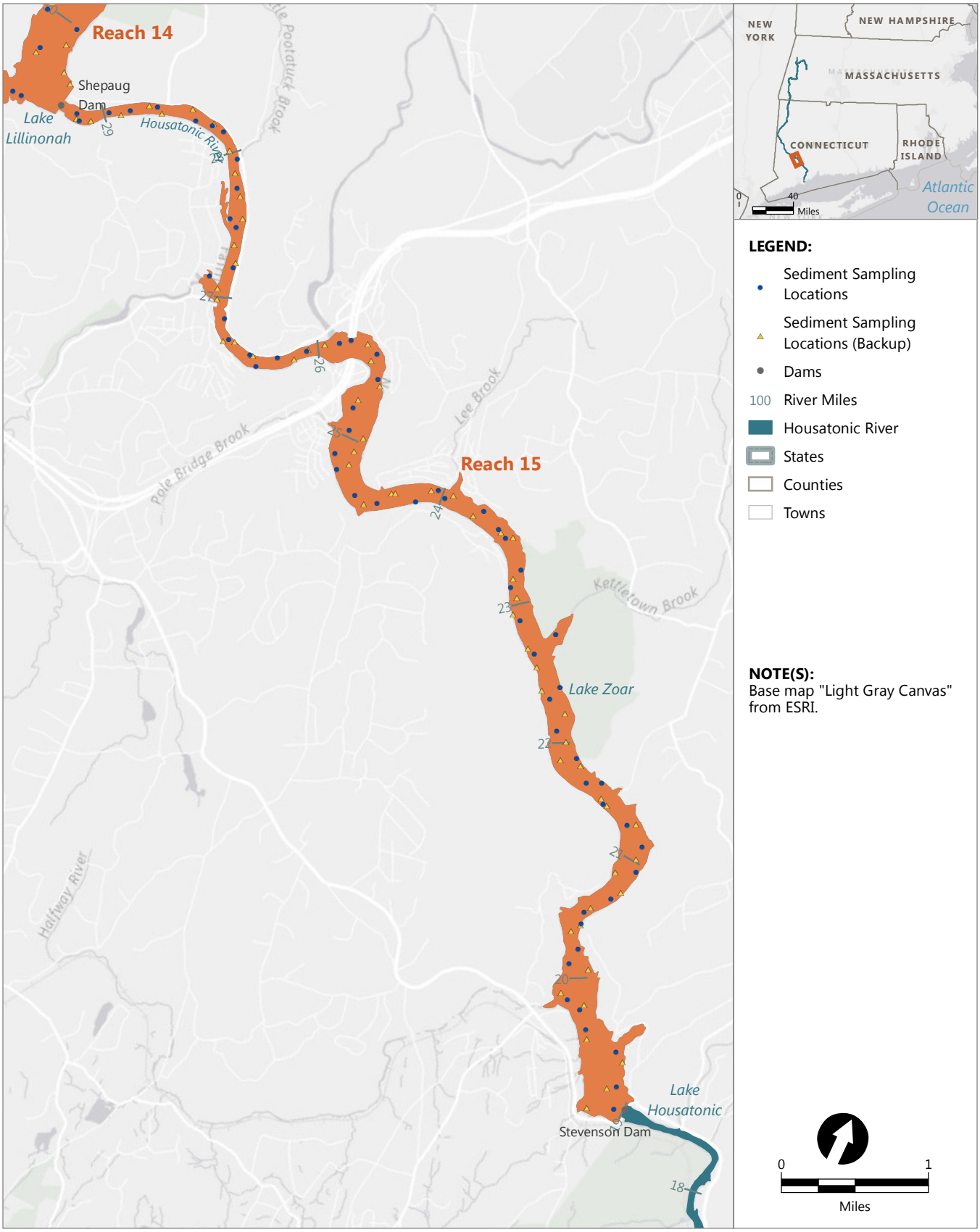

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Figure 5-5i
Sediment Sampling Locations (Lake Zoar)
Baseline Monitoring Plan
Housatonic River – Rest of River