



**U.S. Army
Corps of Engineers**

New England District
Concord, Massachusetts



**U.S. Environmental
Protection Agency**

New England Region
Boston, Massachusetts

REST OF RIVER SITE INVESTIGATION DATA REPORT

Volume I, Text

DCN: GE-080202-ABDK

August 2002

**General Electric (Ge)/Housatonic River Project
Pittsfield, Massachusetts**

Contract No. DACW33-00-D-0006

Task Order 0003

REST OF RIVER SITE INVESTIGATION DATA REPORT

VOLUME I — TEXT

**ENVIRONMENTAL REMEDIATION CONTRACT
GENERAL ELECTRIC (GE)/HOUSATONIC RIVER PROJECT
PITTSFIELD, MASSACHUSETTS**

Contract No. DACW33-00-D-0006, Task Order No. 0003
DCN: GE-080202-ABDK

Prepared for

**U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT**
Concord, Massachusetts

and

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND REGION**
Boston, Massachusetts

Prepared by

WESTON SOLUTIONS, INC.
West Chester, Pennsylvania 19380

August 2002

W.O. No. 20123.001.096.0635

TABLE OF CONTENTS

Section	Page
1. INTRODUCTION.....	1-1
1.1 OVERVIEW OF SAMPLING APPROACH	1-1
1.2 OVERVIEW OF ANALYTICAL PROGRAM	1-2
1.2.1 Overview of PCB Analyses	1-2
1.2.2 Overview of Other Analyses.....	1-2
1.3 OVERVIEW OF SUPPLEMENTAL INVESTIGATION DATA REPORT.....	1-2
1.3.1 Organization of this Report.....	1-2
1.3.2 Explanation of Tables	1-3
1.4 OVERVIEW OF THE QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROGRAM.....	1-5
1.4.1 Data Validation	1-5
1.4.2 PCB Stability and Inter-laboratory Studies.....	1-6
1.4.3 Field Duplicates	1-6
2. FIELD INVESTIGATIONS	2-1
2.1 SYSTEMATIC SAMPLING	2-3
2.1.1 1,500-Foot Transects (Reach 5).....	2-3
2.1.1.1 Program Description and Summary	2-3
2.1.1.2 Explanation of Differences	2-5
2.1.2 West Branch Transects	2-7
2.1.2.1 Program Description and Summary	2-7
2.1.2.2 Explanation of Differences	2-8
2.1.3 Channel Geometry/Modeling Transects (Reaches 5 and 6)	2-9
2.1.3.1 Program Description and Summary	2-9
2.1.3.2 Explanation of Differences	2-12
2.1.4 Sediment Characterization Cores.....	2-14
2.1.4.1 Program Description and Summary	2-14
2.1.4.2 Explanation of Differences	2-16
2.1.5 2,500-Foot Transects.....	2-17
2.1.5.1 Program Description and Summary	2-17
2.1.5.2 Explanation of Differences	2-18
2.1.6 Other Transect-Related Samples.....	2-20
2.1.6.1 Program Description and Summary	2-20
2.1.6.2 Explanation of Differences	2-21
2.2 DISCRETE SAMPLING	2-23
2.2.1 Human Health Risk Assessment Sampling.....	2-23
2.2.1.1 Introduction.....	2-23
2.2.1.2 Recreational Exposure (Reaches 5 and 6)	2-23
2.2.1.3 Residential Exposure (Reaches 5 and 6).....	2-30

TABLE OF CONTENTS (CONTINUED)

Section	Page
2.2.1.4	Commercial/Industrial Exposure (Reaches 5 and 6) 2-33
2.2.1.5	Agricultural Exposure (Reaches 5 and 6) 2-36
2.2.1.6	Exposure Areas (Reaches 7 Through 9) 2-40
2.2.2	Aggrading Bars and Terraces 2-43
2.2.2.1	Program Description and Summary 2-43
2.2.2.2	Explanation of Differences 2-44
2.2.3	Temporary and Permanent Pools 2-45
2.2.3.1	Program Description and Summary 2-45
2.2.3.2	Explanation of Differences 2-46
2.2.4	Sediment Cores 2-47
2.2.4.1	Non-Transect Sediment Cores 2-47
2.2.4.2	Grain Size Fractionation 2-48
2.2.4.3	Pore Water 2-50
2.2.4.4	Supplemental Pore Water 2-51
2.2.4.5	Radionuclide Dating 2-52
2.2.4.6	Explanation of Differences 2-53
2.2.5	Impoundments 2-54
2.2.5.1	Program Description and Summary 2-54
2.2.5.2	Explanation of Differences 2-55
2.2.6	Connecticut 2-56
2.2.6.1	Program Description and Summary 2-56
2.2.6.2	Explanation of Differences 2-57
2.2.7	Congeners 2-59
2.2.7.1	Low-Resolution Congener Sampling 2-59
2.2.7.2	High-Resolution Congener Sampling 2-61
2.2.8	Former Meanders 2-63
2.2.8.1	Program Description and Summary 2-63
2.2.8.2	Explanation of Differences 2-63
2.2.9	Benthic Invertebrate Community Evaluation 2-64
2.2.9.1	Sediment Sampling 2-64
2.2.9.2	Explanation of Differences 2-65
2.2.9.3	Biological Sampling 2-66
2.2.9.4	Explanation of Differences 2-68
2.2.10	Sediment Macroinvertebrate Toxicity, Bioaccumulation, and Stressor Identification Study 2-70
2.2.10.1	Sediment Sampling 2-70
2.2.10.2	Sediment Toxicity Testing 2-72
2.2.11	Freshwater Mussel Bioaccumulation and Growth 2-75
2.2.11.1	Sediment Sampling 2-75
2.2.11.2	Biota Sampling 2-77
2.2.12	Amphibian Toxicity 2-78

TABLE OF CONTENTS (CONTINUED)

Section	Page
2.2.12.1	Sediment Sampling 2-78
2.2.12.2	Frog Reproduction and Development Study (Leopard Frog) 2-79
2.2.12.3	Study of Amphibian Reproductive and Developmental Success within Vernal Pools (Wood Frog) 2-81
2.2.12.4	Bullfrog Tissue Analysis 2-83
2.2.13	Fish Collection Areas 2-87
2.2.13.1	Sediment Sampling 2-87
2.2.13.2	Biota 2-89
2.2.14	Tree Swallow Study 2-92
2.2.14.1	Sediment and Soil Sampling 2-92
2.2.14.2	Biological Sampling 2-94
2.2.15	Soil Invertebrate Study 2-96
2.2.15.1	Soil Sampling 2-96
2.2.15.2	Tissue Sampling 2-97
2.2.16	Small Mammal Study 2-99
2.2.16.1	Soil Sampling 2-99
2.2.16.2	Biological Study 2-100
2.2.17	Macrophytes, Filamentous Algae, Periphyton, and Plankton/Detritus Study 2-103
2.2.17.1	Program Description and Summary 2-103
2.2.17.2	Explanation of Differences 2-106
2.2.18	Rare Plants and Natural Communities Survey 2-108
2.2.18.1	Program Description and Summary 2-108
2.2.18.2	Explanation of Differences 2-108
2.2.19	Dragonfly Survey 2-109
2.2.19.1	Program Description and Summary 2-109
2.2.19.2	Explanation of Differences 2-110
2.2.20	Avian Field Survey 2-111
2.2.20.1	Program Description and Summary 2-111
2.2.20.2	Explanation of Differences 2-112
2.2.21	River Otter, Mink, and Bat Surveys 2-113
2.2.21.1	Program Description and Summary 2-113
2.2.21.2	Explanation of Differences 2-114
2.2.22	Dietary Exposure of Mink 2-116
2.2.22.1	Program Description and Summary 2-116
2.2.22.2	Explanation of Differences 2-118
2.2.23	Crayfish Tissue Analysis 2-119
2.2.23.1	Program Description and Summary 2-119
2.2.23.2	Explanation of Differences 2-120

TABLE OF CONTENTS (CONTINUED)

Section	Page
2.2.24 Reptile and Amphibian Survey	2-121
2.2.24.1 Program Description and Summary	2-121
2.2.24.2 Explanation of Differences	2-121
2.2.25 Waterfowl Collection and Tissue Analysis.....	2-122
2.2.25.1 Program Description and Summary	2-122
2.2.25.2 Explanation of Differences	2-123
2.2.26 Dairy Land Use/Practice Investigation	2-124
2.2.26.1 Program Description and Summary	2-124
2.2.26.2 Explanation of Differences	2-124
2.2.27 June 2000 Flood Sampling.....	2-125
2.2.27.1 Program Description and Summary	2-125
2.2.27.2 Explanation of Differences	2-126
2.2.28 Discretionary Sampling	2-127
2.2.28.1 Program Description	2-127
2.2.28.2 Explanation of Data Differences.....	2-128
2.2.29 Air Sampling.....	2-129
2.2.29.1 Program Description and Summary	2-129
2.2.29.2 Explanation of Differences	2-129
2.3 WATER QUALITY SAMPLING AND MODELING STUDIES.....	2-130
2.3.1 Surface Water Sampling – Monthly	2-130
2.3.1.1 Program Description and Summary	2-130
2.3.1.2 Explanation of Differences	2-131
2.3.2 Supplemental Surface Water Study	2-133
2.3.2.1 Program Description and Summary	2-133
2.3.2.2 Explanation of Differences	2-134
2.3.3 Water Column Profile(s) for Woods Pond.....	2-135
2.3.3.1 Program Description and Summary	2-135
2.3.3.2 Explanation of Differences	2-135
2.3.4 Stormflow Sampling.....	2-136
2.3.4.1 Program Description and Summary	2-136
2.3.4.2 Explanation of Differences	2-139
2.3.5 Flow Monitoring.....	2-140
2.3.5.1 Program Description and Summary	2-140
2.3.5.2 Explanation of Differences	2-141
2.3.6 River Channel Geometry Measurements.....	2-142
2.3.6.1 Program Description and Summary	2-142
2.3.6.2 Explanation of Differences	2-142
2.3.7 Vertical Definition Cores.....	2-143
2.3.7.1 Program Description and Summary	2-143
2.3.7.2 Explanation of Differences	2-145
2.3.8 Sediment Microscopy	2-146

TABLE OF CONTENTS (CONTINUED)

Section	Page
2.3.8.1	Program Description and Summary 2-146
2.3.8.2	Explanation of Differences 2-146
2.3.9	Toe Pins 2-147
2.3.9.1	Program Description and Summary 2-147
2.3.9.2	Explanation of Differences 2-147
2.3.10	River Channel Resurveys 2-148
2.3.10.1	Program Description and Summary 2-148
2.3.10.2	Explanation of Differences 2-148
2.3.11	Additional Velocity Measurements 2-149
2.3.11.1	Program Description and Summary 2-149
2.3.11.2	Explanation of Differences 2-149
2.3.12	Additional Stormflow Monitoring (Supplemental Modeling Study) 2-150
2.3.12.1	Program Description and Summary 2-150
2.3.12.2	Explanation of Differences 2-151
2.3.13	Sediment Flume Studies 2-152
2.3.13.1	Program Description and Summary 2-152
2.3.13.2	Explanation of Differences 2-152
2.3.14	Meandering and Bank Erosion Study 2-153
2.3.14.1	Program Description and Summary 2-153
2.3.14.2	Explanation of Differences 2-154
2.3.15	Vegetative Stem Counts 2-155
2.3.15.1	Program Description and Summary 2-155
2.3.15.2	Explanation of Differences 2-155

LIST OF TABLES

Title	Page
Table 1.4.3-1 Summary of Field Duplicates.....	1-7
Table 2.1.1-1 Sampling Summary – 1,500-Foot Transects.....	2-4
Table 2.1.1-2 Analyses Summary – 1,500-Foot Transects.....	2-5
Table 2.1.2-1 Sampling Summary – West Branch Transects.....	2-7
Table 2.1.2-2 Analysis Summary – West Branch Transects.....	2-8
Table 2.1.3-1 Sampling Summary – Modeling Transects, Reach 5.....	2-10
Table 2.1.3-2 Sampling Summary – Modeling Transects, Reach 6.....	2-10
Table 2.1.3-3 Analysis Summary – Modeling Transects, Reach 5.....	2-11
Table 2.1.3-4 Analysis Summary – Modeling Transects, Reach 6.....	2-11
Table 2.1.4-1 Sampling Summary – Sediment Characterization Cores, Reach 6.....	2-14
Table 2.1.4-2 Sampling Summary – Sediment Characterization Cores, Reach 8.....	2-15
Table 2.1.4-3 Analysis Summary – Sediment Characterization Cores, Reach 6.....	2-15
Table 2.1.4-4 Analysis Summary – Sediment Characterization Cores, Reach 8.....	2-16
Table 2.1.5-1 Sampling Summary – 2,500-Foot Transects.....	2-17
Table 2.1.5-2 Analysis Summary – 2,500-Foot Transects.....	2-18
Table 2.1.6-1 Sampling Summary – Other Transects, Reach 6.....	2-20
Table 2.1.6-2 Sampling Summary – Other Transects, Reach 8.....	2-21
Table 2.1.6-3 Analysis Summary – Other Transects, Reach 6.....	2-21
Table 2.2.1-1 Sampling Summary by Recreational Exposure Area.....	2-25
Table 2.2.1-2 Summary of Analyses by Exposure Area: Human Risk Recreational.....	2-26
Table 2.2.1-3 Sampling Summary – Human Health Risk Residential, Reach 5.....	2-31
Table 2.2.1-4 Sampling Summary – Human Health Risk Residential, Reach 6.....	2-31

**LIST OF TABLES
(CONTINUED)**

Title	Page
Table 2.2.1-5 Analysis Summary – Human Health Risk Residential, Reach 5.....	2-32
Table 2.2.1-6 Analysis Summary – Human Health Risk Residential, Reach 6.....	2-32
Table 2.2.1-7 Sampling Summary – Human Health Risk Commercial/Industrial	2-34
Table 2.2.1-8 Analysis Summary – Human Health Risk Commercial/Industrial	2-35
Table 2.2.1-9 Sampling Summary – Agricultural.....	2-38
Table 2.2.1-10 Analysis Summary – Agricultural.....	2-39
Table 2.2.1-11 Sampling Summary – Exposure Areas, Reaches 7 through 9.....	2-41
Table 2.2.1-12 Analysis Summary – Exposure Areas, Reaches 7 through 9	2-41
Table 2.2.2-1 Sampling Summary – Aggrading Bars and Terraces	2-43
Table 2.2.2-2 Analysis Summary – Aggrading Bars and Terraces	2-44
Table 2.2.3-1 Sampling Summary – Temporary and Permanent Pools.....	2-45
Table 2.2.3-2 Analysis Summary – Temporary and Permanent Pools.....	2-46
Table 2.2.4-1 Sampling Summary – Non-Transect Sediment Cores.....	2-47
Table 2.2.4-2 Analysis Summary – Non-Transect Sediment Cores	2-48
Table 2.2.4-3 Sampling Summary – Grain Size Fractionation.....	2-49
Table 2.2.4-4 Analysis Summary – Grain Size Fractionation.....	2-49
Table 2.2.4-5 Sampling Summary – Pore Water.....	2-50
Table 2.2.4-6 Analysis Summary – Pore Water	2-51
Table 2.2.4-7 Sampling Summary – Supplemental Pore Water	2-52
Table 2.2.4-8 Analysis Summary – Supplemental Pore Water	2-52
Table 2.2.4-9 Sampling Summary – Radioisotope.....	2-53
Table 2.2.4-10 Analysis Summary – Radioisotope	2-53

**LIST OF TABLES
(CONTINUED)**

Title	Page
Table 2.2.5-1 Sampling Summary – Impoundments	2-55
Table 2.2.5-2 Analysis Summary – Impoundments	2-55
Table 2.2.6-1 Analysis Summary – Connecticut Sampling.....	2-57
Table 2.2.6-2 Sampling Summary – Connecticut Sampling	2-57
Table 2.2.7-1 Sampling Summary – Low-Resolution Congener.....	2-60
Table 2.2.7-2 Analysis Summary – Low-Resolution Congener	2-60
Table 2.2.7-3 Sampling Summary – High-Resolution Congeners	2-61
Table 2.2.7-4 Analysis Summary – High-Resolution Congeners.....	2-62
Table 2.2.9-1 Sampling Summary – Sediment – Benthic Invertebrate	2-64
Table 2.2.9-2 Analysis Summary – Sediment – Benthic Invertebrate.....	2-65
Table 2.2.9-3 Sampling Summary - Benthic Macroinvertebrate Tissue	2-67
Table 2.2.9-4 Analysis Summary – Benthic Macroinvertebrate Tissue	2-67
Table 2.2.9-5 Sampling Summary – Benthic Macroinvertebrate Community Analysis.....	2-68
Table 2.2.9-6 Analysis Summary – Benthic Macroinvertebrate Community Analysis	2-68
Table 2.2.10-1 Sampling Summary – Sediment Toxicity	2-71
Table 2.2.10-2 Analysis Summary – Sediment Toxicity.....	2-71
Table 2.2.10-3 Analysis Summary – Sediment Toxicity - Biological.....	2-74
Table 2.2.11-1 Sampling Summary – Freshwater Mussel Study	2-75
Table 2.2.11-2 Analysis Summary – Mussel Locations	2-76
Table 2.2.12-1 Sampling Summary – Amphibian Toxicity Study Design– Sediment.....	2-78
Table 2.2.12-2 Analysis Summary – Amphibian Toxicity Study Design– Sediment	2-79
Table 2.2.12-3 Sampling Summary – Amphibian Studies	2-85

**LIST OF TABLES
(CONTINUED)**

Title	Page
Table 2.2.12-4 Analysis Summary – Amphibian Studies.....	2-86
Table 2.2.13-1 Sampling Summary – Fish Collection Locations.....	2-88
Table 2.2.13-2 Analysis Summary – Fish Collection Locations.....	2-88
Table 2.2.13-3 Sampling Summary – Fish Tissue.....	2-90
Table 2.2.13-4 Analysis Summary – Fish Tissue.....	2-90
Table 2.2.14-1 Sampling Summary – Tree Swallows – Sediment.....	2-93
Table 2.2.14-2 Analysis Summary – Tree Swallows – Sediment.....	2-93
Table 2.2.14-3 Sampling Summary – Tree Swallows – Tissue.....	2-95
Table 2.2.14-4 Analysis Summary – Tree Swallows – Tissue.....	2-95
Table 2.2.15-1 Sampling Summary – Soil Invertebrates – Floodplain Soil.....	2-96
Table 2.2.15-2 Sampling Summary – Soil Invertebrates – Tissue.....	2-97
Table 2.2.15-3 Analysis Summary – Soil Invertebrates - Tissue.....	2-98
Table 2.2.16-1 Sampling Summary – Soil – Small Mammals.....	2-99
Table 2.2.16-2 Analysis Summary – Soil – Small Mammals.....	2-100
Table 2.2.16-3 Sampling Summary – Small Mammals.....	2-101
Table 2.2.16-4 Analysis Summary – Small Mammals.....	2-102
Table 2.2.17-1 Sampling Summary – Macrophytes, Filamentous Algae, Periphyton, and Plankton/Detritus.....	2-105
Table 2.2.17-2 Analysis Summary – Macrophytes, Filamentous Algae, Periphyton, and Plankton/Detritus.....	2-106
Table 2.2.19-1 Summary of Dragonfly Survey.....	2-110
Table 2.2.20-1 Summary of Avian Surveys.....	2-112
Table 2.2.21-1 Survey Summary – Mink and Otter.....	2-114

**LIST OF TABLES
(CONTINUED)**

Title	Page
Table 2.2.21-2 Survey Summary – Bats	2-114
Table 2.2.22-1 Sampling Summary – Fish, Diets and Mink Liver Tissue Analysis	2-117
Table 2.2.22-2 Analysis Summary – Fish, Diets and Mink Liver Tissue Analysis.....	2-117
Table 2.2.23-1 Sampling Summary – Crayfish Tissue.....	2-119
Table 2.2.23-2 Analysis Summary–Crayfish Tissue	2-120
Table 2.2.25-1 Sampling Summary – Waterfowl	2-122
Table 2.2.25-2 Analysis Summary – Waterfowl	2-123
Table 2.2.27-1 Sampling Summary – June 2000 Flood	2-125
Table 2.2.27-2 Analysis Summary – June 2000 Flood.....	2-126
Table 2.2.28-1 Sampling Summary – Discretionary Sampling.....	2-127
Table 2.2.28-2 Analysis Summary – Discretionary Sampling	2-128
Table 2.2.29-1 Air Sampling Summary of Particulate and Volatile PCB/Aroclors	2-129
Table 2.3.1-1 Sampling Summary – Surface Water – Monthly Sampling.....	2-131
Table 2.3.1-2 Analysis Summary – Surface Water – Monthly Sampling	2-131
Table 2.3.2-1 Sample and Analysis Summary—Supplemental Surface Water Study	2-134
Table 2.3.3-1 Sampling and Analysis Summary – Woods Pond Water Column Profiles....	2-135
Table 2.3.4-1 Sampling Summary – Stormflow	2-137
Table 2.3.4-2 Analysis Summary – Stormflow	2-138
Table 2.3.4-3 Sampling Summary – Stormflow Suspended Solids (in Bag Filters)	2-138
Table 2.3.4-4 Analyses Summary – Stormflow Suspended Solids (in Bag Filters).....	2-138
Table 2.3.5-1 Measurement Summary – Flow Monitoring	2-141
Table 2.3.7-1 Sampling Summary – VDCs and Supplemental Floodplain Sampling.....	2-144

**LIST OF TABLES
(CONTINUED)**

Title	Page
Table 2.3.7-2 Analysis Summary – VDCs and Supplemental Floodplain Sampling	2-144
Table 2.3.12-1 Sampling Summary (Per Event) – Additional Stormflow Monitoring	2-150
Table 2.3.12-2 Analyses Summary (Per Event) – Additional Stormflow Monitoring	2-151
Table 2.3.14-1 Sampling Summary – Meandering and Bank Erosion Study	2-154

LIST OF ACRONYMS

ADCP	Acoustic Doppler Current Profiler
CERC	Columbia Environmental Research Center
DOC	dissolved organic carbon
DOM	dissolved organic matter
EDTA	ethylene-diaminetetra-acetate
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
LPIL	lowest practical identification level
MFD	Modeling Framework Design
MS	matrix spike
MSD	matrix spike duplicate
OEL	Onsite Environmental Laboratories
PAH	polyaromatic hydrocarbon
PE	performance evaluation
PSA	Primary Study Area
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SI	Supplemental Investigation
SIWP	Supplemental Investigation Work Plan
SOP	standard operating procedure
SOW	scope of work
TIE	Toxicity Identification Evaluation
TOC	total organic carbon
TOM	total organic matter
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
VDC	vertical definition core

1. INTRODUCTION

This Supplemental Investigation (SI) Data Report is presented in two volumes. Volume I provides a summary of the data collection activities, tasks, and programs completed in accordance with the Supplemental Investigation Work Plan (SIWP) for the Lower Housatonic River (WESTON, 22 February 2000). These data collection activities were conducted under contract to the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA).

The SIWP presented the data collection activities proposed for the Lower Reach of the Housatonic River (Rest of River). The Rest of River is the portion of the river that flows from the confluence of the East and West Branches of the Housatonic River (the confluence) through western Massachusetts and Connecticut, discharging into Long Island Sound. The Rest of River was defined in the Consent Decree entered with the U.S. District Court, Western Division, Massachusetts, in October 2000, and includes the river and associated floodplain (except for Actual/Potential Lawns), to which waste materials that originated at the GE Plant Area have migrated. Under the Consent Decree, EPA has the responsibility to conduct the human health and ecological risk assessments and modeling study.

The Rest of River area is a complex hydrological system with many different land uses and numerous ecological habitats and receptors. The SI was designed to provide a logical framework for characterizing this large and diverse study area.

1.1 OVERVIEW OF SAMPLING APPROACH

The sampling approach included the collection of samples from historical data locations (i.e., at locations previously sampled by GE) and at other locations in support of the human and ecological risk assessments and the modeling study. The approach was organized into the Systematic Sampling Program, Discrete Sampling Program, and Water Quality Sampling and Modeling Study. The first two, Systematic and Discrete Sampling Programs, included sediment/soil, air, and tissue sampling programs. The third, Water Quality Sampling and Modeling Studies, included sampling and measurement activities undertaken primarily to

1 provide information for the modeling study. An iterative approach was used whenever possible
2 to optimize the data collection activities and achieve data quality objectives.

3 **1.2 OVERVIEW OF ANALYTICAL PROGRAM**

4 **1.2.1 Overview of PCB Analyses**

5 Soil and sediment, water, air, and tissue samples were analyzed for PCBs. The field laboratory,
6 located at the project office in Pittsfield, MA, was used to analyze many of the soil and sediment
7 samples using a modified EPA Method 8082 for total PCBs and Aroclors. In addition, 10% of
8 soil and sediment samples were split and/or analyzed separately for PCBs/Aroclors at a fixed
9 laboratory, also by modified EPA Method 8082. Approximately 500 soil and sediment samples
10 were to be collected for congener analysis using EPA Method 1668 at a fixed laboratory.

11 **1.2.2 Overview of Other Analyses**

12 Approximately 10% of the soil and sediment samples collected were to be analyzed for a
13 modified Appendix IX compound list. In addition, about 2% of sediment and soil samples were
14 to be analyzed for a supplemental list of Appendix IX organophosphate pesticides and
15 herbicides. All sediment samples and approximately 10% of soil samples were to be analyzed
16 for total organic carbon (TOC) and grain size.

17 In addition to sediment and soil samples, surface water, pore water, air, and tissue samples were
18 collected and analyzed for PCBs and other parameters. Descriptions of these other sampling
19 programs are provided in Section 2.

20 **1.3 OVERVIEW OF SUPPLEMENTAL INVESTIGATION DATA REPORT**

21 **1.3.1 Organization of this Report**

22 Volume I of this report summarizes the data collected from the various investigations outlined in
23 the SIWP. Section 2 of Volume I of this report describes the individual field investigation
24 programs. Each subsection provides a brief description of the program, a comparison between
25 the proposed and completed tasks, and, where applicable, a brief discussion of the differences.

1 Volume II of the report presents data collected in implementing the SIWP as well as data from a
2 small number of additional programs that were subsequently identified and documented in
3 separate SOPs; these sampling programs are summarized in Volume I. The data are provided on
4 CDs or in hard copy. The Table of Contents for Volume II lists the programs described in
5 Volume I, and provides a directory indicating where the data are presented (CD, hard copy, or
6 both). One CD contains the Monthly Data Exchange Database dated August 2, 2002, which
7 contains all the chemistry data and the majority of the information associated with
8 implementation of the SIWP. The other CD contains electronic data not included in the Data
9 Exchange Database due to necessary differences in format. The data tables that are not available
10 electronically are provided in hard copy.

11 In addition, some information that was collected specifically to support the modeling study or
12 individual ecological risk assessment studies does not lend itself to the electronic formats used
13 for the project databases or has not yet been reviewed by EPA. This information will be
14 presented as Additional Supporting Analyses in the final Modeling Framework Design (MFD)
15 document, or in the individual investigators' reports as they become available.

