Draft
Eighteenmile Creek Baseline Fish Sampling Report

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Prepared for:

NIAGARA COUNTY SOIL AND WATER CONSERVATION DISTRICT
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Table of Contents

Table of Contents (cont.)

List of Tables

List of Figures

List of Abbreviations and Acronyms

ALS-Kelso	ALS Environmental, Kelso, Washington
AOC	*Area of Concern*
BUI	Beneficial Use Impairment
°C	Celsius
DUSR	data usability summary report
E & E	Ecology and Environment, Inc.
EDD	electronic data deliverable
ERDC	Engineering Research and Development Center
GLRI	Great Lakes Restoration Initiative
GPC	gel penetration chromatography
IJC	International Joint Commission
mg/kg	milligrams per kilogram
NCSWCD	Niagara County Soil and Water Conservation District
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAP	Remedial Action Plan Start here
RI	Remedial Investigation
SDG	sample delivery group
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

Executive Summary

This report presents the results of a study designed to establish current baseline levels of polychlorinated biphenyls (PCBs) in fish from different trophic levels in Eighteenmile Creek. Three Beneficial Use Impairments (BUIs) at Eighteenmile Creek