16 **1.3.2 Explanation of Tables**

17 Much of the information in this report is presented in the form of tables. For most programs or
18 studies, details of the number of samples and analyses conducted are presented in the form of
19 paired tables. The first table in each pair (Sampling Summary) compares the number of samples
20 proposed, generally in the Supplemental Investigation Work Plan (SIWP), with the number of
21 sample actually collected when the particular program or study was implemented. Types of
22 information that are not applicable to a particular study (e.g., number of transects for a sampling
23 program that was not organized into transects) are indicated by "N/A" and information that was
24 not specified in the SIWP or SOP prepared for the study is indicated by "NS".

25 The second table (Analysis Summary) provides information on the analyses conducted on the
26 samples listed in the Sampling Summary table. In many cases, numbers of analyses were not
27 specified in the SIWP by number but rather by percentage (e.g., 10% of samples to be analyzed
28 for Appendix IX chemicals, duplicates to be collected at 5% of the number of samples) and these
29 percentages were specified for larger groupings of samples than those shown in the individual

1 Sampling Summary tables. For example, in many cases the data in Sampling Summary tables
 2 are presented separately by Reach, but the percentage requirement in the SIWP applied not to
 3 individual Reaches, but to the entire program, or in some cases groups of programs. For that
 4 reason, the number of samples “collected” in the Analysis Summary table reflects the numbers
 5 derived from the nominal percentages rather than an actual sample count.

6 For example, in the following actual Analysis Sampling table taken from the report, the number
 7 of samples collected for Total PCB analysis (77) is obtained by multiplying the number of
 8 samples actually collected times the percentage of samples designated to be analyzed for the
 9 particular parameter (in this case 100%). In all the table pairs, this value will be identical to the
 10 number collected in the Sampling Summary table. Lower numbers reflect lower percentages of
 11 samples designated for the particular analysis. For example, the large number of analyses
 12 showing 8 samples “collected” indicates that these analyses were specified for 10% of the
 13 samples ($77 * .10 = 7.7$, or 8). As discussed above, however, that percentage applies to the
 14 larger population of transect samples, not necessarily to West Branch transects.

15 **Analysis Summary – West Branch Transects**

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide
WB	West Branch Transects	Sediment	Collected	77	77	77	77	8	2	2	8	8	8	8	8
			Analyzed	68	68	73	70	7	0	0	7	7	7	7	7

16
 17 As the “Analyzed” category in the Analysis Summary table shows, in fact only 7 samples were
 18 analyzed for these parameters rather than the 8 nominal samples “collected.” In all cases, these
 19 counts shown in the Analyzed category are actual data records present in the database, and are
 20 presented to allow users of this report to verify that the complete number of records are obtained
 21 from database queries. This also results in some apparent anomalies. For example, the table
 22 above appears to indicate that 77 samples were analyzed for total PCB and another 77 samples
 23 were analyzed for Aroclors. In fact, these were the same samples as these two parameters are

1 derived from the same analysis. This form of presentation was necessary to capture the full
2 amount of information present in the database that is included with this report.

3 **1.4 OVERVIEW OF THE QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)** 4 **PROGRAM**

5 The QA/QC program included established protocols, Standard Operating Procedures, data
6 validation procedures, and various samples, including field duplicates, splits, matrix spike/spike
7 duplicates, and performance evaluation samples, that provide numerical measures of data quality.
8 The program was designed to ensure that data are consistently of known quality and achieve the
9 data quality objectives established for the project.

10 This section provides a brief overview of aspect of the QA/QC program that pertain to this
11 report, and certain types of QC samples are not discussed below. Results of matrix spike/spike
12 duplicates are part of individual data validation packages and are not entered into the database,
13 nor are results of performance evaluation samples, which are provided to EPA and are not
14 considered part of the project database. EPA results for samples split with GE are included in
15 the database, but the results reported by GE for these same samples are not.

16 **1.4.1 Data Validation**

17 Data validation was originally proposed for 100% of the analytical datasets as outlined below:
18

Matrix	EPA Region I - Validation Level
Tissue	Tier III
Groundwater	Tier II + chromatograms
Surface Water	Tier II
Soil	Tier II
Sediment	Tier II
Dioxin/Furan and PCB Congeners	Tier II + chromatograms
On-Site PCB Aroclors	Modified Tier II

19

1 Data validation was performed in accordance with these specifications, with one exception. In
2 October 1999, due to the consistently high level of quality and performance of analyses
3 performed at Texas A&M Geotechnical and Environmental Research Group, the amount of data
4 validated was reduced from 100% to 15% for the remaining tissue samples.

5 **1.4.2 PCB Stability and Inter-laboratory Studies**

6 Residual soil/sediment from 32 samples (collected from August 1998 to March 1999 and stored
7 at room temperature for up to several months) was used to evaluate the effect of sample storage
8 on PCB concentration. The samples were submitted to a fixed laboratory for analysis by EPA
9 SW846 Method 3550B/8082. Evaluation of the results and subsequent discussions between
10 EPA, USACE, and WESTON concluded that there was no difference in PCB concentrations
11 between the original samples and the stored residues.

12 In addition, an inter-laboratory study (round robin) was performed to evaluate proposed
13 modifications to the on-site laboratory sample extraction procedure prior to implementing the
14 modifications for the remaining analytical program. Blind samples were submitted to the Onsite
15 Environmental Laboratories (OEL) field laboratory and to three fixed laboratories (STL,
16 Quanterra, and Ecology and Environment) for PCB analysis. Based on the results of the round
17 robin study, modifications were made to the OEL laboratory SOP and to the QAPP.

18 **1.4.3 Field Duplicates**

19 The purpose of collecting field duplicates is to assess the precision of the sampling protocol and
20 analytical method. The number of field duplicates to be collected was proposed to be 5% of the
21 total number of samples collected for chemistry analysis. Table 1.4.3-1 summarizes the number
22 of field duplicates that were analyzed. The analytical results for field duplicates are included in
23 the project database and the numbers of field duplicates collected and analyzed for each program
24 or study are presented in this report.

25

1
2
3

Table 1.4.3-1

Summary of Field Duplicates

Matrix	Parameter	No. of Field Duplicates
Water	PCBs	27
	TOC	24
	Pesticides	15
	Herbicides	14
	OP Pesticides	14
	Metals	14
	Volatiles	4
	Semivolatiles	14
	Dioxin/Furans	15
	Cyanide/Sulfide/Wet Chem	14
	Congeners	14
Soil/Sediment	PCBs	351
	TOC	241
	Grain Size	219
	Pesticides	12
	Herbicides	5
	OP Pesticides	5
	Metals	12
	Semivolatiles	12
	Dioxin/Furans	20
	Cyanide/Sulfide	12
	Congeners	31
Tissue (Laboratory)	PCBs/Congeners	64
	Pesticides	64
	Dioxin/Furans	41
	Aliphatics	2
	PAHs	2
Tissue (Field)	PCBs/Congeners	35
	Pesticides	28
	Dioxin/Furans	26

4

1 **2. FIELD INVESTIGATIONS**

2 Sampling of sediment, soil, air, water, and biota were performed along the Housatonic River and
3 other measurements and field studies in support of human health and ecological risk assessments
4 and the modeling effort. Sediment and soil samples were collected using two strategies:
5 systematic sampling and discrete sampling.

6 Systematic sampling was proposed along transects, generally spaced at regular intervals
7 perpendicular to the course of the river, in order to characterize the horizontal and vertical extent
8 of contamination and to focus future sampling efforts. Most of the sediment and soil sampling
9 activities were completed through this systematic (transect) sampling approach. This method
10 was employed to determine patterns of contamination across large portions of the study area such
11 as a river reach, and not to delineate specific areas of contamination.

12 Discrete samples were proposed for collection in specific locations or in support of other studies
13 (e.g., ecological and biological studies or human health exposure areas, or air). This strategy
14 involved collecting samples at distinct locations, such as smaller scale substrates (e.g., aggrading
15 bars); within a defined habitat or location (e.g., vernal pools); or as discretionary samples in
16 specific locations after an initial review of data, to improve the characterization and better
17 achieve data quality objectives.

18 The following subsections present summaries of each field investigation program. Each
19 summary provides a brief description of the proposed tasks; a comparison between the proposed
20 and completed tasks; and, where relevant, a brief discussion of the differences between the
21 proposed and completed tasks.

22 Minor differences between the number of samples proposed versus the number collected and
23 analyzed can be attributed to several factors, for example, actual field conditions that were
24 different than anticipated when preparing the scope for the task (resulting in fewer or more
25 sample locations or depths), complications in handling and transport of samples, and inadequate
26 sample volume (resulting in slightly fewer samples than proposed). These minor differences are
27 not discussed.

1 Differences between the number of samples or analyses proposed and those performed may have
2 occurred because of one or more of the following situations:

3 ▪ **Re-sampling**—For a number of the systematic sampling programs conducted in 1998
4 and 1999, re-analysis or re-sampling was conducted to rectify issues associated with
5 the PCB extraction techniques initially used by the on-site laboratory. As a result of
6 an audit performed by the U.S. Army Corps of Engineers (USACE) of the on-site
7 laboratory, it was observed that PCB sample preparation and extraction techniques
8 initially used would not be sufficient for some sample conditions (e.g., low % solids)
9 and could affect the analytical results by not adequately extracting the PCBs.
10 Therefore, it was decided that selected samples would be re-analyzed (if adequate
11 sample volume was available) or re-sampled. All locations re-sampled were
12 analyzed for PCBs (total and Aroclors) as well as TOC and grain size by the modified
13 laboratory preparation and extraction method. The PCB result obtained using the
14 initial techniques was compared to the result from the modified method. In most
15 cases the newer result was used in place of the older data. When the newer results
16 verified that the previous results were valid, both results were retained.

17 Therefore, in general, if re-sampling/analysis was conducted for a particular program,
18 the difference between the number of samples proposed and the number of samples
19 analyzed for total PCBs and Aroclors, as well as TOC and grain size, may be greater
20 than expected under normal circumstances. In the cases where re-sampling/analysis
21 was conducted, the initial analytical results for parameters other than PCBs associated
22 with the sample (e.g., grain size and TOC) were considered valid and reported. This
23 resulted in the reporting of more TOC and grain size analyses than proposed, and in
24 some cases more samples were collected than were analyzed. For each program
25 where this may have occurred, a brief description, including the number of samples,
26 is provided.

27 ▪ **Other Analytical Parameters**—As the sampling program was implemented, the data
28 were periodically evaluated to determine if the Appendix IX chemicals were
29 consistently detected. If not, the particular analyte was eliminated from the suite to
30 conserve resources for other, more critical analyses (see page 5-2 of the SIWP).
31 Deleting some Appendix IX analytes during the course of implementing the work
32 plan affected the number of analyses performed versus the analyses proposed for
33 several sampling programs. When applicable, this issue is noted in the Explanation
34 of Differences sections for the programs affected.

35

1 **2.1 SYSTEMATIC SAMPLING**

2 Systematic sampling was conducted in Reaches 5 through 8 in most cases by use of transects
3 spaced at regular intervals approximately perpendicular to the main axis of the river and
4 associated floodplains. Systematic sampling was not proposed in Reach 9. In addition, non-
5 transect sampling programs (for example, core locations along the length of the river placed at
6 regular intervals) were also conducted to systematically assess PCB contamination. The
7 following subsections provide a descriptive summary of the proposed and completed systematic
8 sampling programs, including the types of samples (sediment, riverbank, and/or floodplain)
9 proposed and the samples actually collected and analyzed.

10 **2.1.1 1,500-Foot Transects (Reach 5)**

11 **2.1.1.1 Program Description and Summary**

12 Transects were proposed at 1,500-foot intervals perpendicular to the river, resulting in a total of
13 37 transects from the confluence of the East and West Branches of the Housatonic River to just
14 upstream of Woods Pond (Reach 5). Each transect was to extend from the boundary of the 10-
15 year floodplain on one side of the river to the same boundary on the other side of the river.
16 Sampling along each transect would then include floodplain and riverbank soil, and sediment, as
17 described below:

- 18 ▪ Sediment samples to be collected from three locations across the river channel (right
19 side, mid-channel, left side) and from four depth intervals (0-6 inches, 6-12 inches,
20 12-18 inches, and 18-24 inches).
- 21 ▪ Riverbank soil samples to be collected only when pronounced banks were
22 encountered during the transect sampling. It was assumed that banks would be
23 encountered only on five transects, for a total of 30 samples (two banks per transect,
24 and three samples [0-6 inches, 12-18 inches, and 24-30 inches] per bank).
- 25 ▪ Floodplain soil samples to be collected from each of the 37 transects at three locations
26 on each side of the river, resulting in 666 samples (37 transects; six locations; three
27 depths [0-6 inches, 12-18 inches, and 24-30 inches]).
- 28 ▪ Sediment samples to be analyzed for PCBs (total and Aroclors), grain size, and TOC.
29 In addition, approximately 10% of the samples were to be analyzed for modified

1 Appendix IX (40 CFR 264) parameters. Two percent of the samples were also to be
 2 analyzed for Appendix IX organophosphate pesticides and herbicides.

- 3 ■ Riverbank and floodplain soil samples were to be analyzed for PCBs (total and
 4 Aroclor) with approximately 10% analyzed for TOC, grain size, and modified
 5 Appendix IX parameters, and 2% analyzed for Appendix IX organophosphate
 6 pesticides and herbicides.
- 7 ■ After review of PCB results, approximately 10% of the systematic transect locations
 8 were to be sampled and analyzed for PCB congeners. (See Subsection 2.2.28,
 9 Discretionary Sampling, and Subsection 2.2.7, Congener Sampling Program.)

10 Tables 2.1.1-1 and 2.1.1-2 summarize the proposed and completed sampling and analysis.

11 **Table 2.1.1-1**

12 **Sampling Summary – 1,500-Foot Transects**

13

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
5	1,500-foot Transects	Sediment	Proposed	37	111	444	22	466
			Collected	38	112	513	31	544
		Riverbank	Proposed	5	10	30	2	32
			Collected	5	10	30	1	31
		Floodplain	Proposed	37	222	666	33	699
			Collected	38	198	576	1	577

14
 15

1
2
3

Table 2.1.1-2

Analyses Summary – 1,500-Foot Transects

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide
5	1,500-foot Transects	Sediment	Collected	544	544	544	544	54	11	11	54	54	54	54	54
			Analyzed	424	424	460	517	39	8	8	39	39	39	39	39
		Riverbank	Collected	31	31	3	3	3	1	1	3	3	3	3	3
			Analyzed	31	31	4	5	3	0	0	3	3	3	3	3
		Floodplain	Collected	577	577	57	57	57	11	11	57	57	57	57	57
			Analyzed	575	575	112	114	57	10	10	57	57	57	57	57

4

5 **2.1.1.2 Explanation of Differences**

6 Differences between the proposed versus completed numbers of samples and analyses are
7 discussed below.

8 **2.1.1.2.1 Sediment**

9 **Transects**

- 10
 - 38 transects were completed instead of the 37 proposed. This was due to the reach
11 being slightly longer than originally estimated, and the boundary between Reaches 5
12 and 6 being adjusted farther downstream to include the segment of river just upstream
13 of Woods Pond.

14 **Locations**

- 15
 - Although one additional transect was completed, the number of sample locations
16 remained virtually identical (111 proposed and 112 locations completed). With the
17 additional transect, 114 locations could have been sampled; however, because of
18 refusal at two locations, the number of locations actually completed was 112.

19 **Samples**

- 20
 - 544 samples were collected versus 466 proposed samples. This increase is due to the
21 re-sampling of transect locations to address issues associated with the PCB extraction
22 techniques (see Section 2 above for a more detailed explanation).

1 **Analyses**

2 ▪ 424 samples were analyzed for PCBs (total and Aroclors) versus 544 samples
3 collected. Again this difference is attributed to the re-sampling as noted above. Of
4 the samples collected for re-analysis (186), the new PCB result was used in most
5 cases, replacing the prior result in the database. Although the PCB results were
6 replaced, other analyses, such as organic carbon and grain size, from the initial
7 sampling were still valid and are contained within the database.

8 ▪ 460 samples were analyzed for TOC versus the 544 that were collected. The
9 difference in the number of samples collected in relation to those analyzed is
10 attributed to the re-sampling issue.

11 **2.1.1.2.2 Floodplain Soil**

12 **Locations**

13 ▪ 198 locations were sampled instead of the proposed 222 locations. In some areas, the
14 floodplain was not as wide as the assumptions made in the work plan. In these areas,
15 only one location was sampled versus the three proposed.

16 **Samples**

17 ▪ 577 samples were collected instead of the proposed 699 samples. The decrease in
18 samples is due to the decrease in the number of locations sampled (see above). Also,
19 in a number of sample locations, refusal occurred before the 2.5-foot depth could be
20 collected.

21 **Analyses**

22 ▪ 112 and 114 samples were analyzed for TOC and grain size, respectively, versus 57
23 collected. These additional samples were analyzed for TOC and grain size as a result
24 of the re-sampling/analysis.

25

1 **2.1.2 West Branch Transects**

2 **2.1.2.1 Program Description and Summary**

3 Up to seven transects at 200-ft intervals were proposed along the West Branch to determine the
4 background PCB concentrations in the sediments upstream of the confluence with the East
5 Branch. Only sediment sampling was originally proposed for the West Branch transect program
6 as described below:

- 7 ▪ Sediment to be sampled in three locations (right side, mid-channel, and left side) at
8 four depth intervals (0-6 inches, 6-12 inches, 12-18 inches, and 18-24 inches),
9 resulting in 84 sediment samples.
- 10 ▪ All samples to be analyzed for PCBs (total and Aroclors), grain size, and TOC. In
11 addition, approximately 10% of the samples to be analyzed for modified Appendix IX
12 parameters, and 2% to be analyzed for Appendix IX organophosphate pesticides and
13 herbicides.
- 14 ▪ After review of the PCB data, approximately 10% of the total transect locations to be
15 sampled and analyzed for PCB congeners. (See Subsection 2.2.28, Discretionary
16 Sampling, and Subsection 2.2.7, Congener Sampling Program.)

17 Tables 2.1.2-1 and 2.1.2-2 summarize the proposed and completed sampling and analysis.

18 **Table 2.1.2-1**

19 **Sampling Summary – West Branch Transects**

20

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
WB	West Branch Transects	Sediment	Proposed	7	21	84	4	88
			Collected	8	23	68	9	77

21

22

1 **Table 2.1.2-2**

2 **Analysis Summary – West Branch Transects**

3

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide
WB	West Branch Transects	Sediment	Collected	77	77	77	77	8	2	2	8	8	8	8	8
			Analyzed	68	68	73	70	7	0	0	7	7	7	7	7

4

5

6 **2.1.2.2 Explanation of Differences**

7 Differences between the proposed versus completed numbers of samples and analyses are

8 discussed below.

9 **2.1.2.2.1 Sediment**

10 **Transects**

- 11
- 12
- One more transect was completed than proposed, in order to characterize the river sediment adjacent to Dorothy Amos Park.

13 **Samples**

- 14
- 15
- 16
- 77 samples were collected versus 88 proposed samples. The number of samples collected resulted from refusal at depths shallower than the proposed sampling depths.

17 **Analyses**

- 18
- 19
- 20
- The difference between the number of samples collected and analyzed for PCBs (total and Aroclors), TOC, and grain size is due to the re-sampling/analyses associated with the on-site laboratory issue, as described previously.

1 **2.1.3 Channel Geometry/Modeling Transects (Reaches 5 and 6)**

2 **2.1.3.1 Program Description and Summary**

3 Seventeen transects were proposed in Reach 5, perpendicular to the river across the entire width
4 of the 10-year floodplain, to define the channel geometry for the modeling study synoptically
5 with the PCB concentrations. In addition, one transect was proposed in Reach 6 (Woods Pond).
6 The modeling transect sampling program included sediment, riverbank, and floodplain locations
7 as described below:

- 8 ▪ Sediment samples to be collected along each transect in Reach 5 from three locations
9 across the river channel (right side, mid-channel, left side) and from four depth
10 intervals (0-6 inches, 6-12 inches, 12-18 inches, and 18-24 inches).
- 11 ▪ Sediment samples in Reach 6 (Woods Pond) to be collected every 100 ft from 6-inch
12 intervals to a depth of 2 ft.
- 13 ▪ Sediment samples to be analyzed for PCBs (total and Aroclors), grain size, and TOC.
- 14 ▪ Riverbank soil samples to be collected when a defined bank was present. It was
15 estimated that 102 samples might be collected along the 17 transects in Reach 5. No
16 systematic riverbank samples were proposed for Reach 6 (Woods Pond) because the
17 backwater areas are characterized by a broader floodplain with low or no discernable
18 banks.
- 19 ▪ Floodplain samples to be collected along the 17 transects every 50 ft across the 10-
20 year floodplain. Samples to be collected at 0-6 inches from every location, and 6-12
21 inches from every other location (i.e., every 100 ft). Approximately 600 floodplain
22 samples to be collected along these transects in Reach 5. Within Reach 6 (Woods
23 Pond), approximately 20 samples to be collected from the east and west shores, which
24 correspond to the 10-year floodplain.
- 25 ▪ Riverbank and floodplain samples to be analyzed for PCBs (total and Aroclors) with
26 approximately 10% analyzed for TOC, grain size, and modified Appendix IX
27 parameters, and 2% for Appendix IX organophosphate pesticides and herbicides. No
28 congener analysis was proposed for floodplain and riverbank samples collected from
29 Reaches 5 and 6; these locations were eligible for future congener samples after
30 review of the data.

31 Tables 2.1.3-1 through 2.1.3-4 summarize the proposed and completed sampling and analysis.

1
2
3

Table 2.1.3-1

Sampling Summary – Modeling Transects, Reach 5

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
5	Modeling Transects	Sediment	Proposed	17	51	204	10	214
			Collected	16	51	231	19	250
		Riverbank	Proposed	17	34	102	5	107
			Collected	0	0	0	0	0
		Floodplain	Proposed	17	400	600	30	630
			Collected	17	447	825	42	867

4
5
6
7
8

Table 2.1.3-2

Sampling Summary – Modeling Transects, Reach 6

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
6	Modeling Transects	Sediment	Proposed	1	NS	NS	NS	NS
			Collected	1	19	74	3	77
		Floodplain	Proposed	1	NS	20	11	21
			Collected	1	7	10	11	11

NS = Not specified in the SIWP.

9
10
11

1
2
3

Table 2.1.3-3

Analysis Summary – Modeling Transects, Reach 5

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide
5	Modeling Transects	Sediment	Collected	250	250	250	250	0	0	0	0	0	0	0	0
			Analyzed	188	188	226	224	0	0	0	0	0	0	0	0
		Floodplain	Collected	867	867	87	87	87	17	17	87	87	87	87	87
			Analyzed	841	841	105	92	1	0	0	1	1	1	1	1

4
5
6
7
8
9

Table 2.1.3-4

Analysis Summary – Modeling Transects, Reach 6

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide
6	Modeling Transects	Sediment	Collected	77	77	77	77	0	0	0	0	0	0	0	0
			Analyzed	76	76	76	73	3	0	0	3	3	3	3	3
		Floodplain	Collected	11	11	1	1	1	0	0	1	1	1	1	1
			Analyzed	11	11	1	1	0	0	0	0	0	0	0	0

10
11
12

1 **2.1.3.2 Explanation of Differences**

2 Differences between the proposed versus completed numbers of samples and analyses are
3 discussed below.

4 **2.1.3.2.1 Reach 5 - Sediment**

5 **Transects**

- 6 ▪ Although 17 transects were established and sampled across the floodplain, one fewer
7 transect was sampled for sediment within the river channel than proposed because
8 this transect was inadvertently surveyed incorrectly and did not cross the main river
9 channel.

10 **Locations**

- 11 ▪ Although one fewer transect was sampled for sediment, the same number of sample
12 locations as proposed was completed. Three additional sampling locations were
13 identified along one transect in order to characterize a backwater area that the transect
14 crossed.

15 **Samples**

- 16 ▪ 250 samples were collected compared to 214 proposed. This increase is due to the re-
17 sampling/analysis, as previously discussed.

18 **Analyses**

- 19 ▪ 188 samples were analyzed for PCBs (total PCBs and Aroclors) versus 250 collected.
20 In addition, 226 and 224 samples were analyzed for TOC and grain size, respectively,
21 versus 250 collected. These differences are attributed to the re-sampling/analysis. Of
22 the samples collected for re-analysis, for 119 samples the new PCB result was
23 retained, replacing the prior result in the database. Although the PCB result was
24 replaced, other original analyses, such as organic carbon and grain size, were
25 retained, and the new samples were also analyzed for TOC and grain size and are also
26 contained within the database. This resulted in more samples analyzed for TOC and
27 grain size than for PCBs.

1 **2.1.3.2.2 Reach 5 - Riverbank**

2 **Transects**

- 3 ▪ No riverbank samples were collected. The proximity of the floodplain samples to the
4 river negated the need for these additional riverbank samples.

5 **2.1.3.2.3 Reach 5 - Floodplain**

6 **Locations**

- 7 ▪ 447 locations were sampled instead of the proposed 400 locations. The increase was
8 due to an in-field interpretation of the location of the 10-year floodplain boundary.
9 As a result, some samples were collected beyond the 10-year floodplain.

10 **Samples**

- 11 ▪ The increase in the number of locations (above) resulted in an increase in total
12 samples collected. In addition, the re-sampling/analysis contributed to the increase in
13 the total number of samples.

14 **Analyses**

- 15 ▪ The proposed number of Appendix IX analyses were inadvertently not completed for
16 the floodplain locations.

17 **2.1.3.2.4 Reach 6 - Floodplain**

18 **Samples**

- 19 ▪ 10 samples were collected instead of the proposed 20. The floodplain adjacent to
20 Woods Pond was estimated to be wider than it actually is, thus fewer samples were
21 collected than proposed to meet the sampling objectives.

22 **Analyses**

- 23 ▪ The proposed number of Appendix IX analyses were inadvertently not completed for
24 the floodplain locations.

25

1 **2.1.4 Sediment Characterization Cores**

2 **2.1.4.1 Program Description and Summary**

3 Sediment cores were proposed for collection from Woods Pond (Reach 6) and Rising Pond
 4 (Reach 8) to provide information on characteristics of deep sediment. The proposed program is
 5 described below:

- 6 ▪ Approximately 25 sediment cores to be collected to a depth of first refusal in Woods
 7 Pond.
- 8 ▪ Approximately 20 sediment cores to be collected to a depth of first refusal in Rising
 9 Pond.
- 10 ▪ Sediment samples from the individual cores to be obtained from each 6-inch interval
 11 of the cores.
- 12 ▪ All core samples to be analyzed for PCBs (total and Aroclor), TOC, and grain size.
 13 In addition, approximately 10% of the samples to be analyzed for modified Appendix
 14 IX compounds and PCB congeners. Approximately 2% of these samples to be
 15 analyzed for modified Appendix IX organophosphate pesticides and herbicides.

16 Tables 2.1.4-1 through 2.1.4-4 summarize the proposed and completed sampling and analysis.

17 **Table 2.1.4-1**

18 **Sampling Summary – Sediment Characterization Cores, Reach 6**

19

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
6	Sediment Characterization Cores	Sediment	Proposed	N/A	25	365	19	384
			Collected	N/A	23	339	19	358

20 N/A = Not applicable

21

1
2
3

Table 2.1.4-2

Sampling Summary – Sediment Characterization Cores, Reach 8

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
8	Sediment Characterization Cores	Sediment	Proposed	N/A	20	201	11	212
			Collected	N/A	20	289	18	307

4
5

N/A = Not applicable

6
7
8

Table 2.1.4-3

Analysis Summary – Sediment Characterization Cores, Reach 6

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners	Bulk Density
6	Sediment Characterization Cores	Sediment	Collected	358	358	358	358	36	7	7	36	36	36	36	36	36	0
			Analyzed	319	319	357	358	35	5	5	35	35	35	35	35	34	18

9
10

1
2
3
Table 2.1.4-4

Analysis Summary – Sediment Characterization Cores, Reach 8

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners
8	Sediment Characterization Cores	Sediment	Collected	307	307	307	307	31	6	6	31	31	31	31	31	31
			Analyzed	279	279	305	306	32	4	4	32	32	32	32	32	32

4
5
6 **2.1.4.2 Explanation of Differences**

7 Differences between the proposed versus completed numbers of samples and analyses are
8 discussed below.

9 **Samples**

- 10
- 11 ■ In Reach 6, 23 cores were collected instead of the 25 originally proposed. Of the two
12 cores not sampled, one was considered to be discretionary. The deep core-drilling rig
13 could not reach the other location. 358 samples were collected in Woods Pond versus
14 384 samples proposed. This decrease occurred because recovery was not as deep as
planned for the majority of the cores.
 - 15 ■ In Reach 8, 307 samples were collected versus the 212 samples originally proposed.
16 This increase is due to cores that were advanced deeper than expected.

17 **Analysis**

- 18
- 19 ■ In Reach 6, 358 samples were collected for PCB and Aroclor analysis versus 319
20 analyzed. The decrease in the number of samples analyzed is attributed to the
21 resampling/reanalysis that was conducted to address issues associated with the PCB
22 extraction techniques used by the on-site lab. As a result, samples were sent to the
23 fixed laboratory for PCB analysis, and 39 samples did not have adequate volume for
PCB analysis.
 - 24 ■ In Reach 6, analysis for bulk density was not proposed (an oversight in the work
25 plan). Eighteen (18) samples were analyzed.

1 **2.1.5 2,500-Foot Transects**

2 **2.1.5.1 Program Description and Summary**

3 Transects were to be established approximately every 2,500 ft in Reach 7, which equates to a
 4 total of 36 transects. The proposed sampling is described below:

- 5 ▪ Sediment samples to be taken in three locations (right side, mid-channel, and left
 6 side) at four depth intervals (0-6 inches, 6-12 inches, 12-18 inches, and 18-24 inches)
 7 for a total of 432 samples.
- 8 ▪ A total of 18 floodplain samples per transect (36 transects), resulting in 648 samples.
 9 Three sampling locations to be established across the floodplain on each side of the
 10 river; depth intervals for each location to include 0-6 inches, 12-18 inches, and 24-30
 11 inches.
- 12 ▪ Sediment samples to be analyzed for PCBs (total and Aroclor), TOC, and grain size.
 13 In addition, approximately 10% of the samples to be analyzed for modified Appendix
 14 IX organophosphate pesticides and herbicides. After review of initial PCB analyses,
 15 approximately 10% of sample locations to be sampled for PCB congeners.

16 Tables 2.1.5-1 and 2.1.5-2 summarize the proposed and completed sampling and analysis.

17 **Table 2.1.5-1**

18 **Sampling Summary – 2,500-Foot Transects**

19

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
7	2,500-foot transects	Sediment	Proposed	36	108	432	22	454
			Collected	41	121	279	15	294
		Floodplain	Proposed	36	216	648	32	680
			Collected	40	224	636	27	663

20
21

1
2
3

Table 2.1.5-2

Analysis Summary – 2,500-Foot Transects

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	
7	2,500-foot transects	Sediment	Collected	294	294	294	294	29	6	6	29	29	29	29	29	
			Analyzed	294	294	285	258	0	0	0	0	0	0	0	0	0
		Floodplain	Collected	663	663	66	66	66	13	13	66	66	66	66	66	66
			Analyzed	663	663	0	0	0	0	0	0	0	0	0	0	0

4
5

2.1.5.2 Explanation of Differences

7 Differences between the proposed versus completed numbers of samples and analyses are
8 discussed below.

9 **2.1.5.2.1 Sediment**

10 **Transects**

- 11 ▪ Sampling on 41 transects was completed instead of the 36 proposed. The change in
12 number of transects occurred due to a refinement of the actual length of the reach
13 versus the estimated length, resulting in an increase in transects.

14 **Locations**

- 15 ▪ As a result of the increase in number of transects, there should have been 123
16 sampling locations. However, 121 locations were sampled because there was refusal
17 at two locations.

18 **Samples**

- 19 ▪ 294 samples were collected instead of the 454 proposed. This difference in the
20 number of samples is due to refusal before the full 2-foot core could be collected.

1 **Analyses**

- 2 ▪ 258 samples were analyzed for grain size versus 294 collected. Insufficient sample
3 volume was recovered at some locations to analyze for grain size.
- 4 ▪ As the sampling program was implemented, the data were periodically evaluated to
5 determine if the Appendix IX chemicals were consistently detected, as described
6 above in Section 2. As a result, the number of analyses performed versus the
7 analyses proposed was affected for several sampling programs.

8 **2.1.5.2.2 Floodplain**

9 **Transects**

- 10 ▪ 40 transects were sampled instead of the proposed 36 transects. The increase was due
11 to refinement of the actual length of the reach. Forty-one transects were then to be
12 sampled; however, 40 were completed because there was no floodplain adjacent to
13 the river at one location.

14 **Samples**

- 15 ▪ 663 samples were collected instead of 680 proposed because of refusal before
16 reaching the required depth of 2.5 feet, or because of complete refusal at some
17 locations, especially in areas where the bank was very steep and no floodplain was
18 present.

19 **Analysis**

- 20 ▪ As the sampling program was implemented, the data were periodically evaluated to
21 determine if the Appendix IX chemicals were consistently detected, as described
22 above in Section 2. As a result, the number of analyses performed versus the
23 analyses proposed was affected for several sampling programs.

24

1 **2.1.6 Other Transect-Related Samples**

2 **2.1.6.1 Program Description and Summary**

3 Additional floodplain sampling was proposed in Reaches 6 and 8 to further characterize the areas
 4 adjacent to Woods Pond and Rising Pond, as described below:

- 5 ▪ For Reach 6, approximately 36 samples at 12 locations, with the sample locations to
 6 be chosen in the field.
- 7 ▪ In Reach 8, up to 36 soil samples for the floodplain surrounding Rising Pond.
- 8 ▪ Because of the limited extent of the 10-year floodplain adjacent to Rising Pond,
 9 sample locations to be positioned at approximately six locations on each side of the
 10 pond.
- 11 ▪ All samples to be analyzed for PCBs (total and Aroclor), TOC, and grain size. In
 12 addition, approximately 10% of these samples to be analyzed for modified Appendix
 13 IX compounds. Approximately 2% of these samples to be analyzed for modified
 14 Appendix IX organophosphate pesticides and herbicides. After a review of initial
 15 PCB results, up to 10% of sample locations may be sampled for PCB congeners.

16 Tables 2.1.6-1 through 2.1.6-3 summarize the proposed and the actual sampling and analysis.

17 **Table 2.1.6-1**

18 **Sampling Summary – Other Transects, Reach 6**

19

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
6	Other Transects	Floodplain	Proposed	N/A	12	36	2	38
			Collected	N/A	12	36	0	36

20 N/A = Not applicable

21
 22

1
2
3

Table 2.1.6-2

Sampling Summary – Other Transects, Reach 8

Reach	Program	Media		No. of Transects	Sample Locations	Samples	Duplicates	Total Samples
8	Other Transects	Floodplain	Proposed	N/A	12	36	2	38
			Collected	N/A	0	0	0	0

N/A = Not applicable

4
5
6
7
8

Table 2.1.6-3

Analysis Summary – Other Transects, Reach 6

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide
6	Other Transects	Floodplain	Collected	36	36	4	4	4	1	1	4	4	4	4	4
			Analyzed	36	36	6	6	3	0	0	3	3	3	3	3

NS – Not specified in the SIWP.

9
10

2.1.6.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

14

1 **2.1.6.2.1 Floodplain**

2 **Reach 6**

3 Appendix IX and OP pesticide and herbicide analyses were reduced. As the sampling program
4 was implemented, the data were periodically evaluated to determine if these contaminants were
5 consistently detected, as described above in Section 2.

6 **Reach 8**

7 Based on an evaluation of historical sample results and the analytical results obtained in the
8 program implemented under the SIWP, it was decided that additional sampling in Reach 8 was
9 not necessary to support the risk assessment or modeling studies. PCB concentrations in the
10 floodplain areas around Rising Pond were very low or not detected.

11

1 **2.2 DISCRETE SAMPLING**

2 Discrete sampling was conducted in Reaches 5 through 9 to address specific data quality
3 objectives. In general, samples were collected to support individual programs that required
4 particular types of data from specific locations. In addition, after a review of data collected,
5 further discrete sampling was implemented to address identified data gaps and to improve the
6 overall utility of the data set for use in achieving data quality objectives.

7 Differences between the number of areas, locations, and/or samples proposed in the SIWP versus
8 the samples collected are discussed in the subsequent sections. In several instances, field
9 conditions were quite different than expected.

10 **2.2.1 Human Health Risk Assessment Sampling**

11 **2.2.1.1 Introduction**

12 Sampling of sediment, riverbank, and floodplain soils associated with potential exposure areas
13 was conducted in an iterative manner. An initial screening of the possible exposure areas was
14 performed to determine which areas would be sampled, and to estimate the type and number of
15 samples to be collected. Due to this iterative sampling approach, the number of samples
16 collected for many of the sampling programs for the human health risk assessment were either
17 greater than, or in some cases less than, initially estimated in the SIWP.

18 **2.2.1.2 Recreational Exposure (Reaches 5 and 6)**

19 **2.2.1.2.1 Program Description and Summary**

20 Several areas along the river in Reaches 5 and 6 were identified in the SIWP as current
21 recreational exposure areas. These areas include: “Paintball Area,” Canoe Meadows, John
22 Decker Canoe Launch, DeVos Farm (floodplain only), Lenox Sportsman Club, three river access
23 areas off October Mountain Road, Duck Blind Areas, and Woods Pond Boat Launch (sediment
24 and floodplain only). The proposed sampling of these recreational exposure areas is described
25 below:

- 1 ▪ One sediment sample from 0-6 inches to be collected per 50 ft of shoreline for each of
2 the public access areas in Reaches 5 and 6, for up to 70 samples.
- 3 ▪ Sediment samples to be collected in areas of easiest access.
- 4 ▪ One riverbank sampling location from 0-6 inches and 6-12 inches to be collected per
5 50 ft of shoreline depending on the existence of riverbanks in each exposure area for
6 up to 164 samples.
- 7 ▪ Up to 220 floodplain samples 0-6 inches and 6-12 inches to be collected in the above
8 recreational areas.
- 9 ▪ All sediment samples to be analyzed for PCBs (total and Aroclors), grain size, and
10 TOC. In addition, approximately 10% of samples to be analyzed for PCB congeners,
11 and modified Appendix IX parameters. Approximately 2% of samples to be analyzed
12 for Appendix IX organophosphate pesticides and herbicides.
- 13 ▪ All riverbank and floodplain samples to be analyzed for PCBs (total and Aroclors). In
14 addition, approximately 10% of the samples to be analyzed for TOC, grain size, PCB
15 congeners/homologs, and modified Appendix IX parameters.

16 Additional discrete sampling activities were conducted for the recreational exposure sampling
17 program because additional areas/parcels within Reaches 5 and 6 were identified as being used
18 for recreational purposes. All samples were to be analyzed for PCBs (total and Aroclors), and a
19 subset of the samples were to be analyzed for TOC and grain size.

20 Tables 2.2.1-1 and 2.2.1-2 summarize the proposed and completed sampling and analysis.

21

1
2
3

Table 2.2.1-1

Sampling Summary by Recreational Exposure Area

Reach	Program		Sediment Sampling					Riverbank Sampling					Floodplain Sampling				
			Number of Areas	Number of Locations	Number of Samples	Number of Duplicate Samples	Total Number of Samples	Number of Areas	Number of Locations	Number of Samples	Number of Duplicate Samples	Total Number of Samples	Number of Areas	Number of Locations	Number of Samples	Number of Duplicate Samples	Total Number of Samples
5	Paintball Area	Proposed	1	20	20	1	21	1	20	40	2	42	1	20	40	2	42
		Collected	1	12	12	0	12	1	8	16	0	16	1	8	16	1	17
	Canoe Meadows	Proposed	1	20	20	1	21	1	20	40	2	42	1	10	20	1	21
		Collected	1	15	15	0	15	1	11	22	1	23	1	22	44	3	47
	John Decker Canoe Launch	Proposed	1	5	5	0	5	1	4	8	0	8	1	10	20	1	21
		Collected	1	7	7	0	7	1	5	10	0	10	1	22	39	3	42
	DeVos Farm	Proposed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	20	40	2	42
		Collected	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	12	24	1	25
	Lenox Sportsman Club	Proposed	1	4	4	0	4	1	20	40	2	42	1	10	20	1	21
		Collected	1	7	7	0	7	1	5	10	1	11	1	8	16	1	17
	October Mountain Access Points	Proposed	3	9	9	0	9	3	9	18	1	19	3	10	20	2	21
		Collected	2	2	2	1	3	3	8	8	0	8	3	28	34	2	36
5&6	Duck Blinds	Proposed	9	9	9	0	9	9	9	18	1	19	9	20	40	2	42
		Collected	9	13	13	1	14	9	9	18	1	19	0	0	0	0	0
	Other	Proposed	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Collected	1	1	1	0	1	1	2	2	0	2	9	65	73	8	81
6	Woods Pond Boat Launch	Proposed	1	5	5	0	5	N/A	N/A	N/A	N/A	N/A	1	10	20	1	21
		Collected	1	4	4	0	4	N/A	N/A	N/A	N/A	N/A	1	19	24	2	26

4 N/A = Not applicable

5 NS = Not specified in the SIWP

6

1
2
3

Table 2.2.1-2

Summary of Analyses by Exposure Area: Human Risk Recreational

Reach	Program		Sediment												
			Total PCBs	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOCs	Dioxins/Furans	Cyanide	Sulfide	PCB Congeners
5	Paintball Area	Collected	12	12	12	12	2	1	1	2	2	2	2	2	2
		Analyzed	12	12	1	1	1	0	0	1	1	1	1	1	1
	Canoe Meadows	Collected	15	15	15	15	2	1	1	2	2	2	2	2	2
		Analyzed	15	15	4	4	2	0	0	2	2	2	2	2	4
	John Decker Canoe Launch	Collected	7	7	7	7	1	1	1	1	1	1	1	1	1
		Analyzed	7	7	2	3	1	1	1	1	1	1	1	1	3
	DeVos Farm	Collected	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Analyzed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Lenox Sportsman Club	Collected	7	7	7	7	1	1	1	1	1	1	1	1	1
		Analyzed	7	7	7	3	1	1	1	1	1	1	1	1	3
October Mountain Access Points	Collected	3	3	3	3	1	1	1	1	1	1	1	1	1	
	Analyzed	3	3	3	3	0	0	0	0	0	0	0	0	3	
5&6	Duck Blinds	Collected	14	14	14	14	1	1	1	1	1	1	1	1	1
		Analyzed	14	14	5	5	1	0	0	1	1	1	1	1	5
	Other	Collected	1	0	0	0	0	0	0	0	0	0	0	0	0
		Analyzed	1	1	0	0	0	0	0	0	0	0	0	0	0
6	Woods Pond Boat Launch	Collected	4	4	4	4	1	1	1	1	1	1	1	1	1
		Analyzed	4	4	3	1	0	0	0	0	0	0	0	0	1

4

1
2
3
4

Table 2.2.1-2

**Summary of Analyses by Exposure Area: Human Risk Recreational
(Continued)**

Reach	Program		Riverbank												
			Total PCBs	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOCs	Dioxins/Furans	Cyanide	Sulfide	PCB Congeners
5	Paintball Area	Collected	16	16	2	2	2	0	0	2	2	2	2	2	2
		Analyzed	16	16	3	3	3	0	0	3	3	3	3	3	3
	Canoe Meadows	Collected	23	23	3	3	3	0	0	3	3	3	3	3	3
		Analyzed	23	23	1	1	1	0	0	1	1	1	1	1	1
	John Decker Canoe Launch	Collected	10	10	1	1	1	0	0	1	1	1	1	1	1
		Analyzed	10	10	1	1	1	0	0	1	1	1	1	1	3
	DeVos Farm	Collected	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Analyzed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Lenox Sportsman Club	Collected	11	11	2	2	2	0	0	2	2	2	2	2	2
		Analyzed	11	11	1	1	1	0	0	1	1	1	1	1	1
	October Mountain Access Points	Collected	8	8	1	1	1	0	0	1	1	1	1	1	1
		Analyzed	7	7	3	3	1	0	0	1	1	1	1	1	0
5&6	Duck Blinds	Collected	19	19	2	2	2	0	0	2	2	2	2	2	2
		Analyzed	19	19	2	2	2	0	0	2	2	2	2	2	2
	Other	Collected	2	2	0	0	0	0	0	0	0	0	0	0	0
		Analyzed	2	2	0	0	0	0	0	0	0	0	0	0	0
6	Woods Pond Boat Launch	Collected	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Analyzed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

5

1
2
3
4

Table 2.2.1-2

**Summary of Analyses by Exposure Area: Human Risk Recreational
(Continued)**

Reach	Program		Floodplain												
			Total PCBs	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOCs	Dioxins/Furans	Cyanide	Sulfide	PCB Congeners
5	Paintball Area	Collected	17	17	2	2	2	1	1	2	2	2	2	2	2
		Analyzed	17	17	0	0	0	0	0	0	0	0	0	0	0
	Canoe Meadows	Collected	47	47	5	5	5	1	1	5	5	5	5	5	5
		Analyzed	47	47	3	3	3	0	0	3	3	3	3	3	3
	John Decker Canoe Launch	Collected	42	42	5	5	5	1	1	5	5	5	5	5	5
		Analyzed	42	42	4	4	4	0	0	4	4	4	4	4	4
	DeVos Farm	Collected	25	25	3	3	3	1	1	3	3	3	3	3	3
		Analyzed	25	25	1	1	1	0	0	1	1	1	1	1	1
	Lenox Sportsman Club	Collected	17	17	2	2	2	1	1	2	2	2	2	2	2
		Analyzed	17	17	2	2	2	1	1	2	2	2	2	2	1
	October Mountain Access Points	Collected	36	36	4	4	4	1	1	4	4	4	4	4	4
		Analyzed	35	35	7	7	3	0	0	3	3	3	3	3	0
5&6	Duck Blinds	Collected	0	0	0	0	0	0	0	0	0	0	0	0	0
		Analyzed	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	Collected	81	NS	NS	NS	0	0	0	0	0	0	0	0	0
		Analyzed	81	81	15	2	0	0	0	0	0	0	0	0	0
6	Woods Pond Boat Launch	Collected	26	26	3	3	3	1	1	3	3	3	3	2	
		Analyzed	26	26	2	3	3	0	0	3	3	3	3	2	

5 N/A = Not applicable
6 NS – Not specified in the SIWP
7

8 **2.2.1.2.2 Explanation of Differences**

9 The length of shoreline and number of areas where sampling were to be conducted were
10 determined prior to beginning field activities. However, in implementing the iterative sampling
11 strategy, before sampling was conducted a field survey was completed for each area, and sample
12 locations were reassessed based on the survey. As a result, the number of samples proposed may
13 be more or less than the actual number of samples completed, as described below.

1 **Sediment**

2 Samples

- 3 ▪ For the Paintball Area, Canoe Meadows, October Mountain Access Points, and
4 Woods Pond Boat Launch, the shoreline length was less than proposed; therefore,
5 fewer samples were collected.
- 6 ▪ In Decker Canoe Launch, Lenox Sportsman Club, and Duck Blinds, field assessments
7 determined there was more shoreline length than proposed, and more samples were
8 collected.
- 9 ▪ “Other” areas were not initially proposed for sampling but were determined in the
10 field, and one sample was collected.

11 **Riverbank**

12 Samples

- 13 ▪ For the Paintball Area, Canoe Meadows, Lenox Sportsman Club, and October
14 Mountain Access Areas, the shoreline length was less than proposed; therefore, fewer
15 samples were collected.
- 16 ▪ For Decker Canoe Launch, field assessments indicated that there was more shoreline
17 length than proposed, leading to a greater number of samples collected.
- 18 ▪ The “Other” areas were not originally proposed for sampling but were determined in
19 the field, and two samples were collected.

20 **Floodplain**

21 Samples

- 22 ▪ For the Paintball Area, DeVos Farm, and Lenox Sportsman Club, the exposure was
23 smaller than assumed; therefore, fewer samples were collected.
- 24 ▪ For Canoe Meadows, Decker Canoe Launch, October Mountain Access Points, and
25 Woods Pond Boat Launch, the exposure was greater than assumed; therefore, more
26 samples were collected.
- 27 ▪ For the Duck Blind sampling program, it was determined that the riverbank sampling
28 would be adequate for evaluating exposure to soil around the blinds. Therefore, no
29 floodplain samples were collected.

- 1 ▪ The “Other” areas were not originally proposed for sampling but were determined in
2 the field, and two samples were collected.

3 **2.2.1.3 Residential Exposure (Reaches 5 and 6)**

4 **2.2.1.3.1 Program Description and Summary**

5 Sampling was proposed in Reaches 5 and 6 for parcels adjacent to the river that were identified
6 as zoned for residential use. It was assumed that up to 40 properties would be included in the
7 sampling program, as described below:

- 8 ▪ Up to three sediment samples (0-6 inches) to be collected for each residentially zoned
9 property in Reaches 5 and 6, for a total of up to 120 samples.
- 10 ▪ Up to three riverbank locations to be sampled each from 0-6 inches and 6-12 inches
11 for each residentially zoned property in Reach 5 for a total of up to 240 samples (or
12 one location per 50 feet of riverbank).
- 13 ▪ For each of the current residential properties in Reaches 5, and for those properties
14 zoned for future residential development that extend into the 10-year floodplain, up to
15 five sample locations to be sampled at two depths (0-6 inches and 6-12 inches) for a
16 total of up to 400 samples.
- 17 ▪ All sediment samples to be analyzed for PCBs (total and Aroclors), grain size, and
18 TOC. In addition, approximately 10% of samples to be analyzed for PCB congeners,
19 and modified Appendix IX parameters. Approximately 2% of samples to be analyzed
20 for Appendix IX organophosphate pesticides and herbicides.
- 21 ▪ All riverbank samples to be analyzed for PCBs (total and Aroclors). In addition,
22 approximately 10% of riverbank samples to be analyzed for TOC, grain size, PCB
23 congeners, and modified Appendix IX parameters.
- 24 ▪ All floodplain samples to be analyzed for PCBs (total and Aroclors). In addition,
25 approximately 10% of floodplain samples were to be analyzed for TOC, grain size,
26 PCB congeners, and modified Appendix IX parameters. Approximately 2% of
27 samples to be analyzed for Appendix IX organophosphate pesticides and herbicides.

28 Tables 2.2.1-3 through 2.2.1-6 summarize the proposed and completed sampling and analysis.

29

1
2
3

4
5
6
7
8

9
10
11

Table 2.2.1-3

Sampling Summary – Human Health Risk Residential, Reach 5

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Human Health Risk Residential	Sediment	Proposed	NS	110	110	6	116
			Collected	23	35	35	2	37
		Riverbank	Proposed	NS	120	240	12	252
			Collected	22	44	88	3	91
		Floodplain	Proposed	NS	200	400	20	420
			Collected	63	192	372	16	388

NS = Not specified in the SIWP

Table 2.2.1-4

Sampling Summary – Human Health Risk Residential, Reach 6

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
6	Human Health Risk Residential	Sediment	Proposed	NS	10	10	0	10
			Collected	1	2	2	0	2
		Riverbank	Proposed	0	0	0	0	0
			Collected	0	0	0	0	0
		Floodplain	Proposed	N/A	N/A	N/A	N/A	N/A
			Collected	1	4	8	1	9

N/A = Not applicable

NS = Not specified in the SIWP

1
2
3

Table 2.2.1-5

Analysis Summary – Human Health Risk Residential, Reach 5

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/Furans	Cyanide	Sulfide	Congeners	
5	Human Health Risk Residential	Sediment	Collected	37	37	37	37	4	1	1	4	4	4	4	4	4	
			Analyzed	37	37	15	15	3	0	0	3	3	3	3	3	3	11
		Riverbank	Collected	91	91	9	9	9	2	2	9	9	9	9	9	9	9
			Analyzed	91	91	25	17	5	1	1	5	5	5	5	5	5	5
		Floodplain	Collected	388	388	38	38	38	7	7	38	38	38	38	38	38	38
			Analyzed	388	388	43	33	10	3	3	10	10	10	10	10	10	11

4
5
6
7
8

Table 2.2.1-6

Analysis Summary – Human Health Risk Residential, Reach 6

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/Furans	Cyanide	Sulfide	Congeners	
6	Human Health Risk Residential	Sediment	Collected	2	2	2	2	1	0	0	1	1	1	1	1	1	
			Analyzed	2	2	2	0	0	0	0	0	0	0	0	0	0	0
		Floodplain	Collected	9	9	1	1	1	0	0	1	1	1	1	1	1	1
			Analyzed	9	9	0	0	0	0	0	0	0	0	0	0	0	0

9
10

2.2.1.3.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

13

1 **Reaches 5 and 6 Sampling**

- 2 ▪ Based on a field reconnaissance of the accessibility of residential properties to the
3 river, the number of properties initially proposed for sampling was reduced and fewer
4 samples were collected.

5 **Reach 5 Analyses**

6 Sediment

- 7 ▪ 37 samples were proposed for TOC and grain size; 15 were analyzed. The difference
8 in the number of analyses is due to the decrease in the number of samples collected.
- 9 ▪ 4 samples were proposed for PCB congeners; 11 were analyzed.

10 Riverbank

- 11 ▪ 9 samples were proposed for TOC; 25 were analyzed. The additional TOC analyses
12 were conducted to provide better characterization of this area.
- 13 ▪ 9 samples were proposed for grain size; 17 were analyzed. The additional TOC
14 analyses were conducted to provide better characterization of this area.

15 Floodplain

- 16 ▪ The difference in the number of analyses is due to the decrease in the number of
17 samples collected, which resulted from fewer properties sampled as discussed above.

18 **2.2.1.4 Commercial/Industrial Exposure (Reaches 5 and 6)**

19 **2.2.1.4.1 Program Description and Summary**

20 Commercial/industrial sampling was proposed in Reach 5 to assess exposure to utility workers
21 and groundskeepers for current commercial/industrial properties. For the utility worker exposure
22 scenario, it was determined that four types of utility easements intersected the study area and
23 required sampling: a gas pipeline, telephone lines, electrical lines, and sewer lines. An
24 assessment of where groundskeeping activities were being conducted in areas adjacent to the
25 river was completed, and it was determined that only one location (Miss Hall's School) resulted
26 in a current exposure scenario. Riverbank and floodplain samples were to be collected from each

1 utility easement where applicable; and floodplain sampling was proposed for the groundskeeper
 2 exposure scenario as described below:

- 3 ▪ For riverbank utility easements, approximately 20 locations at two depths (0-6 inch
 4 and 6 inches-6 feet) to be sampled, for up to 40 samples.
- 5 ▪ Groundskeeper floodplain samples to be taken at two depths, 0-6 inches and 6-12
 6 inches, for up to 100 samples.
- 7 ▪ Floodplain samples at utility easements to be taken at three depths, 0-6 inches, 6-
 8 12 inches, and 1-6 feet, for up to 115 samples.
- 9 ▪ All riverbank samples to be analyzed for PCBs (total and Aroclors). In addition,
 10 approximately 10% of riverbank samples to be analyzed for TOC, grain size, PCB
 11 congeners/homologs, and modified Appendix IX parameters.
- 12 ▪ All floodplain samples to be analyzed for PCBs (total and Aroclors). In addition,
 13 approximately 10% of floodplain samples to be analyzed for TOC, grain size, PCB
 14 congeners/homologs, and modified Appendix IX parameters. Approximately 2% of
 15 samples to be analyzed for Appendix IX organophosphate pesticides and herbicides.

16 Tables 2.2.1-7 and 2.2.1-8 summarize the proposed and completed sampling and analysis.

17 **Table 2.2.1-7**

18 **Sampling Summary – Human Health Risk Commercial/Industrial**

19

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Human Health Risk Commercial/Industrial	Riverbank	Proposed	NS	20	40	2	42
			Collected	4	16	36	3	39
		Floodplain	Proposed	5+	108	215	11	226
			Collected	8	59	133	6	139

20 NS = Not specified in the SIWP.

21
 22

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Table 2.2.1-8

Analysis Summary – Human Health Risk Commercial/Industrial

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners	
5	Human Health Risk Commercial/ Industrial	Riverbank	Collected	39	39	4	4	4	0	0	4	4	4	4	4	4	
			Analyzed	39	39	6	6	5	0	0	5	5	5	5	5	5	
		Floodplain	Collected	139	139	14	14	14	3	3	14	14	14	14	14	14	14
			Analyzed	139	139	20	20	11	0	0	11	11	11	11	11	11	7

2.2.1.4.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

Riverbank

Samples

- Because of less existing riverbank in some areas than anticipated, 16 locations were sampled instead of 20 proposed locations, resulting in fewer samples collected.

Analysis

- Additional TOC grain size, OP pesticides, and Appendix IX analyses were conducted to provide better characterization of this area.

Floodplain

Samples

- Fewer samples were collected than proposed because observations of field conditions made at the time of sampling indicated that fewer samples would be necessary to adequately characterize the potential exposure area.

1 Analyses

- 2 ▪ To provide additional soil characterization data, 20 samples were analyzed for TOC
3 and grain size versus the 20 proposed.
- 4 ▪ 14 samples were proposed for PCB congener analyses: 7 were analyzed due to fewer
5 locations sampled.

6 **2.2.1.5 Agricultural Exposure (Reaches 5 and 6)**

7 **2.2.1.5.1 Program Description**

8 Floodplain soil sampling for agricultural exposure was proposed based on land currently zoned
9 for agricultural use within Reach 5 and is described below:

- 10 ▪ Up to five soil sample locations per 5 acres of tillable cropland or pastureland to be
11 sampled, with a total of up to 150 samples collected.
- 12 ▪ Samples to be collected at two depths, 0-6 inches and 6-12 inches.
- 13 ▪ All floodplain samples to be analyzed for PCBs (total and Aroclors). In addition,
14 approximately 10% of floodplain samples from Reach 5 to be analyzed for TOC,
15 grain size, PCB congeners/homologs, and modified Appendix IX parameters.
16 Approximately 2% of samples from Reach 5 to be analyzed for Appendix IX
17 organophosphate pesticides and herbicides.

18 An evaluation of agricultural properties was performed as part of the risk assessment to assess
19 potential agricultural exposures. As a result, soil and vegetation sampling was proposed at
20 specific locations that could be used to evaluate the potential for risks to human health as
21 described below.

22 **Cornfield**

23 Surface soil samples (0-6 inches) were to be collected concurrently with corn sampling from four
24 locations at up to five different agricultural areas within the floodplain:

- 25 ▪ Three soil samples to be collected adjacent to each of the areas where corn samples
26 were taken.
- 27 ▪ Single samples to be collected to a depth of 1 ft.

- 1 ▪ Approximately 30 soil samples to be collected and analyzed for PCBs (total and
2 Aroclors).

3 **Fiddlehead Sampling**

4 Surface soils (0-6 inches) and fiddlehead fern samples were collected by the Massachusetts
5 Department of Environmental Protection and by EPA consultants in 1999. Because all the 1999
6 fiddlehead fern data were R-qualified in validation due to low percent solids, a second round of
7 sampling was conducted in spring 2000. Samples were to be analyzed for PCBs (total and
8 Aroclors).

9 **Squash Sampling**

10 In September 1999, four acorn squash samples were collected from a squash field on a farm in
11 the Reach 5 floodplain. All squash samples were analyzed for PCBs (total and Aroclors).

12 **Grass Sampling**

13 Reed canary grass and co-located soil samples were collected to provide data for estimation of
14 transfer of PCB, dioxin, and furan congeners from soil and grass to cattle. In 2001, 10 paired
15 pasture grass and soil samples were collected from a former dairy farm in early July, when hay
16 harvesting typically occurs. Samples were to be collected from areas where relatively high PCB
17 concentrations were detected to avoid obtaining results below detection limits.

18 Tables 2.2.1-9 and 2.2.1-10 summarize the proposed and completed sampling and analysis.

19

1
2
3

Table 2.2.1-9

Sampling Summary – Agricultural

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5 & 6	Agriculture	Floodplain	Proposed	NS	75	Up to 150	8	158
			Collected	2	45	90	3	93
	Cornfield	Floodplain	Proposed	5	75	75	4	79
			Collected	2	14	32	2	34
	Corn	Tissue	Proposed	2	NS	NS	NS	NS
			Collected	2	19	29	1	30
	Fiddleheads	Surface Soil	Proposed	NS	NS	NS	NS	NS
			Collected	3	4	4	1	5
	Fiddleheads	Tissue	Proposed	NS	NS	NS	NS	NS
			Collected	3	3	3	1	4
	Squash	Surface Soil	Proposed	NS	NS	NS	NS	NS
			Collected	1	4	4	0	4
	Squash	Tissue	Proposed	NS	NS	NS	NS	NS
			Collected	1	2	4	0	4
	Grass	Surface Soil	Proposed	NS	NS	NS	NS	NS
			Collected	1	10	10	1	11
Grass	Tissue	Proposed	NS	NS	NS	NS	NS	
		Collected	1	10	10	1	11	

4 NS = Not specified in the SIWP.

1
2
3

Table 2.2.1-10

Analysis Summary – Agricultural

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/Furans	Cyanide	Sulfide	Congeners	% Lipids		
	Agriculture	Floodplain	Collected	93	93	9	9	9	2	2	9	9	9	9	9	9	-		
			Analyzed	93	93	6	6	5	1	1	5	5	5	5	5	4	-		
	Cornfield	Floodplain	Collected	34	34	0	0	0	0	0	0	0	0	0	0	0	0	-	
			Analyzed	34	34	0	0	0	0	0	0	0	0	0	0	0	0	-	
	Corn	Biological	Collected	30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Analyzed	30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Fiddleheads	Floodplain	Collected	5	5	0	0	0	0	0	0	0	0	0	0	0	5	-	
			Analyzed	0	0	0	0	0	0	0	0	0	0	0	0	0	5	-	
	Fiddleheads	Biological	Collected	4	4	0	0	0	0	0	0	0	0	0	0	0	4	0	
			Analyzed	3	3	0	0	0	0	0	0	0	0	0	0	0	10	0	
	Squash	Floodplain	Collected	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	-
			Analyzed	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	Squash	Biological	Collected	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Analyzed	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Grass	Floodplain	Collected	11	11	11	0	0	0	0	0	0	0	11	0	0	11	-	
			Analyzed	11	11	11	0	0	0	0	0	0	0	11	0	0	11	-	
	Grass	Biological	Collected	11	11	0	0	0	0	0	0	0	0	11	0	0	11	11	
			Analyzed	11	11	0	0	0	0	0	0	0	0	11	0	0	11	11	

4
5

1 **2.2.1.5.2 Explanation of Differences**

2 **Samples**

3 Samples to be collected in the farmed areas were estimated based on the number of properties to
4 be sampled. Before sampling was conducted, a field survey was completed for each farm, and
5 the number of sample locations was adjusted to reflect actual practices and conditions.

6 **2.2.1.6 Exposure Areas (Reaches 7 Through 9)**

7 **2.2.1.6.1 Program Description and Summary**

8 Exposure areas to be sampled in Reaches 7 through 9 included recreational, residential,
9 agricultural, and commercial/industrial areas as described below.

- 10 ▪ Sediment samples to be collected at recreational and residential areas at reduced
11 frequency due to anticipated lower levels of contamination expected based upon
12 historical data. Approximately 150 sediment samples were estimated.
- 13 ▪ Riverbank samples to be collected as necessary based on project protocols and
14 amount of riverbank present at time of sampling; no estimate of the number of
15 samples was listed in the SIWP.
- 16 ▪ Up to 350 floodplain soil samples to be collected. A field assessment of the areas in
17 Reaches 7 through 9 to be completed to locate potential human exposure areas.
- 18 ▪ Sediment samples to be analyzed for PCBs (total and Aroclors), grain size, and TOC.
19 In addition, approximately 10% of samples to be analyzed for PCB congeners/
20 homologs, and modified Appendix IX parameters. Approximately 2% of samples to
21 be analyzed for Appendix IX organophosphate pesticides and herbicides. Other
22 parameters to be analyzed only after determining that PCBs were present at
23 concentrations that might be of concern.
- 24 ▪ Riverbank and floodplain samples to be analyzed for PCBs (total and Aroclors). In
25 addition, approximately 10% of these samples to be analyzed for TOC, grain size,
26 PCB congeners, and modified Appendix IX parameters. Other parameters to be
27 analyzed only if PCBs present at concentrations of concern.

28 Tables 2.2.1-11 and 2.2.1-12 summarize the proposed and completed sampling and analysis.

29

1
2
3

Table 2.2.1-11

Sampling Summary – Exposure Areas, Reaches 7 through 9

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
7-9	Exposure Areas	Sediment	Proposed	NS	NS	150	8	158
			Collected	83	86	87	8	95
		Riverbank	Proposed	NS	NS	NS	NS	NS
			Collected	83	9	20	0	20
		Floodplain	Proposed	NS	NS	350	18	368
			Collected	57	543	957	60	1017

NS = Not specified in the SIWP.

4
5
6
7
8

Table 2.2.1-12

Analysis Summary – Exposure Areas, Reaches 7 through 9

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners	
7-9	Exposure Areas	Sediment	Collected	95	95	95	95	0	0	0	0	0	0	0	0	0	
			Analyzed	95	95	63	64	0	0	0	0	0	0	0	0	0	0
		Riverbank	Collected	20	20	0	0	0	0	0	0	0	0	0	0	0	0
			Analyzed	20	20	0	0	0	0	0	0	0	0	0	0	0	0
		Floodplain	Collected	1017	1017	101	101	101	20	20	101	101	101	101	101	101	101
			Analyzed	1017	1017	81	82	9	0	0	9	9	9	9	9	9	6

9
10

2.2.1.6.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

13

1 **Floodplain**

2 Samples

3 ▪ The number of sediment samples was decreased because the field assessment of
4 recreational areas showed these areas to be smaller in area than anticipated.

5 ▪ The number of floodplain samples was increased because the field assessment
6 indicated the area was larger than anticipated.

7 Analysis

8 ▪ Many analytes were discontinued for this sampling program based upon an evaluation
9 of historical data and results that indicated that these parameters were consistently not
10 detected, as described in Section 2.

11 ▪ The decrease in the number of TOC and grain size samples analyzed for sediment and
12 floodplain area was due to a number of these samples inadvertently not being
13 submitted for analysis.

14

1 **2.2.2 Aggrading Bars and Terraces**

2 **2.2.2.1 Program Description and Summary**

3 To characterize potentially contaminated sediments, approximately 50 aggrading bars and
4 terraces, located within Reach 5 in an assessment performed by MADEP (1997), were proposed
5 to be sampled. The proposed sampling is described below:

- 6 ▪ Two cores to be collected at each aggrading bar or terrace to first refusal.
- 7 ▪ One of these two cores to be collected at the maximum depth of accumulated
8 sediment, with the other core being collected equidistant from the first core at the
9 farthest end of the aggrading bar or terrace.
- 10 ▪ The assumption was that each core would average 2.5 feet in depth and be divided
11 into 6-inch sections, resulting in five samples per location, or a total of approximately
12 500 samples.
- 13 ▪ All samples to be analyzed for PCBs (total and Aroclors), grain size, and TOC. In
14 addition, approximately 10% of the samples to be analyzed for modified Appendix IX
15 parameters and PCB congeners, and approximately 2% of the samples to be analyzed
16 for Appendix IX organophosphate pesticides and herbicides.

17 Tables 2.2.2-1 and 2.2.2-2 summarize the proposed and completed sampling and analysis.

18 **Table 2.2.2-1**

19 **Sampling Summary – Aggrading Bars and Terraces**

20

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Aggrading Bars and Terraces	Sediment	Proposed	50	100	500	25	525
			Collected	45	92	559	28	587

21

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

Table 2.2.2-2

Analysis Summary – Aggrading Bars and Terraces

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners
5	Aggrading Bars and Terraces	Sediment	Collected	587	587	587	587	59	12	12	59	59	59	59	59	59
			Analyzed	586	586	582	584	53	9	9	53	53	54	53	53	53

2.2.2.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

Area/Location

- There were five fewer aggrading bars and terraces located in the field than originally proposed. In addition, two more cores were collected to provide additional sample locations on bars that were larger than anticipated.

Samples

- 587 samples were collected versus the 525 proposed. Although fewer areas were sampled, the average core length collected was greater than the 2.5 feet proposed, resulting in an increase in the number of samples and duplicates collected.

1 **2.2.3 Temporary and Permanent Pools**

2 **2.2.3.1 Program Description and Summary**

3 Sediment samples were proposed to be collected from approximately 56 pools located in the
4 floodplain of adjoining Reach 5. These pools were previously selected during ecological
5 characterization efforts for biological sampling. The sampling program is described below:

- 6 ▪ Samples to be collected from 0-6 inches in depth.
- 7 ▪ Three to five samples to be collected per pool, depending on the pool size, for a total
8 of between 168 and 280 samples.
- 9 ▪ All samples to be analyzed for PCBs (total and Aroclors), grain size, and total organic
10 carbon.

11 Tables 2.2.3-1 and 2.2.3-2 summarize the proposed and completed sampling and analysis.

12 **Table 2.2.3-1**

13 **Sampling Summary – Temporary and Permanent Pools**

14

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Temporary and Permanent Pools	Sediment	Proposed	56	168-280	168-280	8-14	176-294
			Collected	67	301	313	17	330

15
16

1
2
3

4
5
6
7
8
9
10
11
12
13
14
15

Table 2.2.3-2

Analysis Summary – Temporary and Permanent Pools

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size
5	Temporary and Permanent Pools	Sediment	Collected	330	330	330	330
			Analyzed	308	308	330	329

2.2.3.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

Areas

- 67 temporary and permanent pools were identified during field sampling versus the 56 pools initially estimated for the study area.

Samples

- As a result of the increase in the number of pools, 330 samples were collected versus the 168 to 280 proposed.

1 **2.2.4 Sediment Cores**

2 Discrete (i.e., non-transect) sediment cores were collected from the channel of the Housatonic
3 River as well as from impoundments, primarily in Reaches 5 and 6. These cores were analyzed
4 for PCBs, TOC, and grain size. Selected cores were also used for extraction and analysis of pore
5 water and radioisotope dating. The non-transect sediment core, grain size fractionation, pore
6 water and radionuclide dating programs are described below.

7 **2.2.4.1 Non-Transect Sediment Cores**

8 **2.2.4.1.1 Program Description and Summary**

9 To assess the location and concentration of PCBs in areas of the river not associated with the
10 systematic transect sampling, sediment cores were proposed as part of the discrete sampling
11 program, as described below:

- 12 ▪ Sample locations to be selected based on the iterative review of chemical data as it
13 was received as well as observations of river flow and sedimentation patterns.
- 14 ▪ All samples to be analyzed for PCBs (total and Aroclor), TOC, and grain size.

15 Tables 2.2.4-1 and 2.2.4-2 summarize the proposed and completed sampling and analysis.

16 **Table 2.2.4-1**

17 **Sampling Summary – Non-Transect Sediment Cores**

18

Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
Sediment	Proposed	NS	NS	NS	NS	NS
	Collected	N/A	8	74	4	78

19 N/A = Not applicable

20 NS = Not specified in the SIWP

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27

Table 2.2.4-2

Analysis Summary – Non-Transect Sediment Cores

Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners
Sediment	Collected	78	78	78	78	8	2	2	8	8	8	8	8	8
	Analyzed	74	74	78	64	7	1	1	7	7	7	7	7	6

2.2.4.1.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

- 64 grain size samples analyzed versus 78 collected because of inadequate sample volume for multiple analyses.
- Some samples were analyzed for Appendix IX compounds to evaluate their presence in selected areas of the site.

2.2.4.2 Grain Size Fractionation

2.2.4.2.1 Program Description and Summary

A series of sediment cores was collected from the river channel, Woods Pond, and backwater areas to provide characterization data by grain size class for use in the modeling study. The proposed program is described below:

- 3 cores per transect to be collected along 11 transects in Reach 5.
- Sample locations from Woods Pond (6) and backwater areas (3) to be selected based on the subbottom profiling survey and to coincide with the cores collected as part of the systematic sampling at Woods Pond.
- Core samples to be collected at 0-6 inches and 12-18 inches depth intervals, resulting in 66 samples from Reach 5 and 18 samples from Reach 6.
- Each interval to be sieved into three separate grain size classes, resulting in a total of 252 fractionated samples.
- Analyses to include PCB and TOC analysis of each of the three size fractions and PCB analysis on the bulk sediment.

1 Tables 2.2.4-3 and 2.2.4-4 summarize the proposed and completed sampling and analysis.

2
3
4

Table 2.2.4-3

Sampling Summary – Grain Size Fractionation

Reach	Media		No. of Areas	Sample Locations	Bulk Samples	Fractions Samples	Duplicates	Total Samples
4	Sediment	Proposed	NS	NS	NS	NS	NS	NS
		Collected	1 Transect	3	6	18	1	25
West Branch	Sediment	Proposed	NS	NS	NS	NS	NS	NS
		Collected	1 Transect	3	6	18	0	24
5	Sediment	Proposed	11 Transects	33	66	NS	NS	NS
		Collected	9 Transects	27	53	159	7	219
	Floodplain	Proposed	NS	NS	NS	NS	NS	NS
		Collected	2	2	4	12	0	16
6	Sediment	Proposed	9	9	18	NS	NS	NS
		Collected	1 Trans & 1 Non-Trans	7	13	42	0	55

5
6
7
8
9

NS = Not specified in the SIWP

Table 2.2.4-4

Analysis Summary – Grain Size Fractionation

Reach	Media		PCB	Aroclors	TOC	Congeners
4	Sediment	Collected	25	25	25	NS
		Analyzed	25	25	25	6
West Branch	Sediment	Collected	24	24	24	NS
		Analyzed	24	24	24	18
5	Sediment	Collected	219	219	219	NS
		Analyzed	218	218	218	54
	Floodplain	Collected	16	16	16	NS
		Analyzed	16	16	16	7
6	Sediment	Collected	55	55	55	NS
		Analyzed	55	55	55	40

10
11
12

NS = Not specified in the SIWP

1 **2.2.4.2 Explanation of Differences**

2 Sample locations were added to the program to evaluate PCB concentrations in areas of interest
3 for the risk assessments or the modeling study that were not included in the SIWP.

4 **2.2.4.3 Pore Water**

5 **2.2.4.3.1 Program Description and Summary**

6 The objective of collecting sediments for pore water analysis was to provide data to be used to
7 evaluate partitioning of PCBs between sediment and water. The proposed sampling is described
8 below:

- 9 ▪ Samples to be collected from the 0-6 inch depth interval at 6 to 15 locations.
- 10 ▪ Sample processing to be conducted at a fixed laboratory where the pore water was
11 separated and analyzed for PCBs and dissolved organic carbon.

12 Tables 2.2.4-5 and 2.2.4-6 summarize the proposed and completed sampling and analysis.

13 **Table 2.2.4-5**

14 **Sampling Summary – Pore Water**

15

Media		No. of Areas	Sample Locations	Bulk Samples	Sediment After Centrifugation	Pore Water	Duplicates	Total Samples
Sediment	Proposed	N/A	6-15	6-15	6-15	6-15	NS	NS
	Collected	N/A	13	13	6	13	0	32

16 N/A = Not applicable

17 NS = Not specified in the SIWP

18

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Table 2.2.4-6

Analysis Summary – Pore Water

Media		PCB	Aroclors	TOC	DOC	Congeners
Sediment	Collected	19	19	NS	NS	NS
	Analyzed	12	12	0	0	19
Pore Water	Collected	13	13	13	13	13
	Analyzed	8	8	5	8	13

NS = Not specified in SIWP

2.2.4.3.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

- Fewer analyses were performed due to difficulties in processing the samples to extract the pore water.

2.2.4.4 Supplemental Pore Water

2.2.4.4.1 Program Description and Summary

The Supplemental Pore Water Study was conducted to provide a better understanding of PCB partitioning and the effect of organic carbon on the sorptive behavior of PCBs in the Housatonic River. The extraction technique for the supplemental program was created to develop a consistent data set representative of pore waters at the site.

Fifty sample locations in Reaches 4, 5, and 6 were selected for the Supplemental Pore Water Study. All bulk sediment was analyzed for total PCB, TOC, grain size, bulk density, and moisture content. Pore water was separated by centrifugation and filtration and analyzed for total PCB, and dissolved organic carbon. A total of 100 samples were collected.

Tables 2.2.4-7 and 2.2.4-8 summarize the proposed and completed sampling and analysis.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

Table 2.2.4-7

Sampling Summary – Supplemental Pore Water

Media		No. of Areas	Sample Locations	Bulk Samples	Pore Water	Duplicates	Procedural Blanks	Total Samples
Sediment	Proposed	N/A	50	50	50	3	3	106
	Collected	N/A	50	50	50	3	3	106

N/A = Not applicable

Table 2.2.4-8

Analysis Summary – Supplemental Pore Water

Media		PCB	TOC	DOC	Grain Size	Bulk Density	% Moisture	Congeners
Sediment	Collected	53	53	0	53	53	53	53
	Analyzed	53	53	0	53	53	53	53
Pore Water	Collected	53	0	53	0	0	0	53
	Analyzed	53	0	53	0	0	0	53

2.2.4.4.2 Explanation of Differences

The program was implemented as described in the program-specific Standard Operating Procedure (SOP).

2.2.4.5 Radionuclide Dating

2.2.4.5.1 Program Description and Summary

To provided data on sediment deposition rates in Woods Pond and its backwaters, cores were proposed to be collected for dating analysis, as described below:

- Up to 10 cores to be used for dating.

- 1 ▪ Cores to be sectioned every 2 cm for the top 15 cm (0 to 6 inches), every 4 cm for the
- 2 next 30 cm (6 to 12 inches), every 10 cm for the next 60 cm (12 to 36 inches), and
- 3 every 15 cm to a depth of approximately 183 cm (72 inches), resulting in
- 4 approximately 22 samples per core and a total of up to 220 samples.
- 5 ▪ Radionuclide dating to be conducted using cesium¹³⁷, lead²¹⁰, and beryllium⁷.

6 Tables 2.2.4-9 and 2.2.4-10 summarize the proposed and completed sampling and analysis.

7
8
9

Table 2.2.4-9

Sampling Summary – Radioisotope

Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
Sediment	Proposed	N/A	Up to 10	Up to 220	NS	Up to 231
	Collected	N/A	9	188	0	169

10
11
12
13
14

N/A = Not applicable

NS = Not specified in SIWP

Table 2.2.4-10

Analysis Summary – Radioisotope

Media		Total PCB	Aroclors	TOC	Cesium-137	Lead-210	Beryllium-7
Sediment	Collected	188	188	188	188	188	188
	Analyzed	147	147	115	132	188	132

15
16
17

2.2.4.6 Explanation of Differences

18 Differences in the number of samples proposed, collected, and analyzed resulted from refusal
19 during collection and difficulties with sediment processing and analytical extractions.

20

1 **2.2.5 Impoundments**

2 **2.2.5.1 Program Description and Summary**

3 The objective of sampling sediment accumulated in downstream depositional areas was to
4 characterize the concentrations of PCBs for use in the risk assessments and modeling study. The
5 proposed program is described below:

- 6 ▪ Samples to be collected behind the following three existing dams:
 - 7 ▪ Columbia Mill
 - 8 ▪ Willow Mill
 - 9 ▪ Glendale Dam
- 10
- 11
- 12 ▪ Samples to be collected behind the following seven former dams:
 - 13 ▪ Niagara Mills
 - 14 ▪ Lee/Eagle Mills
 - 15 ▪ Eaton-Bikeman
 - 16 ▪ Monument Mills No. 2
 - 17 ▪ Monument Mills No. 3
 - 18 ▪ Former Southern Berkshire Dam (Reach 9)
- 19
- 20
- 21 ▪ At least one transect with three sampling locations to be sampled in depositional areas
22 immediately upstream of each dam or former dam.
- 23 ▪ Sampling locations and numbers of samples to be determined after field probing of
24 sediment depths, evaluation of site characteristics, and review of existing data.
25 Estimated numbers of samples: 60 at existing dams; 54 at former dams.
- 26 ▪ All samples to be analyzed for PCBs (total and Aroclors), grain size, and total organic
27 carbon.

28 Tables 2.2.5-1 and 2.2.5-2 summarize the proposed and completed sampling and analysis.

1
2
3

Table 2.2.5-1

Sampling Summary – Impoundments

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
7-9	Impoundments	Sediment	Proposed	9	NS	114	6	120
			Collected	10	23	52	2	54

NS = Not specified in the SIWP

4
5
6
7
8

Table 2.2.5-2

Analysis Summary – Impoundments

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size
7-9	Impoundments	Sediment	Collected	54	54	54	54
			Analyzed	54	54	53	49

9
10

2.2.5.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

Samples

- The number of dams to be sampled was increased from 9 to 10 because an additional former dam was identified downstream of the Glendale Dam during field sampling.
- 54 samples were collected versus the 114 proposed. This decrease is attributable to actual field conditions that were different than anticipated and sample refusal before the estimated sample depths could be achieved.

19

1 **2.2.6 Connecticut**

2 **2.2.6.1 Program Description and Summary**

3 The objective of this sampling program was to characterize river sediments and soils in areas of
4 potential human exposure to support the human health assessment. The proposed program is
5 described below:

- 6 ▪ Samples to be collected from selected areas along the river channel and from behind
7 several dams in the Connecticut portion of the Housatonic River.
- 8 ▪ River channel sediments to be collected from 0-6 inches and 6-12 inches at the
9 midpoint of the main channel.
- 10 ▪ Sediment samples to be collected behind dams to approximately 4 to 5 feet in depth,
11 with only the first and last 6-inch interval to be sampled, resulting in a total of 20
12 samples.
- 13 ▪ Both river channel and dam samples to be analyzed for PCBs (total and Aroclors),
14 total organic carbon, and grain size.
- 15 ▪ Soil (floodplain) samples to be collected at access areas along the edge of the river.
16 Approximately 14 soil samples at seven locations to be collected from 0-6 inches and
17 6-12 inches.
- 18 ▪ Samples to be analyzed for PCBs (total and Aroclors), total organic carbon, and grain
19 size.

20 Tables 2.2.6-1 and 2.2.6-2 summarize the proposed and completed sampling and analysis.

21

1
2
3

Table 2.2.6-1

Analysis Summary – Connecticut Sampling

Reach	Program	Media		Sample Locations	Samples	Duplicates	Total Samples
CT	Connecticut Sampling	Sediment-River Channel	Proposed	NS	NS	NS	NS
			Collected	17	26	2	28
		Sediment-Dam	Proposed	NS	NS	NS	NS
			Collected	4	8	1	9
		Floodplain	Proposed	NS	NS	NS	NS
			Collected	4	6	1	7

4

NS = Not specified in the SIWP

5
6
7

Table 2.2.6-2

Sampling Summary – Connecticut Sampling

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size
CT	Connecticut Sampling	Sediment-River Channel	Collected	28	28	28	28
			Analyzed	28	28	28	2
		Sediment-Dam	Collected	9	9	9	9
			Analyzed	9	9	9	0
		Floodplain	Collected	7	7	7	7
			Analyzed	7	7	7	7

8
9

10 **2.2.6.2 Explanation of Differences**

11 Differences between the proposed versus completed numbers of samples and analyses are
12 discussed below.

13

1 **Samples**

- 2 ▪ The number of samples collected for each sampling location (river channel, dam, and
3 floodplain) decreased due to actual field conditions that were different than
4 anticipated and to sample refusal prior to reaching the required depth.
- 5 ▪ Floodplain sampling locations decreased due to fewer exposure areas than originally
6 anticipated.

7 **Analysis**

- 8 ▪ The number of grain size analyses was less than the number of collected samples due
9 to insufficient sample volume for analysis.

10

1 **2.2.7 Congeners**

2 Samples were collected for PCB congener analysis to provide data on congener profiles in
3 different media and across a range of PCB concentrations for use in the human health and
4 ecological risk assessments and the modeling study.

5 **2.2.7.1 Low-Resolution Congener Sampling**

6 **2.2.7.1.1 Program Description and Summary**

7 Sampling locations for low-resolution PCB congener analysis (52 congeners by GC/MS) were
8 selected based on a review of the results of the total PCB analyses. Sampling locations were
9 selected to include a range of ecological habitats and areas associated with various human health
10 exposure scenarios. Sediments sampled for PCB congener analyses were also to be analyzed for
11 total PCBs, Aroclors, TOC, and other parameters. Floodplain soils were to be analyzed only for
12 total PCBs and Aroclors in addition to the PCB congeners.

13 Tables 2.2.7-1 and 2.2.7-2 summarize the proposed and completed sampling and analysis for
14 low-resolution congeners.

15

1
2
3

Table 2.2.7-1

Sampling Summary – Low-Resolution Congener

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Low Resolution Congener	Sediment	Proposed	N/A	NS	NS	NS	NS
			Collected	N/A	31	31	1	32
		Floodplain	Proposed	N/A	NS	NS	NS	NS
			Collected	N/A	52	52	2	54
Ref	Low Resolution Congener	Floodplain	Proposed	N/A	NS	NS	NS	NS
			Collected	N/A	3	3	0	3

4
5

N/A = Not applicable. This type of sampling was not outlined for a particular program in the SIWP

6

NS = Not specified in the SIWP

7

Table 2.2.7-2

Analysis Summary – Low-Resolution Congener

8
9

10

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Congeners
5	Low Resolution Congener	Sediment	Collected	32	32	32	32	32
			Analyzed	31	31	31	31	31
		Floodplain	Collected	54	54	0	0	52
			Analyzed	54	54	0	0	52
Ref	Low Resolution Congener	Floodplain	Collected	3	3	0	0	3
			Analyzed	3	3	0	0	3

11

12

2.2.7.1.2 Explanation of Differences

There were only minor differences between the program as planned and as completed.

15

1 **2.2.7.2 High-Resolution Congener Sampling**

2 **2.2.7.2.1 Program Description and Summary**

3 In late 2001 and 2002, samples for high-resolution congener analysis (GC/ECD with 90+ PCB
 4 congeners or co-eluting groups) were collected to better characterize the dioxin-like congeners,
 5 and to supplement the congener data in specific areas and habitats. The high-resolution congener
 6 sediment and floodplain samples were to be analyzed for the same parameters as the low-
 7 resolution congener samples.

8 Tables 2.2.7-3 and 2.2.7-4 summarize the proposed and completed sampling and analysis for
 9 high-resolution congeners.

10 **Table 2.2.7-3**

11 **Sampling Summary – High-Resolution Congeners**

12

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	High-Resolution Congener	Sediment	Proposed	N/A	NS	NS	NS	NS
			Collected	N/A	13	13	2	15
		Floodplain	Proposed	N/A	NS	NS	NS	NS
			Collected	N/A	30	30	3	33
6	High-Resolution Congener	Sediment	Proposed	N/A	NS	NS	NS	NS
			Collected	N/A	2	2	0	2

13 N/A = Not applicable

14 NS = Not specified in the SIWP

15
16

1
2
3

Table 2.2.7-4

Analysis Summary – High-Resolution Congeners

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Congeners
5	High-Resolution Congener	Sediment	Collected	15	15	15	0	15
			Analyzed	30	30	15	0	15
		Floodplain	Collected	33	33	33	0	33
			Analyzed	66	66	14	0	33
6	High-Resolution Congener	Sediment	Collected	2	2	2	0	2
			Analyzed	4	4	2	0	2

4
5

NS = Not specified in the SIWP

6 **2.2.7.2.2 Explanation of Differences**

7 The number of results for PCBs (total and Aroclors) reflects the number of entries for these
8 parameters in the project database for the 15 high-resolution congener samples collected and
9 analyzed. The congener analysis provides a direct measurement for total PCBs and Aroclors and
10 also provides values for these parameters as the sum of the congeners; both of these values were
11 captured in the database.

12

1 **2.2.8 Former Meanders**

2 **2.2.8.1 *Program Description and Summary***

3 Sampling of former meanders in Reach 5 was proposed as part of the discrete sampling program.
4 At the time the SIWP was prepared, it was assumed that some of the transect sampling program
5 locations would intersect former meanders. After review of the available information and data,
6 additional former meanders would be selected for sampling. A total of 54 samples were to be
7 collected and analyzed for PCBs (total and Aroclors), grain size, and total organic carbon.

8 **2.2.8.2 *Explanation of Differences***

9 This program was not implemented. It was determined that the former meanders had been
10 adequately sampled and characterized.

11

1 **2.2.9 Benthic Invertebrate Community Evaluation**

2 The macroinvertebrate community was to be sampled at 13 stations, four of which were to be
 3 located in areas of known background levels of PCBs and were to be considered reference
 4 locations. The remaining nine stations were to be located throughout Reach 5 of the PSA (i.e.,
 5 between the confluence and Woods Pond) and were to be considered target locations. Further
 6 detail on the proposed program is described in the subsections below.

7 **2.2.9.1 Sediment Sampling**

8 **2.2.9.1.1 Program Description and Summary**

9 Sediment sampling was proposed as part of the benthic invertebrate community evaluation and
 10 for use in the Sediment Quality Triad evaluation. The proposed program is described below:

- 11 ▪ Each of the 156 Ponar grab samples (12 replicates at each of the 13 locations) to be
 12 subsampled from the 0-5 cm depth.
- 13 ▪ The two subsamples to be composited in a clean stainless-steel bowl and separated
 14 into two aliquots of approximately 30 cm³ (for total PCB, Aroclor, and TOC analysis)
 15 and 80 cm³ (for grain-size analysis).

16 Tables 2.2.9-1 and 2.2.9-2 summarize the proposed and completed sampling and analysis.

17 **Table 2.2.9-1**

18 **Sampling Summary – Sediment – Benthic Invertebrate**

19

Reach	Program	Media		Sample Locations	Samples	Duplicates	Total Samples
5	Benthic Macroinvertebrate	Sediment	Proposed	13	156	0	156
			Collected	13	156	0	156

20

1
2
3

Table 2.2.9-2
Analysis Summary – Sediment – Benthic Invertebrate

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size
5	Benthic Macroinvertebrate	Sediment	Collected	156	156	156	156
			Analyzed	156	156	156	156

4
5

6 **2.2.9.2 Explanation of Differences**

7 The program was completed as proposed. There was an error in the text description of the
8 benthic invertebrate program in the SIWP regarding the analysis of sediment samples for
9 dioxins/furans and OC pesticides. However, the description provided in Appendix A-14 of the
10 SIWP was correct; no such samples were proposed or collected.

11

1 **2.2.9.3 Biological Sampling**

2 **2.2.9.3.1 Program Description and Summary**

3 The proposed biota sampling program is described below.

- 4 ▪ Twelve replicate samples for taxonomic analysis to be collected from depositional
5 habitats at each of 13 locations with a Petite Ponar grab sampler. These samples to be
6 sieved through a 0.5-mm sieve prior to analysis.
- 7 ▪ Additional macroinvertebrate samples for tissue residue analysis to be collected at
8 each location using a kick-net. If sufficient material was collected, these samples to
9 be separated into community functional groups prior to analysis.
- 10 ▪ All tissue residue samples to be analyzed for PCBs (total, Aroclor, congeners, and
11 homologs), total lipids, and percent moisture. If sufficient material was collected,
12 additional analyses to be conducted for dioxins/furans and OC pesticides.
- 13 ▪ 156 replicate samples to be processed for taxonomy, enumeration, and biomass using
14 stereo and compound microscopes as necessary.
- 15 ▪ All organisms picked from the sample to be identified to the lowest practical
16 identification level (LPIL), which was expected to be genus in most cases. All
17 specimens to be retained as a voucher collection.

18 Tables 2.2.9-3 and 2.2.9-4 summarize the proposed and completed tissue sampling and analysis.

19 Tables 2.2.9-5 and 2.2.9-6 summarize the benthic invertebrate community sampling and analysis.

20

21

1
2
3

Table 2.2.9-3

Sampling Summary - Benthic Macroinvertebrate Tissue

Reach	Program	Media		Locations	Samples	Duplicates	Total Number of Samples
5 + Ref	Benthic Macroinvertebrate	Tissue	Proposed	13	22	2	24
			Collected	12	21	0	21

4
5
6
7

Table 2.2.9-4

Analysis Summary – Benthic Macroinvertebrate Tissue

Reach	Program	Media		Total PCB	Aroclors	Congeners	Percent Lipids	OC Pesticides	Dioxins/ Furans	Percent Moisture
5 + Ref	Benthic Macroinvertebrate	Tissue	Collected	21	21	21	21	11	11	21
			Analyzed	21	0	21	31	21	11	21

8
9
10

1
2
3

Table 2.2.9-5

Sampling Summary – Benthic Macroinvertebrate Community Analysis

Reach	Program	Media		Locations	Samples	Duplicates	Total Number of Samples
5 + Ref	Benthic Macroinvertebrate	Community Analysis	Proposed	13	156	0	156
			Collected	13	12	0	156

4
5
6
7

Table 2.2.9-6

Analysis Summary – Benthic Macroinvertebrate Community Analysis

Reach	Program	Media		Taxonomy	Enumeration	Biomass
5 + Ref	Benthic Macroinvertebrate	Community Analysis	<i>Collected</i>	156	156	156
			Analyzed	156	156	156

8
9

10 **2.2.9.4 Explanation of Differences**

11 Differences between the number of proposed versus completed samples and analyses are
12 discussed below.

13 **Samples**

- 14 ▪ Field duplicates for tissue analysis were not collected due to limited sample mass.

1 ▪ One fewer sample was submitted for tissue analysis than proposed due to sample
2 breakage in storage.

3 **Analyses**

4 ▪ The Aroclor concentrations were to be calculated from the congener results. Because
5 the congener data directly provide more information about PCB composition, no
6 calculated Aroclor concentrations were included in the database.

7 ▪ OC pesticides were analyzed for 21 samples; 11 were collected to be analyzed. As
8 proposed, additional analyses were conducted for OC pesticides.

9 ▪ 31 samples were analyzed for percent lipids versus 21 collected because lipids were
10 analyzed separately for the PCB and the dioxin/furan analyses, respectively.

11

1 **2.2.10 Sediment Macroinvertebrate Toxicity, Bioaccumulation, and Stressor**
2 **Identification Study**

3 This study was proposed to measure water and bulk sediment toxicity in laboratory and field (in
4 situ) exposures of surrogate test organisms and to determine which class of chemicals contribute
5 to toxicity using a sediment Phase I Toxicity Identification Evaluation (TIE). Organisms for in
6 situ toxicity and bioaccumulation studies were exposed at six locations along the Housatonic
7 River in flow-through chambers for 2 to 10 days. In the laboratory, additional life-cycle
8 assessment tests were conducted on organisms for 4 to 6 weeks. The test results are presented in
9 the study report and discussed further in the Ecological Risk Assessment.

10 **2.2.10.1 Sediment Sampling**

11 **2.2.10.1.1 Program Description and Summary**

12 Sediment samples were initially collected and analyzed to assist in selecting locations along the
13 river for conducting the in situ toxicity studies. Following the selection of the toxicity testing
14 locations, sediment samples were collected for laboratory toxicity testing.

15 All sediment samples were proposed to be collected to a depth of 6 inches, and analyzed for
16 PCBs (total and Aroclors), TOC, and grain size. At least one sample per location would be
17 analyzed for PCB congeners and modified Appendix IX constituents.

18 Tables 2.2.10-1 and 2.2.10-2 summarize the proposed and completed sampling and analysis.

19

1
2
3

Table 2.2.10-1

Sampling Summary – Sediment Toxicity

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Sediment Toxicity	Sediment	Proposed	6	6	15 (+5-Ref.)	1	21
			Collected	6 (+pre test locations)	84	84	3	87

4
5
6
7

Table 2.2.10-2

Analysis Summary – Sediment Toxicity

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners
5	Sediment Toxicity	Sediment	Collected	87	87	87	87	6	0	0	6	6	6	6	6	6
			Analyzed	87	87	78	4	8	6	6	8	8	7	2	2	12

8
9

2.2.10.1.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

Samples

- 87 total samples were collected versus 21 proposed. Several iterations of sampling were conducted to select locations in the Housatonic River with low, medium, and high concentrations of PCBs in sediments for the purpose of selecting sites for in situ sediment toxicity testing. Additional sampling was also conducted to locate reference sediment locations.

18

1 **Analyses**

- 2 ▪ 4 samples were analyzed for grain size versus the 87 collected because there was
3 inadequate sample volume.
- 4 ▪ 6 samples were analyzed for herbicide and OP pesticide analyses, although none were
5 originally proposed. These analyses were included with the Appendix IX parameters
6 for these 6 samples.
- 7 ▪ 12 samples were analyzed for PCB congeners versus the proposed 6. Two samples
8 per location were analyzed for congeners to better characterize the variable
9 contamination in the sediments.

10 **2.2.10.2 Sediment Toxicity Testing**

11 **2.2.10.2.1 Laboratory Sediment Toxicity Testing**

12 Laboratory sediment toxicity testing was conducted on two organisms: *Hyaella azteca* and
13 *Chironomus tentans*. Endpoints that were evaluated were survival, growth, and reproduction.

14 ***Hyaella azteca* Life-Cycle Assessment**

- 15 ▪ Endpoints to be monitored included 28-day survival and growth, 35-day survival and
16 reproduction, and 42-day survival, growth, and reproduction. No deviations from this
17 protocol occurred.
- 18 ▪ Water quality to be measured for dissolved oxygen, temperature, conductivity,
19 hardness, alkalinity, ammonia, and pH at the beginning of the sediment exposure of
20 the test, weekly thereafter, then at the end of the test. No deviations from this protocol
21 occurred.

22 ***Chironomus tentans* Life-Cycle Assessment**

- 23 ▪ Endpoints monitored in the survival and growth portion of the study to include 20-
24 day survival, dry weight, ash-free dry weight, and percent emergence. No deviations
25 from this protocol occurred.
- 26 ▪ Emergence data to be collected for complete and partial emergence on or about Day
27 23 and continued for approximately 2 weeks. From Day 23 to the end of the test,
28 emergence of males and females, pupal and adult mortality to be recorded daily for
29 the reproductive replicates. No deviations from this protocol occurred.

30 Abiotic (sediment) samples collected to support the *H. azteca* and *C. tentans* portion of the study
31 are included in the summary tables (Tables 2.2.10-1 and 2.2.10-2).

1 **2.2.10.2.2 In Situ Toxicity and Bioaccumulation Testing**

2 In situ toxicity and bioaccumulation testing was performed at six sites along the Housatonic
3 River and proposed to include two testing periods: a low-flow exposure period and a high-flow
4 exposure. The organisms selected for the in situ testing included the midge, *Chironomus tentans*
5 (8-12 days post hatch), the amphipod, *Hyaella azteca* (7-14 days old), the oligochaete worm
6 *Lumbriculus variegatus* (multiple ages) and the daphnid, *Daphnia magna* (48 hours old).

7 Other specifics of the testing included:

- 8 ▪ *L. variegatus* tissue (7-day exposure) samples from six locations, a trip blank, and
9 ambient blank to be analyzed for PCB congeners.
- 10 ▪ Overlying sediment and water samples from the 7-day exposure locations to be
11 analyzed for PCB congeners, dioxins/furans, pesticides, herbicides, metals, cyanide,
12 sulfide, and semivolatile compounds. In addition, overlying sediment and water
13 column samples from six stations for the 48-hour and 10-day studies to be analyzed
14 for tPCBs by homolog.
- 15 ▪ For each field site, water quality measurements to be collected at test initiation and
16 again upon test termination. Physiochemical measurements to include dissolved
17 oxygen, temperature, conductivity, hardness, alkalinity, turbidity, total ammonia, and
18 pH.

19 **2.2.10.2.3 Toxicity Identification Evaluation (TIE)**

- 20 ▪ A toxicity identification evaluation (TIE) was performed on sediments using
21 *Ceriodaphnia dubia*.
- 22 ▪ Pore water samples from the 6 locations to be separated and analyzed for PCBs (total
23 and Aroclors), inorganics, semivolatile compounds, and dioxins/furans.
- 24 ▪ The TIE Phase I approach for this study to involve 24-h exposures of *Ceriodaphnia*
25 *dubia* to baseline ambient pore water on Day 1. Day 2 test manipulations to include a
26 second pore water baseline test, an oxidation-reduction addition test, and ethylene-
27 diaminetetra-acetate (EDTA) and a pH-adjusted filtration test. Summary of sediment
28 toxicity testing.

29 A summary of the samples collected and analyzed is presented in Table 2.2.10-3. This summary
30 includes the analyses performed on samples from the laboratory sediment toxicity testing, in situ
31 and bioaccumulation testing, and the TIE.

1
2
3

Table 2.2.10-3

Analysis Summary – Sediment Toxicity - Biological

Program	Media		Number of Locations	Number of Samples	Duplicates	Total Number of Samples	Total PCBs	Aroclors	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/Furans	Congeners	
Sediment Toxicity	Water	Collected	6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
		Analyzed	6	18	0	18	18	0	6	6	6	6	6	6	18	
	Pore Water	Collected	5	15	0	15	15	15	0	0	0	15	15	14	0	
		Analyzed	5	15	0	15	15	15	0	0	0	15	15	14	0	
	Tissue	Collected	6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Analyzed	6	30	0	30	0	0	0	0	0	0	0	0	0	30

4
5

NS = Not specified in the SIWP

6 **2.2.10.2.4 Explanation of Differences**

7 For In Situ Toxicity and Bioaccumulation, the high flow-testing event was not completed due to
8 lower than anticipated flow during the study period.

1 **2.2.11 Freshwater Mussel Bioaccumulation and Growth**

2 **2.2.11.1 Sediment Sampling**

3 **2.2.11.1.1 Program Description**

4 Sediment sampling from the locations where mussel racks were deployed is described below:

- 5 ▪ Three sediment samples to be collected from each of six locations where mussel racks
6 were deployed, for a total of 18 samples.
- 7 ▪ Sediment samples to be collected from 0-6 inches.
- 8 ▪ Samples to be analyzed for PCBs (total and Aroclors), TOC, grain size, and
9 ammonia. In addition, one sediment sample from each station to be analyzed for PCB
10 congeners/homologs and Appendix IX OC pesticides.
- 11 ▪ Two water samples from the reference area (Connecticut River) to be collected and
12 analyzed for PCBs (total and Aroclors), TOC, ammonia, PCB congeners, and OC
13 pesticides.

14 Tables 2.2.11-1 and 2.2.11-2 summarize the proposed and completed sampling and analysis.

15 **Table 2.2.11-1**
16 **Sampling Summary – Freshwater Mussel Study**

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5 & Reference	Freshwater Mussel Study	Water	Proposed	1	2	2	0	2
			Collected	1	2	2	0	2
	Sediment	Proposed	6	18	18	1	19	
		Collected	6	61	61	2	63	

17

1
2

**Table 2.2.11-2
Analysis Summary – Mussel Locations**

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/Furans	Cyanide	Sulfide	Ammonia	Congeners	
5 & Reference	Freshwater Mussel Study	Water	Collected	2	2	2	0	2	0	0	2	2	2	2	2	2	1	
			Analyzed	2	2	2	0	2	0	0	1	2	2	1	1	1	1	
		Sediment	Collected	63	63	63	63	1	NS	NS	NS	NS	NS	NS	NS	NS	63	1
			Analyzed	63	63	56	60	15	7	7	15	15	15	15	15	15	41	1

3

4 **2.2.11.1.2 Explanation of Differences**

5 Differences between the proposed versus completed numbers of samples and analyses are
6 discussed below.

7 **Samples**

8 **Sediment**

- 9 ▪ The number of samples increased because sampling was conducted more than once at
10 the mussel locations. In addition, for each sampling event, a composite sample for
11 toxicity testing was collected at each location.

12 **Analysis**

13 **Sediment**

- 14 ▪ Additional analyses reflect the increase in the number of samples as described above.

15

1 Sediment and Water

- 2 ▪ Minor differences between the number of samples collected versus the number
3 analyzed can be attributed to several factors, such as complications with handling,
4 transport, and storage of samples in the field and laboratory or inadequate sample
5 volumes.

6 **2.2.11.2 Biota Sampling**

7 **2.2.11.2.1 Program Description**

8 The proposed freshwater mussel sampling program is described below:

- 9 ▪ Approximately 900 mussels to be collected from a reference area in the Connecticut
10 River.
- 11 ▪ A subset of mussels collected from the reference area (Connecticut River), as well as
12 sediment from the bed from which the mussels were harvested, to be submitted to the
13 laboratory for chemical analyses.
- 14 ▪ Approximately 150 mussels to be deployed at five stations in the Housatonic River
15 and one station in the Connecticut River.
- 16 ▪ Mussels to be collected for tissue analysis at the midpoint (42 days) and the end of the
17 study (84 days).
- 18 ▪ All tissue samples to be analyzed for PCBs (total, Aroclors, congeners, homologs),
19 lipids, and moisture content.
- 20 ▪ A subset of the tissue samples to be submitted for dioxins/furans and select OC
21 pesticides analyses.
- 22 ▪ Mussel tissue to be monitored for glycogen content.
- 23 ▪ During the retrieval of the mussels at the study's midpoint and end, mortality and
24 general mussel condition (e.g., gaping) to be recorded.

25 **2.2.11.2.2 Explanation of Differences**

26 The Mussel Bioaccumulation and Growth Study was terminated prior to completion. The study
27 was terminated due to the burial of the mussel exposure cages in the Housatonic River by a
28 storm event during the exposure period.

1 **2.2.12 Amphibian Toxicity**

2 **2.2.12.1 Sediment Sampling**

3 **2.2.12.1.1 Program Description and Summary**

4 The objective of the wood frog and leopard frog studies was to evaluate reproductive and
5 developmental success in areas with varying levels of sediment PCBs. To further define PCB
6 concentrations within areas, sediment sampling was to be completed concurrently with the
7 amphibian and reptile surveys, which were designed to assess the abundance and richness of
8 species. Based on the results from both of these studies and the historical data, sampling
9 areas/locations were to be established for the wood and leopard frog studies.

10 Tables 2.2.12-1 and 2.2.12-2 summarize the proposed and completed sampling and analysis for
11 study design. The results of the amphibian reproduction study are presented in the study report
12 and discussed further in the Ecological Risk Assessment.

13 **Table 2.2.12-1**

14 **Sampling Summary – Amphibian Toxicity Study Design– Sediment**

15

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Amphibian Tox	Sediment	Proposed	NS	NS	NS	NS	NS
			Collected	33	168	168	11	179

16 NS = Not specified in the SIWP

17
18

1
2
3

Table 2.2.12-2

Analysis Summary – Amphibian Toxicity Study Design– Sediment

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners
5	Amphibian Tox	Sediment	Collected	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Analyzed	170	170	147	156	14	2	2	14	14	13	14	14	1

4 NS = Not specified in the SIWP

5 **2.2.12.1.2 Explanation of Differences**

6 There were no differences between the program as planned and as implemented.

7 **2.2.12.2 Frog Reproduction and Development Study (Leopard Frog)**

8 **2.2.12.2.1 Program Description and Summary**

9 **Sediment Sampling**

- 10 ▪ Sediment samples to be collected in conjunction with the collection of leopard frogs
- 11 for evaluation as part of the amphibian toxicity study.
- 12 ▪ One composite sample to be collected by compositing four grab samples at each of 12
- 13 locations where leopard frogs were harvested.
- 14 ▪ Samples to be collected to a depth of 6 inches.
- 15 ▪ All samples to be analyzed for PCBs (total, Aroclors, congeners, homologs),
- 16 dioxins/furans, OC pesticides, TOC, and grain size.

17 **Water Sampling**

- 18 ▪ Four 2.5-gallon water samples to be taken per sample location and composited into
- 19 10-gallon sample. A portion of each composite to be analyzed for PCBs (total,
- 20 Aroclors, congeners, homologs), dioxins/furans, and OC pesticides.

1 **Biota**

2 The overall objective of this study was to assess the impact of potential PCB contaminant
3 exposure on frog populations in the Lower Housatonic River floodplain between the confluence
4 of the East and West Branches and Woods Pond Dam.

- 5 ▪ Six male and six female frogs to be collected from each of the 12 proposed sites (9
6 exposed and 3 reference sites).
- 7 ▪ A subset of specimens to be analyzed for PCBs (total, Aroclor, congeners, homologs)
8 and lipids. A subset also to be analyzed for dioxins/furans and select OC pesticides.
- 9 ▪ Adult whole-body total PCB analysis to be conducted on 1 male and 1 female
10 collected from each sample location (12 total per study).
- 11 ▪ Ovary, testis, and egg mass analysis to be performed based on tissues collected from
12 at least 1 frog per location. At least 100 eggs to be collected from each individual
13 female.
- 14 ▪ 10 post-hatch larvae to be collected from the developmental studies for each sector
15 and analyzed for total PCBs.
- 16 ▪ 20 metamorphs from each sector to be collected and processed for total PCB analysis.
- 17 ▪ Within each study site, samples from one location to be analyzed for dioxin,
18 dibenzofurans, and OC pesticides.
- 19 ▪ If warranted by total PCB results, PCB congeners to be analyzed in samples.

20 Tables 2.2.12-3 and 2.2.12-4, which appear at the end of this subsection, summarize the
21 proposed and completed sampling and analysis for leopard frogs.

22 **2.2.12.2.2 Explanation of Differences**

23 Differences between the proposed versus completed numbers of samples and analyses are
24 discussed below.

25 **Sediment**

- 26 ▪ Ten of the sediment samples were analyzed for total PCBs concentrations at two
27 laboratories. Therefore, for leopard frogs, the number of PCB analyses is greater than
28 the number (15) collected.

1 **Biota**

2 ▪ Because of the lack of specimens found at the reference site locations, external
3 reference specimens were obtained from a commercial biological supply company.
4 Although no specimens were collected from the reference sites, sediment and water
5 samples were collected for the culturing of the external reference specimens. Adult
6 male and female *R. pipiens* were collected from each of the nine exposed site
7 sampling locations. Of the frogs collected per site, at least four frogs were used for
8 the reproduction and development study, with the remaining specimens used for
9 whole-body and tissue residue analysis.

10 ▪ Eighteen female and eighteen male *R. pipiens* (external reference specimens) were
11 received from a commercial supplier specializing in aquatic biological field
12 specimens for laboratories. Fifty-seven adult female and 51 adult male *R. pipiens*
13 were collected from the exposed area. At least six specimens of each sex were found
14 at each of the exposed sampling locations, with the following exceptions. No male
15 specimen and only two female specimens were found at Site E-5 (Site 31). In
16 addition, five female and five male specimens were found at Site W-4 (Site 36). Five
17 male specimens were also collected at Site W-7a (Site 34).

18 **2.2.12.3 Study of Amphibian Reproductive and Developmental Success within**
19 **Vernal Pools (Wood Frog)**

20 **2.2.12.3.1 Program Description and Summary**

21 **Sediment/Water**

22 One composite sediment sample and two composite water samples were to be collected from
23 each site during the egg mass collection event for organism culture (renewal) and water
24 chemistry (total PCBs, congeners, dioxins/furans, Appendix IX OC pesticides and metals, DO,
25 pH, alkalinity, hardness, conductivity, ammonia-nitrogen, and nitrate/nitrite-nitrogen).

26 **Biota**

27 Reproductive success, development, growth, and maturation in wood frogs within vernal pools
28 was to be evaluated in this study. Nine vernal pools containing varying levels of PCB
29 contamination and three vernal pools locations within designated reference areas were to be
30 selected for sampling.

1 Wood frog egg masses, larvae, and metamorphs were to be collected from selected vernal pools
2 varying in sediment PCB contamination. Egg masses were to be cultured in the laboratory using
3 representative site water and sediment, and evaluated for development, growth, and maturation.
4 Additional sets of larvae and metamorphs were to be collected from the respective vernal pools
5 for examination.

6 A portion of each egg mass, as well as whole bodies of developing embryos and larvae, were to
7 be analyzed for total PCB. Selected samples were to be analyzed for PCB congeners,
8 polyaromatic hydrocarbons (PAHs), dioxins/furans, and Appendix IX OC pesticides and metals.

9 Tables 2.2.12-3 and 2.2.12-4, which appear at the end of this subsection, summarize the
10 proposed and completed sampling and analysis for wood frogs.

11 **2.2.12.3.2 Explanation of Differences**

12 **Sediment/Water**

13 Sediment and water column samples were collected at each vernal pool. Initially, six 4-L
14 samples of water and four 2.5-kg grab samples of sediment were collected at each location and
15 composited by vernal pool. A second and third set of water samples were later collected from
16 the vernal pool sites, with the exception of the three reference pools. The second sampling event
17 was identical to the initial event. Because of concerns that sufficient water to complete the study
18 would be available from the pools later in the season as the pools became dry, the third and final
19 water collection consisted of four 200 to 250-gallon containers.

20 **Area/Location**

21 Twelve locations were monitored for viable egg masses. However, no wood frog egg masses
22 were observed in vernal pool 39-VP-1.

23

1 **2.2.12.4 Bullfrog Tissue Analysis**

2 **2.2.12.4.1 Program Description and Summary**

3 **Sediment Sampling**

4 To support the human health and ecological risk assessments, PCBs (total, Aroclors, congeners,
5 homologs), moisture, and lipid analyses of bullfrog tissue were to be performed. A subset of
6 these samples was also selected to be analyzed for dioxins/furans and select OC pesticides.
7 Additional sediment samples were to be collected as necessary to obtain PCB concentrations
8 where the frogs were captured.

9 **Biological Sampling**

10 The objectives of this study were as follows:

- 11 ▪ To determine the whole-body frog tissue concentrations for use in the
12 bioaccumulation modeling and the ecological risk assessment.
- 13 ▪ To provide bullfrog leg muscle tissue for contaminant analysis data for use in the
14 human health risk assessment.

15 The sampling program is described below:

- 16 ▪ 40 bullfrogs to be collected from 4 (2 within the study area and 2 reference) locations
17 representing a range of sediment PCB concentrations and areas of bullfrog habitat.
18 These areas were to be (1) Woods Pond, (2) backwater areas within 1 mile north of
19 Woods Pond, (3) Threemile Pond, and (4) Muddy Pond.
- 20 ▪ 10 frogs to be collected from each location.

21 **2.2.12.4.2 Explanation of Differences**

22 A total of 30 individual bullfrogs were retained for tissue analysis: 10 from Woods Pond, 10
23 from the upper mile of Woods Pond, 5 from Threemile Mile Pond State Wildlife Management
24 Area, and 5 from Muddy Pond. Bullfrog offal and leg muscle tissue were analyzed for PCBs
25 (total, Aroclors, congeners, homologs), OC pesticides, dioxins/furans, percent moisture, and
26 percent lipids. The number of tissue samples proposed for dioxin/furan analysis was reduced to

1 conserve resources for more critical analyses. The laboratory conducted additional OC pesticide
2 analyses for bullfrog tissue samples.

3 Tables 2.2.12-3 and 2.2.12-4 summarize the proposed and completed sampling and analysis for
4 leopard frog, wood frog, and bullfrog.

5

1
2

**Table 2.2.12-3
Sampling Summary – Amphibian Studies**

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5, 6 + Reference	Leopard Frog	Water	Proposed	NS	12	12	0	12
			Collected	9+3ref	14	13	1	14
		Sediment	Proposed	9+3ref	12	12	1	13
			Collected	12	14	14	1	15
		Tissue	Proposed	9+3ref	NS	144 ^a	NS	NS
			Collected	9	9	55 ^b	5	60
	Wood Frog	Water	Proposed	4 or 5	NS	NS	NS	NS
			Collected	9+3ref	14	24	0	24
		Sediment	Proposed	9+3ref	NS	NS	NS	NS
			Collected	9+3ref	23	23	4	27
		Tissue	Proposed	NS	NS	NS	NS	NS
			Collected	9+3ref	1	60	2	62
	Bullfrog	Sediment	Proposed	4	4	NS	NS	NS
			Collected	4	4	30	1	31
		Tissue	Proposed	4	4	40	NS	42
			Collected	4	4	48	4 ^c	50

3
4
5
6
7
8
9
10

NS = Not specified in the SIWP

^a Number of adult female and male leopard frogs specified in SIWP for field collection, not analysis. 110 male and female leopard frogs, 7 leopard frog egg masses, and 2 tadpole samples were collected from exposed sites.

^b Represents number of leopard frog tissue samples (ovaries, offal, whole body, composites, and egg masses) analyzed.

^c Duplicate samples represent a portion of tissue from a bullfrog analyzed as a separate sample, e.g., the right leg tissue was submitted as a duplicate sample.

1
2
3

Table 2.2.12-4

Analysis Summary – Amphibian Studies

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	OC Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners	Percent Moisture	Percent Lipids	PAH	
5,6 and reference	Leopard Frog	Water	Collected	15	15	NS	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-	-	
			Analyzed	15	15	4	0	15	5	5	5	5	15	5	5	4	-	-	-	
		Sediment	Collected	15	15	15	15	15	15	15	15	15	15	15	15	15	15	0	0	0
			Analyzed ^a	25	25	15	11	15	14	14	14	15	15	14	14	4	0	0	0	
		Tissue	Collected	60	60	0	0	NS	0	0	NS	0	0	0	0	NS	0	NS	NS	
			Analyzed	60	51	0	0	9	0	0	9	0	9	0	0	9	0	60	9	
	Wood Frog	Water	Collected	24	24	0	0	NS	NS	NS	NS	NS	NS	NS	NS	0	-	-	-	
			Analyzed	24	24	0	0	24	4	4	4	4	24	4	4	0	-	-	-	
		Sediment	Collected	27	27	27	27	27	NS	NS	27	NS	27	NS	NS	NS	-	-	-	
			Analyzed	27	27	26	27	27	14	14	27	14	27	14	14	11	-	-	-	
		Tissue	Collected	62	62	0	0	NS	0	0	NS	0	NS	0	0	NS	0	NS	NS	
			Analyzed	62	57	0	0	5	0	0	5	0	5	0	0	5	0	62	5	
	Bullfrog	Sediment	Collected	31	31	31	31	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-	-	
			Analyzed	33	33	33	33	1	1	1	1	1	1	1	1	6	-	-	-	
		Tissue	Collected	48 ^b	48 ^b	0	0	48 ^b	0	0	0	0	48 ^b	0	0	48 ^b	48 ^b	48 ^b	0	
			Analyzed ^c	64	64	0	0	64	0	0	0	0	26	0	0	64	64	89 ^d	0	

- 4 NS = Not specified in the SIWP
 5 ^a Two laboratories analyzed sediments; therefore, additional valid results are available.
 6 ^b Represents the number of whole body samples collected, not including duplicates.
 7 ^c Tissue analyses include leg muscle and offal.
 8 ^d % Lipids were analyzed separately for PCB and dioxins/furans tissue analyses, respectively.

1 **2.2.13 Fish Collection Areas**

2 **2.2.13.1 Sediment Sampling**

3 **2.2.13.1.1 Program Description and Summary**

4 The proposed program included seven locations (two reference locations, Goodrich Pond, and
5 four locations downstream of the GE facility) for fish and sediment sampling to support the
6 ecological and human health risk assessments and other study components as appropriate. The
7 four downstream locations were to be sampled under the systematic programs and Goodrich
8 Pond was to be sampled by GE. This section, therefore, deals with the two reference locations,
9 Threemile Pond in Sheffield and Center Pond in Dalton. The proposed program is described
10 below:

- 11 ▪ A total of 12 sediment samples to be collected. Seven samples to be collected from
12 Threemile Pond and five samples from Center Pond.
- 13 ▪ Samples to be collected from 0-6 inches.
- 14 ▪ Samples to be analyzed for PCBs (total and Aroclors), TOC, and grain size. In
15 addition, one sample from each area to be analyzed for modified Appendix IX
16 parameters.

17

1 Tables 2.2.13-1 and 2.2.13-2 summarize the proposed and completed sampling and analysis.

2
3
4

Table 2.2.13-1

Sampling Summary – Fish Collection Locations

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Fish Collection	Sediment	Proposed	2	12	12	1	13
			Collected	2	12	12	0	12

5
6
7
8

Table 2.2.13-2

Analysis Summary – Fish Collection Locations

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide
5	Fish Collection	Sediment	Collected	12	12	12	12	2	0	0	2	2	2	2	2
			Analyzed	5	5	12	12	1	2	1	1	1	1	1	1

9
10

2.2.13.1.2 Explanation of Differences

12 Differences between the proposed versus completed numbers of samples and analyses are
13 discussed below.

14 Analysis

- 15 ▪ The five samples from Center Pond were analyzed for total PCB and Aroclors. The
16 seven samples collected from Threemile Pond were not analyzed for PCBs because it
17 was determined that historical and recent PCB data from other sampling programs
18 provided adequate characterization.

- 1 ▪ OP pesticides and herbicides were not proposed as part of the modified Appendix IX
2 analyte suite; however, some analyses were performed to evaluate their presence.
- 3 ▪ Due to the reduction in the number of Appendix IX parameters project-wide, only
4 one sample from one of the reference areas was analyzed for Appendix IX
5 parameters.

6 **2.2.13.2 Biota**

7 **2.2.13.2.1 Program Description and Summary**

8 The proposed program included sampling seven locations, including two reference locations,
9 Goodrich Pond, and four locations downstream of the GE facility, for fish and sediment to
10 support the ecological and human health risk assessments.

11 **Tissue**

- 12 ▪ Various size classes of fish to be collected for tissue analysis during three
13 electrofishing events.
- 14 ▪ Fish to be collected from seven locations—five downstream of the GE facility and
15 two from reference areas.
- 16 ▪ Forage size and adult fish to be collected for each species (largemouth bass and other
17 centrarchids, yellow perch, brown bullhead, and goldfish and other cyprinids).
- 18 ▪ Samples to be submitted for analysis as whole body, whole-fish composites, and
19 fillet/offal samples.
- 20 ▪ Fish tissue samples to be analyzed for PCBs (total, Aroclors, and congeners),
21 dioxin/furans, and OC pesticides.

22 **Fish Toxicity**

- 23 ▪ Adult fish to be collected from Threemile Pond (reference location), Woods Pond,
24 Rising Pond, and the reach below the confluence of the Housatonic River with
25 Roaring Brook (deep reach) and to be transported to the U.S. Geological Survey
26 Columbia Environmental Research Center (CERC) in Columbia, MO, for study.
- 27 ▪ Fish to be maintained at CERC in artificial ponds and allowed to spawn naturally.
- 28 ▪ Fish eggs to be collected, then transferred to the laboratory to be hatched and reared
29 under controlled conditions.

1 **2.2.13.2.2 Explanation of Differences**

2 Differences between the proposed versus completed numbers of samples and analyses are
3 discussed below.

4 **Analysis**

5 Tissue Study

6 ▪ The increased number of lipid analyses are due to lipids being analyzed separately for
7 dioxins/furans and PCB tissue samples, respectively.

8 ▪ The increase in samples analyzed versus samples collected is due to multiple tissue
9 samples separated and analyzed for each whole fish collected. Selected fish tissue
10 samples were submitted for analysis as whole body, whole-fish composites, and
11 fillet/offal samples.

12 ▪ The Aroclor concentrations were to be calculated from the congener results. Because
13 the congener data directly provide more information about PCB composition, no
14 calculated Aroclor concentrations were included in the database

15 Health and Toxicity Study

16 ▪ The decrease in samples analyzed for the health and toxicity study occurred because
17 only a selected number of samples were sent for analyses to conserve resources for
18 more critical needs. Remaining samples of fish tissues were archived for possible
19 future analyses.

20

1 **2.2.14 Tree Swallow Study**

2 **2.2.14.1 Sediment and Soil Sampling**

3 **2.2.14.1.1 Program Description and Summary**

4 Sediment sampling for the tree swallow study was designed to characterize sediments within the
5 immediate vicinity of the nest boxes and within the 400-m average foraging radius of the adult
6 tree swallow during the breeding season. The proposed sampling is described as follows:

- 7 ▪ At each nest box cluster, samples to be collected at 100-ft intervals to cover the linear
8 extent of the area encompassed by the nest boxes along the river. Each sediment
9 sample to be collected at a position midway between the bank opposite the nesting
10 box and the centerline of the stream.
- 11 ▪ Sediments from backwater areas and portions of the river greater than 100 ft from the
12 nest boxes to be sampled according to a stratified random design conducted radially
13 from the box locations.
- 14 ▪ A total of approximately 260 sediment samples to be collected with 40 samples at the
15 Holmes Road tree swallow location, 65 samples at the New Lenox Road location, and
16 75 samples among the Woods Pond location. An additional 80 sediment samples to
17 be collected in reference areas.
- 18 ▪ Samples to be collected from 0-6 inches.
- 19 ▪ Samples to be analyzed for PCBs (total and Aroclors), TOC, and grain size. In
20 addition, approximately 10% of all samples to be analyzed for modified Appendix IX
21 parameters and PCB congeners.

22 Tables 2.2.14-1 and 2.2.14-2 summarize the proposed and completed sampling and analysis.

1
2
3

Table 2.2.14-1

Sampling Summary – Tree Swallows – Sediment

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5 + ref	Tree Swallow	Sediment	Proposed	6	260	260	13	273
			Collected	6	260	260	12	272
		Floodplain	Proposed	0	0	0	0	0
			Collected	6	52	52	2	54

4
5
6
7
8

NS = Not specified in SIWP

Table 2.2.14-2

Analysis Summary – Tree Swallows – Sediment

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/ Furans	Cyanide	Sulfide	Congeners	
5 + ref	Tree Swallow	Sediment	Collected	272	272	272	272	27	0	0	27	27	27	27	27	27	
			Analyzed	258	258	258	267	19	1	1	19	19	19	19	19	19	45
		Floodplain	Collected	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Analyzed	50	50	41	42	3	0	0	3	3	3	3	3	3	1

9

NS = Not specified in the SIWP

2.2.14.1.2 Explanation of Differences

Differences between the proposed versus completed numbers of samples and analyses are discussed below.

12

1 **Samples: Floodplain**

- 2 ▪ 54 floodplain soil samples were collected versus none proposed in the SIWP. These
3 floodplain soil samples were collected to provide adequate assessment of the extent of
4 contamination in the floodplain in the vicinity of the nest box areas.

5 **Analysis: Sediment**

- 6 ▪ 45 samples were analyzed for PCB congeners versus 27 samples collected.
7 Additional congener analyses were determined to be needed to adequately
8 characterize the areas and meet the study objectives.
- 9 ▪ One sample was analyzed for OC pesticides and herbicides as part of the Appendix
10 IX analyte suite to evaluate the presence of these compounds in an area.
- 11 ▪ Fewer Appendix IX analyses were performed than proposed due to project-wide
12 reductions in the number of Appendix IX analyses.

13 **2.2.14.2 Biological Sampling**

14 **2.2.14.2.1 Program Description and Summary**

15 The primary objective of the tree swallow study was to evaluate reproductive success. Tissues
16 were collected for analysis of residue concentrations of PCBs and other analytes in various life
17 stages of tree swallows. The design of tree swallow study is described below:

- 18 ▪ For three study seasons (1998, 1999, and 2000), nest boxes to be installed at four
19 sites—three sites along the Housatonic River downstream of the GE facility in Reach
20 5 (Canoe Meadows, New Lenox Road, and Roaring Brook) and one located along the
21 West Branch, a tributary of the Housatonic River.
- 22 ▪ In 1999, an additional site just upstream of the GE facility near Taconic Valley
23 Trucking Co. and a site at Threemile Pond in Sheffield were added.
- 24 ▪ Eggs and young to be monitored and pippers and nestlings to be collected as
25 appropriate. Collected tree swallows to be euthanized, and stomach contents to be
26 removed and pooled for analysis separate from the carcasses.
- 27 ▪ Selected samples to be analyzed for organochlorine chemicals including total PCBs
28 and PCB congeners. Additionally, trace elements, dioxins and furans, and petroleum
29 hydrocarbons to be analyzed in a subset of tissues and years.

1 Tables 2.2.14-3 and 2.2.14-4 summarize the proposed and completed sampling and analysis.
 2 Results from the reproduction study are presented in the study report and will be discussed
 3 further in the Ecological Risk Assessment.

4 **Table 2.2.14-3**

5 **Sampling Summary – Tree Swallows – Tissue**

6

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5 + ref	Tree Swallow	Tissue	Proposed	6	6	NS	NS	NS
			Collected	6	6	342	0	342

7 NS = Not specified in the SIWP

8 **Table 2.2.14-4**

9 **Analysis Summary – Tree Swallows – Tissue**

10

11

Reach	Program	Media		Total PCB	Pesticides	Aliphatic Hydrocarbons	Metals	Semi-VOAs	Dioxins/Furans	Congeners	Percent Lipids GC	Percent Lipids GC/MS
5 + ref	Tree Swallow	Tissue	Collected	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Analyzed	322	322	34	20	34	123	322	322	123

12 NS = Not specified in the SIWP.

13 **2.2.14.2.2 Explanation of Differences**

14 The study was completed as planned, and aliphatic hydrocarbon analyses were added to the
 15 protocol for selected samples to evaluate the presence of petroleum hydrocarbons. Reduced
 16 numbers for some analyses reflect insufficient mass of sample available to perform all proposed
 17 analyses.

1 **2.2.15 Soil Invertebrate Study**

2 **2.2.15.1 Soil Sampling**

3 **2.2.15.1.1 Program Description and Summary**

4 The proposed floodplain soil sampling to be conducted in conjunction with soil invertebrate
5 tissue sampling is described below:

- 6 ▪ Five to ten plots within each of three locations to be sampled.
- 7 ▪ One composite sample to be collected from each plot for a total of 15 to 30 soil
8 samples.
- 9 ▪ All soil samples to be analyzed for PCBs (total and Aroclors), TOC, and grain size.

10 Table 2.2.15-1 summarizes the proposed and completed sampling.

11 **Table 2.2.15-1**

12 **Sampling Summary – Soil Invertebrates – Floodplain Soil**

13

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Soil Invertebrates	Floodplain	Proposed	3	15-30	30	2	32
			Collected	3	30	30	2	32

14

15 **2.2.15.1.2 Explanation of Differences**

16 Samples were collected as proposed, but were not analyzed because existing data were
17 determined to be adequate to characterize soil PCB concentrations at these locations.

1 **2.2.15.2 Tissue Sampling**

2 **2.2.15.2.1 Program Description and Summary**

3 Earthworms and soil litter invertebrates were to be collected from three sampling areas for
 4 determination of tissue residue concentrations as follows:

- 5 ▪ Approximately ten earthworm and three soil litter invertebrate samples to be collected
 6 from each area, for a total of 39 biological samples.
- 7 ▪ All samples to be analyzed for PCBs (total and Aroclors), PCB congeners, % lipids,
 8 and % moisture. One sample from each location to be analyzed for dioxin/furans and
 9 OC pesticides.

10 Tables 2.2.15-2 and 2.2.15-3 summarize the proposed and completed sampling and analysis.

11 **Table 2.2.15-2**

12 **Sampling Summary – Soil Invertebrates – Tissue**

13

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Soil Invertebrates	Earthworm	Proposed	3	30	30	2	32
			Collected	3	30	30	2	32
		Soil Litter Invertebrate	Proposed	3	3	9	1	10
			Collected	3	3	8	0	8

14

1
2
3
Table 2.2.15-3

Analysis Summary – Soil Invertebrates - Tissue

Reach	Program	Media		Total PCB	Aroclors	Congeners	Dioxins/ Furans	OC Pesticides	% Lipids	% Moisture
5	Soil Invertebrates	Earthworm	Collected	32	32	32	3	3	32	32
			Analyzed	32	32	32	4	3	36	32
		Soil Litter Invertebrate	Collected	8	8	8	3	3	8	8
			Analyzed	8	8	8	0	8	8	8

4
5
6 **2.2.15.2.2 Explanation of Differences**

7 Differences between the proposed versus completed numbers of samples and analyses are
8 discussed below.

9 **Samples: Soil Litter Invertebrate**

- 10
11
12
13
- Eight samples instead of the proposed 10 were collected because invertebrate density was low at one sampling area, allowing for the collection of only two samples, not the proposed three. Field duplicate samples were not collected due to the limited sample mass available within each area.

14 **Analysis: Earthworms**

- 15
16
- Lipids were determined separately for the dioxin/furan samples, resulting in four more percent lipids analyzed than proposed.

17 **Analysis: Soil Litter Invertebrates**

- 18
19
- Due to limited sample mass, dioxin/furan analysis was not possible for three samples.

1 **2.2.16 Small Mammal Study**

2 **2.2.16.1 Soil Sampling**

3 **2.2.16.1.1 Program Description and Summary**

4 Soil sampling was conducted at the 12 small mammal trapping locations within the floodplain.
5 Results from the initial screening performed under the Preliminary Work Plan (WESTON, 1998)
6 were to be reviewed and used to determine specific trapping areas for small mammals. The
7 proposed study is described below:

- 8 ▪ Approximately 10 soil samples to be collected at each of the 12 locations, resulting in
9 approximately 120 samples total.
- 10 ▪ Samples to be collected to a depth of 6 inches.
- 11 ▪ All samples to be analyzed for PCBs (total and Aroclors).
- 12 ▪ Additional soil samples to be collected in each selected area to better define the extent
13 of PCB contamination as necessary.

14 Tables 2.2.16-1 and 2.2.16-2 summarize the proposed and completed sampling and analysis.

15 **Table 2.2.16-1**

16 **Sampling Summary – Soil – Small Mammals**

17

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
5	Small Mammals	Floodplain	Proposed	12	120	120	6	126
			Collected	13	150	152	7	159

18

1
2
3

Table 2.2.16-2

Analysis Summary – Soil – Small Mammals

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size
5	Small Mammals	Floodplain	Collected	159	159	NS	NS
			Analyzed	157	157	14	14

4
5

NS = Not specified in the SIWP

6 **2.2.16.1.2 Explanation of Differences**

7 To provide additional geographic coverage, the number of sampling locations was increased
8 from 12 to 13. This addition also increased the number of samples collected from 126 to 159.

9 **2.2.16.2 Biological Study**

10 **2.2.16.2.1 Program Description and Summary**

11 The objective of the small mammal trapping was to verify the occurrence of some small mammal
12 species within the study area and to provide tissue samples for contaminant residue analysis.

13 The proposed study is described below:

- 14 ▪ At each trap area, 100 small mammal traps baited with peanut butter to be placed in
15 an “+” pattern (when possible).
- 16 ▪ Pit trap arrays to be used at each trapping site. Arrays to consist of four plastic drift
17 fences arranged in an “+” formation.
- 18 ▪ Individual pit traps to be installed on both sides and at either end of each of the four
19 drift fences, for a total of 16 pits per array.
- 20 ▪ All trap arrays to be set for five consecutive nights for a total of 580 trap nights (116
21 traps times 5 nights).

1
2
3

Table 2.2.16-4

Analysis Summary – Small Mammals

Reach	Program	Survey		Biometric measurements	Placental Scars	Total PCB	Aroclors	Congeners	Dioxins/ Furans	OC Pest
5	Small Mammals	1998	Collected	221	0	NS	NS	NS	NS	NS
			Analyzed	221	0	0	0	0	0	0
		1999	Collected	122	NS	NS	NS	NS	NS	NS
			Analyzed	122	61	76	76	76	12	76

4
5

NS = Not specified in the SIWP.

6 **2.2.16.2.2 Explanation of Differences**

7 The study was completed as proposed; 76 tissue samples were selected for PCB analysis.

8

1 **2.2.17 Macrophytes, Filamentous Algae, Periphyton, and Plankton/Detritus Study**

2 **2.2.17.1 Program Description and Summary**

3 The objective of sampling macrophytes, filamentous algae, periphyton, and plankton/detritus
4 was to obtain information on biomass per unit area (standing crop) during a period when
5 significant biomass was present in the Housatonic River study area and to determine contaminant
6 concentrations in these communities for use in the modeling study.

7 **2.2.17.1.1 Macrophyte Sampling**

- 8 ▪ Three samples of each macrophyte community to be collected from each sampling
9 area and analyzed individually for biomass; a composite sample to be collected and
10 analyzed for tissue residue.
- 11 ▪ All residue samples to be analyzed for PCBs (total, Aroclors, and congeners). A
12 subset of the samples to be analyzed for dioxins/furans and OC pesticides. Biomass
13 samples to be analyzed for wet weight, dry weight, TOC, and ash-free dry matter.
- 14 ▪ Within each area sampled, the distribution of macrophyte communities to be
15 estimated to allow for a determination of total biomass (standing crop). Macrophyte
16 voucher samples to be collected for identification by a qualified botanist.

17 **2.2.17.1.2 Filamentous Algae**

- 18 ▪ Filamentous algae sample locations to be selected following qualitative surveys of the
19 filamentous algae distribution in the study area. Three samples of filamentous algae
20 to be collected from each area and analyzed individually for biomass. A single
21 composite sample to be analyzed for tissue residue.
- 22 ▪ Analysis of all samples for PCBs (total, Aroclors, and congeners). A subset of
23 samples also to be analyzed for dioxins/furans and OC pesticides. Biomass samples
24 to be analyzed for chlorophyll a and phaeophytin, wet and dry weight, TOC, and ash-
25 free dry matter.

- 1 ▪ Within each area sampled, the distribution of filamentous algae to be estimated,
2 allowing for a determination of total biomass (standing crop). Voucher samples to be
3 collected and preserved for taxonomic identification.

4 **2.2.17.1.3 Periphyton**

- 5 ▪ Cobble and gravel riffle, soft bottom, and aquatic macrophyte bed locations
6 containing periphyton communities to be selected for sampling. Three samples of
7 periphyton communities to be collected from each study area and analyzed
8 individually for biomass; a composite sample to be analyzed for tissue residue.

- 9 ▪ Analysis of all samples for PCBs (total, Aroclors, and congeners). A subset of
10 samples to be analyzed for dioxins/furans and OC pesticides. Periphyton biomass
11 samples collected from cobble riffles and macrophytes to be analyzed for chlorophyll
12 a, phaeophytin a, dry matter, ash-free dry matter, and TOC. Periphyton collected
13 from soft bottom and gravel substrates to be analyzed for chlorophyll a and
14 phaeophytin.

- 15 ▪ Within each area sampled, the distribution of periphyton to be estimated to allow for
16 a determination of total biomass (standing crop). Voucher samples to be collected
17 and preserved for taxonomic identification.

18 **2.2.17.1.4 Plankton/Detritus**

- 19 ▪ Three samples of the plankton (phytoplankton and zooplankton) and detritus
20 community from each reach to be collected and analyzed for biomass; composite
21 phytoplankton and zooplankton samples from each reach to be analyzed for tissue
22 residue.

- 23 ▪ Analysis of all samples for PCBs (total, Aroclors, and congeners); a subset of samples
24 to be analyzed for dioxins/furans and OC pesticides. Plankton biomass samples to be
25 analyzed for chlorophyll a and phaeophytin, wet and dry weight, TOC, and ash-free
26 dry matter. Detritus biomass samples to be analyzed for total organic matter (TOM)
27 and dissolved organic matter (DOM).

28 Tables 2.2.17-1 and 2.2.17-2 summarize the proposed and completed sampling and analysis.

1
2
3
4

Table 2.2.17-1

Sampling Summary – Macrophytes, Filamentous Algae, Periphyton, and Plankton/Detritus

Reach	Program	Media		No. of Areas	Sample Locations	Biological Samples	Chemical Samples	Duplicates	Total Samples
4, 5, and 6	Macrophyte, Filamentous Algae, Periphyton, and Plankton/Detritus	Macrophytes	Proposed	7	21	21	7	1	29
			Collected	6	18	18	6	1	25
		Filamentous algae	Proposed	7	21	21	7	1	29
			Collected	4	12	12	4	0	16
		Periphyton (from macrophytes)	Proposed	7	21	21	7	1	29
			Collected	6	18	18	6	0	24
		Periphyton (from substrate)	Proposed	7	21	21	7	1	29
			Collected	7	21	21	7	0	28
		Phytoplankton	Proposed	7	21	21	7	1	29
			Collected	7	21	21	7	1	29
		Zooplankton	Proposed	7	21	21	7	1	29
			Collected	7	21	21	7	0	28
		Detritus	Proposed	7	21	21	7	1	29
			Collected	7	21	21	7	1	29
		TOC/DOC	Proposed	7	21	21	7	1	29
			Collected	7	21	21	7	1	29

5

1
2
3
4

Table 2.2.17-2

Analysis Summary – Macrophytes, Filamentous Algae, Periphyton, and Plankton/Detritus

Program Species		Total PCB	Aroclors	Congeners	Homologs	Dioxins/ Furans	OC Pesticides	Biological (weights, % solids, pigments)
Macrophytes	Collected	6	6	6	6	1	1	18
	Analyzed	6	6	6	6	1	1	18
Filamentous algae	Collected	4	4	4	4	1	1	12
	Analyzed	4	4	4	4	1	1	12
Periphyton (from macrophytes)	Collected	6	6	6	6	1	1	18
	Analyzed	6	6	6	6	1	1	18
Periphyton (from substrate)	Collected	7	7	7	7	1	1	21
	Analyzed	7	7	7	7	1	1	21
Phytoplankton	Collected	7	7	7	7	1	1	21
	Analyzed	7	7	7	7	1	1	21
Zooplankton	Collected	7	7	7	7	1	1	21
	Analyzed	7	7	7	7	1	1	21
Detritus	Collected	7	7	7	7	1	1	21
	Analyzed	7	7	7	7	1	1	21
TOC/DOC	Collected	7	7	7	7	0	0	21
	Analyzed	7	7	7	7	0	0	21

5
6

2.2.17.2 Explanation of Differences

Area/Location/Samples

Filamentous Algae

- Field observations determined that filamentous algae were not present in the three northernmost areas sampled.

10
11

1 Macrophyte, Periphyton

- 2 ▪ Field observations determined that macrophyte and periphyton (from macrophytes)
3 samples did not occur in one of the areas sampled.

4 Minor differences between the number of samples proposed versus the number collected can be
5 attributed to several factors, such as actual field conditions that were different than anticipated or
6 complications with handling, transport, and storage of samples from the field.

7

1 **2.2.18 Rare Plants and Natural Communities Survey**

2 **2.2.18.1 Program Description and Summary**

3 The proposed rare plant and natural community survey included the following activities:

- 4 ▪ Compilation of information concerning known and historic distributions of rare
5 species and communities known or suspected to occur in the study area.
- 6 ▪ Taxonomic identification of rare occurrences—Rare plant species to be identified to
7 subspecific level based on morphological, phenological, habitat, and distributional
8 information. Collection of voucher specimens and photographs, if appropriate, to
9 allow confirmation of identification.
- 10 ▪ Natural community and population data—Each rare occurrence (plant or community)
11 to include collection of descriptive information (e.g., associated plant species,
12 population area, canopy height, aerial cover of species, canopy tree age and diameter,
13 substrate).
- 14 ▪ Collection of tree cores, enumeration of growth rings, and samples saved for
15 verification if needed.

16 **2.2.18.2 Explanation of Differences**

17 The survey was completed as planned. Seven communities of state conservation concern were
18 identified in the study area. A total of 20 state-listed species were documented from 37 sites.
19 These data are presented in the Ecological Characterization Report.

20

1 **2.2.19 Dragonfly Survey**

2 **2.2.19.1 Program Description and Summary**

3 The objective of the dragonfly survey was to determine the species that occur or may occur
4 within the study area, with a special emphasis on rare species.

5 Dragonfly surveys were to consist of exuvia collection along the riverbanks. Opportunistic aerial
6 netting of adults was also to be conducted during exuvia collections and other field surveys. The
7 planned surveys are described below:

- 8 ▪ Surveys to be conducted by foot in the shallow upstream reaches and by canoe in the
9 deeper downstream reaches.
- 10 ▪ Two observers to walk or float slowly along the shore and collect exuvia from
11 vegetation, rocks, logs, and exposed substrates.
- 12 ▪ Exuvia to be placed in round paperboard containers and sent to a contracted
13 laboratory for identification.
- 14 ▪ Surveys to be conducted over a 2-day period and repeated five times from
15 approximately mid-May to August.
- 16 ▪ Adult dragonflies to be netted, killed in a killing jar, and then mounted as reference
17 specimens. These specimens to be sent to a contract laboratory for verification.

18 Table 2.2.19-1 summarizes the proposed and completed surveys. These data are presented in the
19 Ecological Characterization Report.

1
2
3

Table 2.2.19-1

Summary of Dragonfly Survey

Reach	Program	Method		No. of Areas	No. of Visits	Biological Samples
5&6	Dragonfly Survey	Exuvia	Proposed	9	5	NS
			Completed	12	5	677
			Identified	N/A	5	651
		Adults	Proposed	N/A	5	NS
			Completed	N/A	N/A	69
			Identified	N/A	N/A	69

4

N/A = Not applicable

5

NS = Not specified in the SIWP

6

7 **2.2.19.2 Explanation of Differences**

8

The survey was conducted as planned.

9

1 **2.2.20 Avian Field Survey**

2 **2.2.20.1 Program Description and Summary**

3 The objective of the avian field survey was to identify the species of birds that occur in the study
4 area.

5 The proposed surveying is described below:

- 6 ▪ Playback point counts to be used to survey raptors within the study area and in two
7 reference areas.
- 8 ▪ Transects to be established along the river or waterbody (for reference area) and
9 adjacent roads, with point counts being taken at 300-m intervals.
- 10 ▪ Approximately 10 minutes to be spent at each point, with calls being broadcast, at
11 various angles, for 10 seconds followed by 30 seconds of silence for each call.
- 12 ▪ All raptors observed to be identified and recorded along with the type of observation.
13 Raptor surveys to be conducted between one-half hour before sunrise to sunset,
14 except owl surveys to be conducted one-half hour after sunset to sunrise.
- 15 ▪ Transects to be visited two to three times during breeding season, at least once during
16 mating season, and once during the nesting-fledgling period.

17 No samples were proposed or collected for chemical analysis. Information recorded at each
18 survey site included location, start and end times, observer, date, visit number, wind speed, cloud
19 cover, precipitation, responses per species, and all other wildlife sightings.

20 Table 2.2.20-1 summarizes the proposed and completed surveys.

1
2
3

Table 2.2.20-1

Summary of Avian Surveys

Reach	Program	Avian Group		No. of Areas	No. of Survey Stations	No. of Visits	Species Observed
Reaches 5, 6, and Reference Areas	Avian Surveys	Marsh Birds	Proposed	7	47	3	NS
			Completed	7	47	3	4
		Hawks	Proposed	4	65	3	NS
			Completed	4	65	3	11
		Owls	Proposed	3	20	3	NS
			Completed	3	20	3	3
		Forest Birds	Proposed	1	14	3	NS
			Completed	1	14	3	47

4 NS = Not specified

5

6 **2.2.20.2 Explanation of Differences**

7 This survey was completed as planned. These data are presented in the Ecological
8 Characterization Report.

1 **2.2.21 River Otter, Mink, and Bat Surveys**

2 **2.2.21.1 Program Description and Summary**

3 The objectives of these surveys are described below:

- 4 ▪ To determine if mink (*Mustela vison*) and river otter (*Lutra canadensis*) are present
5 in the study area.
- 6 ▪ To determine which species of bats are present in the study area and what habitats
7 they are using for feeding, and, potentially, roosting.

8 The planned surveys are described below:

9 River Otter and Mink Surveys:

- 10 ▪ Mammal snow track counts to be conducted in various habitat types.
- 11 ▪ Several 500-m-long transects to be established so that each habitat type (forested and
12 shrub swamp, emergent marsh, forested upland, and agricultural field) is represented.
- 13 ▪ Transects in the study and reference areas to be walked a minimum of two times after
14 fresh snowfall.
- 15 ▪ Scent stations to be used to detect the presence or absence of mink and otter.
- 16 ▪ Transects to be set up parallel to the river. Each transect to be 600 m long and
17 contain 10 scent stations at 60-m intervals.
- 18 ▪ Fine sand to be placed around each scent post in an approximate 0.5-m radius to
19 facilitate track observation.
- 20 ▪ Transects to be visited for 3 days following setup, weather permitting.

21 Bat Survey:

- 22 ▪ Bat species to be surveyed using echolocation.
- 23 ▪ Three 1-km transects to be set up parallel to the river.
- 24 ▪ Surveys to be conducted starting 15 minutes after sunset and performed for 120
25 minutes.

26 Tables 2.2.21-1 and 2.2.21-2 summarize the proposed and completed surveys.

1
2
3

Table 2.2.21-1

Survey Summary – Mink and Otter

Reach	Program	Method		No. of Transects	No. of Survey Stations	No. of Visits
Reaches 5, 6, and Reference Areas	Mink and Otter Surveys	1999 Snow tracking	Proposed	6	N/S	3
			Completed	6	N/S	2-4
		2000 Snow tracking and scent post	Proposed	15	150	3
			Completed	15	150	1-2
		1999 Scent Post	Proposed	3	30	3
			Completed	3	30	3-4
		1998 Scent Post	Proposed	3	30	3
			Completed	3	30	3

NS = Not specified in the SIWP.

4
5
6
7
8

Table 2.2.21-2

Survey Summary – Bats

Reach	Program	Method	Location	No. of Calls Recorded	No. of Species Recorded
5 and 6	Bat Surveys	Echolocation	Transect 1	363	7
			Transect 2	805	6
			Transect 3	639	7

9

10 **2.2.21.2 Explanation of Differences**

11 **Mink and Otter**

12 The number of Year 2000 snow tracking visits for mink and otter depended upon snow
13 conditions. Lack of fresh snowfall and early thaw prevented the proposed number of snow
14 tracking visits. Additionally, access to some reference areas was blocked by heavy snowfall.

1 **Bats**

2 The survey was completed as planned.

3

1 **2.2.22 Dietary Exposure of Mink**

2 **2.2.22.1 Program Description and Summary**

3 This study was designed to evaluate whether farm-raised mink fed diets containing PCB-
4 contaminated fish from the Housatonic River would exhibit impaired reproductive performance
5 and/or offspring (kit) growth and survival. Results of the study would provide information and
6 data for the Ecological Risk Assessment.

- 7 ▪ Fish were to be collected from the Housatonic River in areas of mink habitat. The
8 fish were to be ground and blended into a homogeneous mixture. Three composite
9 samples were to be collected and analyzed for OC pesticides, total PCBs, PCB
10 congeners, and dioxins/furans.
- 11 ▪ The mink toxicity tests were to use six dietary treatments, one of which would be a
12 control diet containing uncontaminated ocean fish. The remaining five diets were to
13 contain mixtures of ocean fish and homogenized fish from the Housatonic River.
- 14 ▪ Three random grab samples from each dietary treatment (for a total of 18) were to be
15 collected for analysis of OC pesticides, total PCBs, PCB congeners, and
16 dioxins/furans; an additional sample from each dietary treatment was to be collected
17 for nutrient analysis.
- 18 ▪ Liver tissue was to be collected from 12 adult females, six mink kits at 6 weeks of
19 age, and an additional six kits at 6 months of age from each dietary treatment. The
20 liver samples were to be analyzed for OC pesticides, total PCBs, PCB congeners, and
21 dioxins/furans.
- 22 ▪ Measurement endpoints for the mink toxicity study were to include body weight,
23 length of gestation, reproductive success, survival, histopathology, biochemical
24 analyses (including cytochrome P-450 levels), and organ weights.

25 Tables 2.2.22-1 and 2.2.22-2 summarize the proposed and completed sampling and analysis.

26

1
2
3

Table 2.2.22-1

Sampling Summary – Fish, Diets and Mink Liver Tissue Analysis

Program	Media		Samples	Duplicates	Total samples
Mink	Adult Liver	Proposed	72	0	72
		Collected	67	0	67
	Kit Liver	Proposed	72	0	72
		Collected	72	0	72
	Housatonic Fish	Proposed	3	0	3
		Collected	3	0	3
	Diet	Proposed	18	0	18
		Collected	18	0	18

4

Table 2.2.22-2

Analysis Summary – Fish, Diets and Mink Liver Tissue Analysis

5
6
7

Program	Media		Total PCB	Congeners	Percent Lipids	Pesticides	Dioxins/ Furans
Mink	Adult Liver	Collected	67	67	67	67	67
		Analyzed	67	67	67	0	67
	Kit Liver	Collected	72	72	72	72	72
		Analyzed	72	72	72	0	72
	Housatonic Fish	Collected	3	3	3	3	3
		Analyzed	3	3	3	3	3
	Diet	Collected	18	18	18	18	18
		Analyzed	18	18	18	0	8

8
9

1 **2.2.22.2 Explanation of Differences**

2 Differences between the proposed versus completed numbers of samples and analyses are
3 discussed below.

4 **Samples**

- 5 ▪ 67 adult kit samples were collected versus 72 proposed. 5 adult female mink died
6 during the trial period; therefore, the livers were not retained for analysis.

7 **Analysis**

- 8 ▪ Pesticides were not analyzed for the livers and the diet mixtures because the
9 Housatonic fish OC pesticide results provided adequate analytical information.

10

1 **2.2.23 Crayfish Tissue Analysis**

2 **2.2.23.1 Program Description and Summary**

3 Crayfish were collected and analyzed for tissue residue concentrations to evaluate
4 bioaccumulation and potential subsequent food chain transfer to upper trophic level species such
5 as largemouth bass and wading birds. The study was proposed to be conducted as follows:

- 6 ▪ Crayfish to be collected using baited traps, hand nets, or seine nets at each of six
7 locations (four locations in Reach 5 plus two reference locations). Deployment of
8 traps may be modified due to field conditions and trapping success.
- 9 ▪ A maximum of 20 crayfish to be collected for whole body tissue analyses from each
10 of 6 sites. A minimum of 10 crayfish samples from each site to be analyzed.
- 11 ▪ Tissue samples to be analyzed for PCBs (total, Aroclors, and congeners), moisture,
12 and lipids; a subset of these samples to also be analyzed for dioxins/furans and OC
13 pesticides.

14 Tables. 2.2.23-1 and 2.2.23-2 summarize the proposed and completed sampling and analyses.

15 **Table 2.2.23-1**

16 **Sampling Summary – Crayfish Tissue**

17

Program	Media		Locations	Samples	Duplicates	Total number of samples
Crayfish	Tissue	Proposed	6 (4+ 2ref)	60	3	63
		Collected	6	153	0	153

18

1 **Table 2.2.23-2**

2 **Analysis Summary–Crayfish Tissue**

3

Program	Media		Total PCB	Aroclors	Congeners	Percent Lipids	Pesticides	Dioxins/Furans	% Moisture
Crayfish	Tissue	Collected	153	153	153	153	NS	NS	153
		Analyzed	60	0	60	78*	60	18	60

4

5 **2.2.23.2 Explanation of Differences**

6 Differences between the proposed versus completed numbers of samples and analyses are
7 discussed below.

8 **Samples**

- 9
- 10 ■ 153 crayfish were collected versus 60 proposed. The additional crayfish were
11 collected to provide additional morphometric data to further characterize the crayfish
population.

12 **Analysis**

- 13 ■ 60 samples were analyzed as proposed versus the 153 crayfish collected. The
14 crayfish that were not sent for chemical analyses were only measured for
15 morphometric data. Morphometric data recorded for captured individuals included
16 species, sex, weight, total length, and carapace length.
- 17 ■ 153 Aroclors collected versus 0 analyzed. The Aroclor data were to be calculated
18 from the congener results. Because the congener data directly provide more
19 information about the PCB composition, the calculated Aroclor data were eliminated.
- 20 ■ Field duplicate samples were not collected due to the limited sample mass.
- 21 ■ Lipids were analyzed separately for the dioxin/furan samples, resulting in 18 more
22 percent lipids analyzed than proposed.

1 **2.2.24 Reptile and Amphibian Survey**

2 **2.2.24.1 Program Description and Summary**

3 The objective of the amphibian and reptile surveys was to determine species present, abundance,
4 and habitat use in the Housatonic River and floodplain. The reptile and amphibian survey is
5 described below:

- 6 ▪ Vernal pool locations to be mapped and the habitat characterized.
- 7 ▪ Pools to be visited and visual and acoustic surveys to be conducted to document the
8 presence of reptiles and amphibians.
- 9 ▪ Aquatic funnel trapping to be conducted during the period when larval amphibians
10 are present, and all individuals captured to be identified and measured.
- 11 ▪ If incidental mortality occurred during sampling, these individuals to be collected for
12 analysis of PCBs (total, Aroclors, congeners, and homologs), lipids, and moisture. A
13 subset of these samples also to be analyzed for dioxins/furans and select OC
14 pesticides if sufficient tissue mass was available.

15 **2.2.24.2 Explanation of Differences**

16 The survey was conducted as planned. No samples were collected for chemical analysis.
17 Samples were to be collected only if incidental mortality occurred.

18

1 **2.2.25 Waterfowl Collection and Tissue Analysis**

2 **2.2.25.1 Program Description and Summary**

3 The objectives of this task were to collect resident mallards and wood ducks from the study area
 4 and appropriate reference areas before the start of the fall migration (late August through mid-
 5 September 1998) and to submit tissue samples for analyses. The proposed program is described
 6 below.

7 Trapping was conducted in Woods Pond and adjacent backwaters. Two floating box traps and
 8 one walk-in trap were used to capture waterfowl in backwaters near Woods Pond and from
 9 Threemile Pond, a reference area located in Sheffield, Massachusetts, in August and September
 10 1998. Morphometric data collected from specimens included age, sex, wing chord length, and
 11 total weight. Twenty wood ducks (11 males, 9 females) and 5 mallards (4 males, 1 female) were
 12 collected from the Housatonic River, and 20 wood ducks (12 males, 8 females) were collected
 13 from Threemile Pond. Liver and breast tissues were analyzed for PCBs (totals, Aroclors,
 14 congeners/homologs), dioxin/furans, organochlorine pesticides, percent lipids, and percent
 15 moisture.

16 Tables 2.2.25-1 and 2.2.25-2 summarize the proposed and completed sampling and analysis.

17 **Table 2.2.25-1**

18 **Sampling Summary – Waterfowl**

19

Reach	Program	Media		No. of Areas	Biological Samples	Tissue Samples	Duplicate Samples	Total Samples
5 & 6	Waterfowl Collection	Wood duck	Proposed	3	40	80	5	85
			Completed	3	40	80	5	85
		Mallard	Proposed	3	5	10	NS	10
			Completed	3	5	10	0	10

20 NS = Not specified in the SIWP.

21

1
2
3
4

Table 2.2.25-2
Analysis Summary – Waterfowl

Reach	Program	Media		Total PCB	Aroclors	Congeners	Homologs	Dioxins/ Furans	OC Pest	% Lipids	% Moisture
Reaches 5 & 6, and Reference Areas	Waterfowl Collection	Wood duck – breast tissue	Collected	40	40	40	40	40	40	40	40
			Analyzed	40	40	40	40	40	40	40	40
		Wood duck – duplicate breast tissue	Collected	5	5	5	5	5	5	5	5
			Analyzed	5	5	5	5	5	5	5	5
		Wood duck – liver tissue	Collected	40	40	40	40	40	40	40	40
			Analyzed	40	40	40	40	40	40	40	40
		Mallards – breast tissue	Collected	5	5	5	5	5	5	5	5
			Analyzed	5	5	5	5	5	5	5	5
		Mallards – liver tissue	Collected	5	5	5	5	5	5	5	5
			Analyzed	5	5	5	5	5	5	5	5

5
6
7
8
9

2.2.25.2 Explanation of Differences

This survey was completed as planned.

1 **2.2.26 Dairy Land Use/Practice Investigation**

2 **2.2.26.1 Program Description and Summary**

3 This survey was conducted to determine dairy land use and practice in the floodplain to support
4 the human health risk assessment. Information was gathered from aerial photographs, first-hand
5 observations, and interviews with the USDA Farm Services Agency and local farmers.

6 **2.2.26.2 Explanation of Differences**

7 This survey was completed as planned.

8
9

1 **2.2.27 June 2000 Flood Sampling**

2 **2.2.27.1 Program Description and Summary**

3 Photographic documentation of the flood event that began on the evening of 6 June 2000 was
 4 collected at various locations along the East Branch of the Housatonic River and the surrounding
 5 floodplain from Newell Street to Woods Pond. Visual inspections of the material deposited by
 6 the floodwaters were conducted from Lyman Street Bridge to Woods Pond and eight locations
 7 were chosen for sampling of recently deposited sediments as scrapings from soil and vegetation.

8 All samples recovered from soil scrapings were analyzed for PCBs, TOC, and grain size.
 9 Vegetation samples were analyzed for PCBs only.

10 Tables 2.2.27-1 and 2.2.27-2 summarize the proposed and completed sampling and analysis.

11 **Table 2.2.27-1**

12 **Sampling Summary – June 2000 Flood**

13

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples
4	June 2000 Flood	Sediment	Proposed	NS	NS	NS	NS	NS
			Collected	NS	7	7	0	7

14 NS = Not specified in the SIWP.

15
16

1
2
3

Table 2.2.27-2

Analysis Summary – June 2000 Flood

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size
4	June 2000 Flood	Sediment	Collected	7	7	7	7
			Analyzed	7	7	6	6

4
5

6 **2.2.27.2 Explanation of Differences**

7 **Analysis**

8 The difference between the number of samples collected and analyzed for PCBs (7) and the
9 number of samples collected and analyzed for TOC and grain size (6) is due to insufficient
10 sample volume available for multiple analyses.

11

1 **2.2.28 Discretionary Sampling**

2 **2.2.28.1 Program Description**

3 An iterative approach to the overall sampling program was used whenever possible to improve
 4 the effectiveness of the field investigations. A review of newly collected data from recently
 5 completed studies was used to design focused discretionary field sampling activities to fill in
 6 identified data gaps and better fulfill data quality objectives.

7 Discretionary sampling activities were initiated to provide further characterization of spatial and
 8 temporal variability in the data to support and complete the human health and ecological risk
 9 assessments and river system modeling activities.

10 Tables 2.2.28-1 and 2.2.28-2 summarize the discretionary sampling and analyses.

11 **Table 2.2.28-1**

12 **Sampling Summary – Discretionary Sampling**

13

Reach	Program	Media		Sample Locations	Samples	Duplicates	Total Samples
5	Discretionary sampling	Sediment	Proposed	NS	NS	NS	NS
			Collected	196	415	13	428
6	Discretionary sampling	Floodplain	Proposed	NS	NS	NS	NS
			Collected	246	316	11	327
		Floodplain	Proposed	NS	NS	NS	NS
			Collected	7	7	0	7

14 NS = Not specified in the SIWP.

15

1
2
3
4

Table 2.2.28-2

Analysis Summary – Discretionary Sampling

Reach	Program	Media		Total PCB	Aroclors	TOC	Grain Size	Pesticides	Herbicides	OP Pesticides	Metals	Semi-VOAs	Dioxins/Furans	Cyanide	Sulfide	Congeners	
5	Discretionary sampling	Sediment	Collected	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
			Analyzed	428	428	428	414	0	0	0	0	0	0	0	0	0	0
6	Discretionary sampling	Floodplain	Collected	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
			Analyzed	327	327	48	45	0	0	0	0	0	0	0	0	6	
		Floodplain	Collected	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			Proposed	7	7	0	0	0	0	0	0	0	0	0	0	0	0

5 NS = Not specified in the SIWP.

6

7 **2.2.28.2 Explanation of Data Differences**

8 As the number of samples and types of analysis were not specified in the SIWP, there can be no
9 differences between what was proposed and performed.

10

1 **2.2.29 Air Sampling**

2 **2.2.29.1 Program Description and Summary**

3 The purpose of the air sampling program was to provide data for the evaluation of potential risks
4 to human health. If the air sampling program resulted in concentrations below levels of concern,
5 the air pathway was to be eliminated from quantitative evaluation in the risk assessment.

6 The proposed air sampling program is described below:

- 7 ▪ Air sampling planned at two locations – across from Decker Canoe Launch and an
8 access area off October Mountain Road.
- 9 ▪ Data to be collected seasonally for 5 consecutive days per season.
- 10 ▪ Samples to be analyzed for PCBs, particulate, and volatile fractions separately.
- 11 ▪ Data collected during the first two seasons to be evaluated and, based on the results,
12 the remaining collection program potentially terminated or modified.

13 Table 2.2.29-1 summarizes the proposed and completed sampling and analysis.

14 **Table 2.2.29-1**

15 **Air Sampling Summary of Particulate and Volatile PCB/Aroclors**

16

Location		Spring April	Summer July	Autumn	Winter	Total Samples
Decker Canoe Launch	Proposed	5	5	5	5	20
	Analyzed	8 (5+3 dups)	8 (5+3 dups)	0	0	16
October Mountain Road	Proposed	5	5	5	5	20
	Analyzed	7 (5+2 dups)	7 (5+2 dups)	0	0	14

17

18 **2.2.29.2 Explanation of Differences**

19 Because concentrations from the spring and summer sampling events were below the risk-based
20 limits, the program was not continued for the remaining seasons.

1 **2.3 WATER QUALITY SAMPLING AND MODELING STUDIES**

2 Water quality sampling was conducted primarily to support the modeling study. Specific
3 activities undertaken to support the modeling data needs include surface water sampling and
4 storm event sampling, measurement of channel geometry cross sections, and flow monitoring.
5 Water sampling programs, as specified in the SIWP, are summarized in the following sections.
6 Each summary includes a brief description of the program proposed in the SIWP for sample
7 collection and analysis.

8 **2.3.1 Surface Water Sampling – Monthly**

9 **2.3.1.1 Program Description and Summary**

10 Surface water samples were proposed to be collected monthly at 17 locations along the
11 Housatonic River and tributaries from August 1998 through September 1999 (15 months, due to
12 an overlap in sampling at the end of July and beginning of August 1998). Fourteen of the
13 locations were on the main (East) Branch of the Housatonic River. Two locations were on
14 tributaries to the river, and the remaining location was on the West Branch of the Housatonic
15 River near the confluence with the East Branch. The following parameters were to be analyzed:

- 16 ▪ Total suspended solids
- 17 ▪ Total dissolved solids
- 18 ▪ Filtered and unfiltered PCBs (total, Aroclors, and congeners)
- 19 ▪ Biochemical oxygen demand (5-day)
- 20 ▪ Phosphorus (ortho- and total –P)
- 21 ▪ Appendix IX parameters (filtered and unfiltered metals)
- 22 ▪ Calcium
- 23 ▪ Magnesium
- 24 ▪ Alkalinity
- 25 ▪ Hardness
- 26 ▪ Chlorophyll-a
- 27 ▪ Total Kjeldahl nitrogen
- 28 ▪ Ammonia nitrogen
- 29 ▪ Nitrite nitrogen
- 30 ▪ Nitrate nitrogen
- 31 ▪ Total organic carbon (TOC) and dissolved organic carbon (DOC) (particulate organic
32 carbon by difference)
- 33 ▪ Cyanide
- 34 ▪ Sulfide

1
 2 Parameters measured in the field included pH, temperature, dissolved oxygen, turbidity, and
 3 specific conductance.

4 Tables 2.3.1-1 and 2.3.1-2 summarize the proposed and completed sampling and analysis.

5 **Table 2.3.1-1**
 6
 7 **Sampling Summary – Surface Water – Monthly Sampling**

Reach	Program	Media		Sample Locations	Samples	Duplicates	Total Samples
1-6	Surface Water	Water	Proposed	17	255	15	270
			Collected	17	238	15	253

8
 9 **Table 2.3.1-2**
 10
 11 **Analysis Summary – Surface Water – Monthly Sampling**

Parameter	Surface Water																																	
	Total PCBs (unfiltered)	Aroclors (unfiltered)	PCB Congeners (unfiltered)	Total PCBs (filtered)	Aroclors (filtered)	PCB Congeners (filtered)	TSS	Metals (unfiltered)	Metals (filtered)	Dioxins/Furans	Cyanide	Sulfide	TDS	BOD5	Semi-VOAs	OP-Pesticides	Pesticides	Herbicides	Ortho-Phosphorous	Total-Phosphorous	Calcium	Magnesium	Alkalinity	Hardness	Chlorophyll-a	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrite Nitrogen	Nitrate Nitrogen	TOC	DOC	POC		
Collected	253	253	136	253	253	136	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	255
Analyzed	235	251	138	251	251	137	251	250	251	250	249	250	250	258	250	250	250	243	250	250	169	169	250	250	253	250	250	250	250	137	252	0		

12
 13 **2.3.1.2 Explanation of Differences**

14 Fewer samples were collected and analyzed due to the following:

- 15 ▪ Samples were not collected at location SW00013 (stream from Goodrich Pond)
 16 except on 23 March 1999. This location was dry during the other sampling events.
- 17 ▪ A sample was not collected at location SW00017 (discharge stream from Pittsfield
 18 WWTP) on 3 August 1998. The location was added in a revision to the draft work
 19 plan in September 1998.

- 1 ▪ Samples were not collected at locations SW00002 and SW00003 (Woods Pond
2 locations) during some winter months due to field conditions (ice at the sampling
3 locations).
- 4 ▪ Congener analyses were not originally proposed but were added to the program and
5 conducted from February 1999.
- 6 ▪ Calcium and magnesium were not collected for analyses until December 1998. These
7 parameters were not originally proposed but were added at the end of 1998.
- 8 ▪ TOC was not included as a parameter until February 1999.
- 9 ▪ Determination of POC by mass balance was determined to be unreliable; and these
10 data, which included a high number of negative values, have been removed from the
11 database.
- 12

1 **2.3.2 Supplemental Surface Water Study**

2 **2.3.2.1 Program Description and Summary**

3 The supplemental surface water study was proposed to measure PCBs, OC, and related
4 parameters in surface water in the Housatonic River Primary Study Area (PSA). The study was
5 not proposed in the SIWP, but was developed due, in part, to a recommendation from the
6 MFD/QAPP Peer Review in April 2001 to support the Housatonic River modeling. The SOP for
7 the program was developed with the input of QEA, the GE modeling consultant. PCB analyses
8 (modified “Green Bay” congener method by the NEA Laboratory) were contracted by GE, and
9 the other analyses were contracted by WESTON.

10 Samples were collected from four locations in the PSA:

- 11 ▪ Pomeroy Avenue Bridge
- 12 ▪ West Branch of the Housatonic River near the confluence
- 13 ▪ New Lenox Bridge
- 14 ▪ Woods Pond Footbridge

15
16 Three sampling events at the four locations were conducted to evaluate the Housatonic River at
17 low-, medium-, and high-flow conditions. Prior to the three sampling events, a single sampling
18 event was conducted with three replicate samples at the Pomeroy Avenue Bridge location as a
19 trial of the sampling, processing, and analytical protocols (trial event).

20 During each event, the following parameters were measured: dissolved and particulate PCB
21 congeners, total, dissolved, and particulate OC, total suspended solids (TSS), and chlorophyll-a.
22 Staff gage readings for each of the stations and at the USGS Coltsville gage during the time of
23 each sampling were also recorded at the time of sampling.

24 Table 2.3.2-1 summarizes the proposed and completed sampling and analysis.

1
2
3

Table 2.3.2-1

Sample and Analysis Summary—Supplemental Surface Water Study

Sample Type	Locations	Samples	Chlor-a	TSS	Organic Carbon			PCBs		
					TOC	POC*	DOC	Total	Partic. Congeners	Diss. Congeners
Trial Event	1	Proposed	3	3	3	3	3	3	3	3
		Collected & Analyzed	3	3	3	9	3	3	3	3
Low Flow	4	Proposed	4	4	4	4	4	4	4	4
		Collected & Analyzed	4	4	4	12	4	4	4	4
Med Flow	4	Proposed	4	4	4	4	4	4	4	4
		Collected & Analyzed	4	4	4	12	4	4	4	4
High Flow	4	Proposed	4	4	4	4	4	4	4	4
		Collected & Analyzed	4	4	4	12	4	4	4	4
Field Duplicates	1	Proposed	1	1	1	1	1	1	1	1
		Collected & Analyzed	2	2	2	6	2	2	2	2
Total		Proposed	16	16	16	16	16	16	16	16
		Collected & Analyzed	17	17	17	51	17	17	17	17

4 * POC was listed as one POC analysis per composite sample. However, subsequent laboratory arrangements
5 allowed three separate analytical results per composite-filter. The table reflects the availability of three POC
6 results for each composite.

7

8 **2.3.2.2 Explanation of Differences**

9 The study was conducted as planned.

10

1 **2.3.3 Water Column Profile(s) for Woods Pond**

2 **2.3.3.1 Program Description and Summary**

3 Water quality measurements were proposed to evaluate the degree of eutrophication in Woods
 4 Pond. The study included a water column profile of the deep basin at the eastern side of the pond
 5 for the following parameters: pH, temperature, DO, specific conductivity, and turbidity.
 6 Additional water column profiles were to be collected to further assess Woods Pond conditions
 7 depending on the initial results.

8 Table 2.3.3-1 summarizes the proposed and completed measurements.

9 **Table 2.3.3-1**

10 **Sampling and Analysis Summary – Woods Pond Water Column Profiles**

11

Reach	Program	Media		Locations	pH	Temperature	Diss Oxygen	Spec Conductance	Turbidity
6	Woods Pond Water Column	Water	Proposed	NS	NS	NS	NS	NS	NS
			Field Measurement	7	56	56	56	56	56

12 NS - Not specified.

13
 14 The implemented program included a water column profile at seven locations within and
 15 upstream of Woods Pond. Each location was sampled in the spring, summer, and fall of 2000.
 16 Water column measurements included the following parameters: pH, temperature, dissolved
 17 oxygen, specific conductivity, and turbidity.

18 **2.3.3.2 Explanation of Differences**

19 There were no differences between the program as proposed in the SIWP and the implemented
 20 program.

21

1 **2.3.4 Stormflow Sampling**

2 **2.3.4.1 Program Description and Summary**

3 Water samples were proposed to be collected from the Housatonic River and selected tributaries
4 under conditions when water quality and suspended sediment transport are influenced by storm-
5 induced flows. Stormflow sampling collected data on suspended solids, PCBs, and water quality
6 parameters for the Housatonic River modeling. The SIWP did not specify the number of
7 stormflow sampling events to be conducted as they were weather-dependent.

8 For each stormflow event, samples of water and suspended solids were collected from three
9 primary locations. Samples of water (only) were collected from five secondary stormflow
10 sampling locations.

11 The primary sampling locations were:

- 12 ▪ Pomeroy Avenue Bridge (ST000004)
- 13 ▪ New Lenox Road Bridge (ST000007)
- 14 ▪ Wood Pond Dam (at footbridge upstream of the dam, ST000009)

15
16 The secondary locations were:

- 17 ▪ Hubbard Avenue Bridge (Coltsville; ST000002)
- 18 ▪ Unkamet Brook (ST000003)
- 19 ▪ West Branch Housatonic River (ST000005)
- 20 ▪ Sackett Brook (ST000006)
- 21 ▪ Roaring Brook (ST000008)

22
23 Water samples from the primary locations were analyzed for:

- 24 ▪ Ammonia-nitrogen
- 25 ▪ Nitrite-nitrogen
- 26 ▪ Nitrate-nitrogen
- 27 ▪ Total Kjeldhal nitrogen
- 28 ▪ Organic-phosphorus
- 29 ▪ Ortho-phosphorus
- 30 ▪ Total phosphorus
- 31 ▪ Chlorophyll-a
- 32 ▪ Biochemical oxygen demand (5 day)
- 33 ▪ Chemical oxygen demand

1
2
3

Table 2.3.4-2

Analysis Summary – Stormflow

Parameter	Total PCBs (unfiltered)	Aroclors (unfiltered)	PCB Congeners (unfiltered)	Total PCBs (filtered)	Aroclors (filtered)	PCB Congeners (filtered)	TSS	BOD5	Ortho-Phosphorus	Total- Phosphorus	Organic Phosphorus	Alkalinity	Hardness	Chlorophyll-a	Total Kjeldahl Nitrogen	Ammonia Nitrogen	Nitrite Nitrogen	Nitrate Nitrogen	TOC	DOC	POC	COD
Collected	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Analyzed	136	139	24	89	89	24	2456	231	235	235	235	87	88	233	235	235	235	235	235	236	235	88

4 NS – Not specified in the SIWP.

5
6
7
8

Table 2.3.4-3

Sampling Summary – Stormflow Suspended Solids (in Bag Filters)

Bag Samples	Number of Locations	Number of Samples	Number of Fractionated Samples	Total Number of Samples
Proposed	NS	NS	NS	NS
Collected	3	20	79	99

9 NS – Not specified in the SIWP.

10
11
12
13

Table 2.3.4-4

Analyses Summary – Stormflow Suspended Solids (in Bag Filters)

Parameter	Storm Flow (Bag Samples)			
	Grain Size	Aroclors	Total PCBs	TOC
Collected	20	60	60	79
Analyzed	20	67	67	77

14

1 **2.3.4.2 Explanation of Differences**

2 Differences between the proposed versus completed number of samples and analyses are
3 discussed below.

4 **Suspended Solids Sampling**

- 5 ▪ The number of storm events and therefore sample numbers could not be specified in
6 the SIWP as they were weather-dependent. Some samples that were collected were
7 not analyzed when the stormflows were not as large as predicted at the beginning of
8 the storm.

9 **Analysis**

- 10 ▪ The additional seven PCB analyses were due to more of the fractionated grain size
11 samples being analyzed for PCB characterization than proposed.

12

1 **2.3.5 Flow Monitoring**

2 **2.3.5.1 Program Description and Summary**

3 Flow monitoring was completed at numerous locations along the East and West Branches of the
4 Housatonic River and in selected tributaries to characterize flows at different stages of river
5 height.

6 Table 2.3.5-1 summarizes the locations and flow measurements planned in the SIWP and those
7 implemented.

8

1
2
3
4

Table 2.3.5-1

Measurement Summary – Flow Monitoring

Location	Dawes Ave. Bridge	Pomeroy Ave. Bridge	West Branch	Holmes Rd. Bridge	New Lenox Rd. Bridge	Woods Pond Bridge	Lenoxdale Bridge	Unkamet Brook	Sackett Brook	Roaring Brook	Goodrich Pond
Proposed Measurements	NS	3	3	3	3	3	NS	3	3	3	NS
Conducted Measurements	1	10	3	7	9	8	1	3	2	2	2

5 NS – Not specified in the SIWP.

6
7 In September 2001, pressure transducers were installed at Pomeroy Avenue Bridge, West
8 Branch, EPRI, New Lenox Road Bridge, and the Wood Pond Footbridge to provide additional
9 data on the surface water elevation and temperature. The EPRI location was added as the result
10 of establishing a “Test Reach” for the Housatonic River modeling.

11 **2.3.5.2 Explanation of Differences**

12 The number of measurements for the SIWP-specified locations was revised to provide additional
13 resolution at the primary locations and decreased measurements at locations with limited flows.
14 Additional locations were measured to evaluate their flows relative to the SIWP-specified
15 locations.

16 The number of measurements was increased at several locations to provide data at different stage
17 heights. The number of measurements at two locations was decreased due to their limited flows.
18 A limited number of measurements at three locations were added to the program to evaluate
19 relative flows at locations not previously considered.

1 **2.3.6 River Channel Geometry Measurements**

2 **2.3.6.1 Program Description and Summary**

3 Floodplain and channel cross sections were to be surveyed at locations between the GE facility
4 and Woods Pond Dam to provide the channel geometry needed to support the modeling study.

- 5 ▪ Channel measurements to include water depth, sediment depth, and distance to the
6 top of bank at each transect.
- 7 ▪ Approximately 250 cross sections to be completed in Reach 5 to support advanced
8 modeling approaches.

9 **2.3.6.2 Explanation of Differences**

10 A total of 286 cross sections were completed in Reach 5 versus the 250 proposed. Additional
11 cross sections were surveyed to provide more detailed channel measurements to support the
12 modeling activities.

13

1 **2.3.7 Vertical Definition Cores**

2 **2.3.7.1 Program Description and Summary**

3 Subsurface materials were to be sampled within the river in Reaches 5 and 6. These samples,
4 known as the Vertical Definition Cores (VDCs), had three objectives:

- 5 ▪ To determine the vertical extent of PCB contamination.
- 6 ▪ To identify subsurface lithologic features that may have an impact on hydrology or
7 contaminant migration.
- 8 ▪ To look for evidence of an upper, “active” layer of sediment, which is subject to
9 resuspension in certain flow regimes.

10 Sampling was planned at 26 VDC locations in the river. Each VDC location comprised two
11 sample locations on opposite sides of the river, each midway between the thalweg and the bank.
12 The VDC sampling program is described below:

- 13 ▪ Samples to be collected from four 0.5-foot intervals: the interval at the surface of the
14 core (0.0 - 0.5 ft bgs); 3.0 - 3.5 ft bgs; the interval halfway between 3.5 ft bgs and the
15 bottom of the core, and the interval at the bottom of the core. In addition, where
16 unique lithologic units were identified, additional samples of such layers were to be
17 considered for sampling.
- 18 ▪ During sampling, the core to be logged and videotaped.

19 Supplemental floodplain samples were collected at 26 locations in the floodplain adjacent to the
20 VDC in-river locations. Each supplemental floodplain location comprised two sample locations,
21 one on each bank of the river. The proposed sampling program is described below:

- 22 ▪ PCB/TOC samples to be collected from each core. Any fine units between 2.5 feet
23 and the bottom of the core were to be sampled, as was the deepest material from each
24 core.
- 25 ▪ Two cores from each subreach of the river (5A, 5B, and 5C for a total of six cores) in
26 the study area to be dated via lead-210 method so that depositional rates can be
27 calculated.
- 28 ▪ Samples that appeared appropriate for carbon-14 dating to be selected at the
29 discretion of the samplers.

1 **2.3.7.2 Explanation of Differences**

2 Differences between the number of samples and analyses proposed and what was performed are
3 discussed below.

4 **2.3.7.2.1 Sediment**

5 **Sampling**

- 6 ▪ 102 samples were collected versus 109 proposed because of poor recovery with
7 several of the sediment cores.

8 **Analyses**

- 9 ▪ 1 fewer sample was analyzed for radiocarbon due to insufficient sample volume.

10

1 **2.3.8 Sediment Microscopy**

2 **2.3.8.1 Program Description and Summary**

3 Ten riverbank sediment samples located between the confluence of the East and West Branches
4 of the Housatonic River and New Lenox Road (Reach 5) were visually evaluated under a
5 binocular microscope to estimate the mineralogical makeup of the sediments. A portion of each
6 of the 10 samples was sent to a laboratory for x-ray diffraction and for scanning electron
7 microscopy analysis for mineralogical determination.

8 **2.3.8.2 Explanation of Differences**

9 This program was not proposed in the SIWP. A separate Scope of Work (SOW) was developed
10 for evaluating the mineralogical makeup of the sediment in the Housatonic River. The study was
11 performed as planned.

12

1 **2.3.9 Toe Pins**

2 **2.3.9.1 *Program Description and Summary***

3 Based on the results of an initial survey to locate areas of bank erosion in Reach 5, five locations
4 were selected for the installation of toe pins. In October 2001, four pins of half-inch rebar, each 5
5 feet in length, were driven into the bank to a depth of 4 feet at each location, leaving a 1-foot
6 length of each bar exposed. The pins were installed during low- to medium-flow conditions at
7 approximately the water surface and each pin was marked to indicate the amount exposed. The
8 toe pins were re-measured in May 2001, August 2001, April 2002, and June 2002.

9 **2.3.9.2 *Explanation of Differences***

10 Toe pin installation was proposed but not specifically described in the SIWP. A detailed SOP
11 was developed to quantify bank erosion and deposition to support model development.

12

1 **2.3.10 River Channel Resurveys**

2 **2.3.10.1 Program Description and Summary**

3 Nine transects were selected for periodic survey to evaluate changes in channel morphology over
4 time and after significant high-flow events. The transects were surveyed in September 2001,
5 April 2002, and June 2002.

6 **2.3.10.2 Explanation of Differences**

7 These river channel surveys were proposed but not specifically described in the SIWP. A
8 detailed SOP was developed at the request of the Housatonic River modeling program to
9 evaluate changes in the channel morphology.

10

1 **2.3.11 Additional Velocity Measurements**

2 **2.3.11.1 Program Description and Summary**

3 Acoustic Doppler Current Profiler (ADCP) velocity data were collected in several areas of the
4 PSA. These areas included the headwaters of Woods Pond, Woods Pond, New Lenox Road,
5 portions of the Test Reach (so-called ADCP bend), and Pomeroy Avenue. The ADCP work had
6 two primary objectives:

- 7 ▪ To collect high-frequency velocity data for use in calibration of the hydrodynamic
8 model and to support development of stage/discharge rating curves.
- 9 ▪ To collect detailed bathymetry information to evaluate potential changes in the
10 sediment bed over time.

11 The ADCP was used to collect high-intensity velocity data, flow data, and bathymetric readings.
12 Measurements were taken during two different flow conditions.

13 **2.3.11.2 Explanation of Differences**

14 The additional velocity measurements were proposed but not specifically described in the SIWP.
15 A detailed SOP was developed separately for this program.

16

1 **2.3.12 Additional Stormflow Monitoring (Supplemental Modeling Study)**

2 **2.3.12.1 Program Description and Summary**

3 The primary objective of the additional stormflow monitoring was to evaluate selected
 4 characteristics of the bed and suspended sediment loads in the Housatonic River during high-
 5 flow events. Representative samples of total suspended solids (TSS) and bedload sediments were
 6 proposed along with velocity measurements. Up to four events were proposed with sampling to
 7 be conducted at three locations: the Pomeroy Avenue Bridge, adjacent to the Electric Power
 8 Research Institute (EPRI), and at the New Lenox Road Bridge. For each event, nine bedload
 9 sediment samples were proposed for PCB, TOC, and grain size analysis, and up to 15 surface
 10 water samples were proposed for PCB, TSS, and TOC analysis. To date, one sampling event has
 11 been completed, with samples from Pomeroy Avenue Bridge (only) submitted for analysis.

12 Tables 2.3.12-1 and 2.3.12-2 summarize the proposed and completed sampling and analysis.

13 **Table 2.3.12-1**

14 **Sampling Summary (Per Event) – Additional Stormflow Monitoring**

15

Reach	Program	Media		No. of Areas	Sample Locations
5	Additional Stormflow Monitoring	Surface Water	Proposed	3	3
			Collected	1	1
		Bedload Sediment	Proposed	3	3
			Collected	1	1

16

1
2
3

Table 2.3.12-2

Analyses Summary (Per Event) – Additional Stormflow Monitoring

Reach	Program	Media		Total PCB	TOC	Grain Size	TSS
5	Additional Stormflow Monitoring	Surface Water	Collected	10	10	N/A	10
			Analyzed	10	10	N/A	10
		Bedload Sediment	Collected	10	10	10	N/A
			Analyzed	10	10	10	0

4
5
6
7

N/A = Not applicable. This type of analysis was not proposed for this particular program in the SIWP.

8 **2.3.12.2 Explanation of Differences**

9 **Samples**

10 Based on conditions during the storm event, only samples from Pomeroy Avenue Bridge were
11 collected for analysis.

12 The additional stormflow monitoring (Supplemental Modeling Study) was proposed but not
13 specifically described in the SIWP. A detailed SOP was developed separately to evaluate
14 characteristics of bed and suspended loads during high-flow events.

15

1 **2.3.13 Sediment Flume Studies**

2 **2.3.13.1 Program Description and Summary**

3 A Sediment Flume (Sedflume) study was conducted to evaluate the erosion potential of bottom
4 sediments as a function of shear stress. Sediment was analyzed for TOC, bulk density, and grain
5 size in support of the study. Twenty-four total cores (17 from Reach 5 and 7 from Reach 6,
6 including duplicate and reconstituted cores) were collected.

7 **2.3.13.2 Explanation of Differences**

8 The Sedflume study was proposed but not specifically described in the SIWP. A detailed SOP
9 was developed separately to evaluate the sediment erosion in the river. The study was performed
10 as planned.

11

1 **2.3.14 Meandering and Bank Erosion Study**

2 **2.3.14.1 Program Description and Summary**

3 The objectives of the meander survey were as follows:

- 4 ▪ To identify long-term changes in the course of the river and provide estimates of the
5 extent of riverbank erosion by reach.
- 6 ▪ To estimate short-term changes in the volume of riverbank soil loss per reach after a
7 bank-full flow event (1.5-year flood event).
- 8 ▪ To map areas that are currently eroding or accreting and determine the percent of
9 linear riverbank eroding for each reach.
- 10 ▪ To characterize sediment grain size for a sample of eroding banks.

11 Stereo-pairs of aerial photos from 1972 and 1952 were used to create a georeferenced river line
12 for each of these time periods, and these river lines were overlaid with the 1990 and 2000 river
13 lines in AutoCAD. The comparison of these river lines was used to estimate the amount of long-
14 term erosion.

15 Field visits were conducted to map areas of ongoing erosion and accretion in the Primary Study
16 Area (PSA). Site-specific erosion and accretion characteristics (e.g., extent of erosion/accretion
17 area, soil type, vegetation, etc.) were recorded at each location. Fifteen sites that covered the
18 range of potential low to high erosion rates were selected in Reaches 5a and 5b. Transects at
19 these locations were surveyed twice, with the second survey following a bank-full flood event.
20 The second terrain surface survey was overlaid onto the initial terrain surface to estimate the
21 volume of soil loss at each site.

22 A total of 29 soil samples (1 to 3 per site) were collected and analyzed for grain size.

23 Table 2.3.14-1 summarizes the proposed and completed sampling.

24

1
2
3
4
5
6
7
8
9
10

Table 2.3.14-1

Sampling Summary – Meandering and Bank Erosion Study

Reach	Program	Media		No. of Areas	Sample Locations	Samples	Duplicates	Total Samples	Grain Size
5	Meandering and Bank Erosion	Riverbank	Proposed	NS	NS	NS	NS	NS	NS
			Collected	17	29	29	0	29	29

NS = Not specified in the SIWP.

2.3.14.2 Explanation of Differences

The Meandering and Bank Erosion Study was not proposed as part of the SIWP. A detailed SOP was developed separately to evaluate bank erosion along the river. The study was performed as planned.

1 **2.3.15 Vegetative Stem Counts**

2 **2.3.15.1 Program Description and Summary**

3 A vegetative stem count survey was conducted in the floodplain of the PSA to provide data on
4 vegetation density that potentially could be incorporated into the hydrodynamic model to
5 simulate attenuation of flow velocity during flood events.

6 **2.3.15.2 Explanation of Differences**

7 The vegetative stem count survey was conducted under an SOP developed subsequent to the
8 SIWP.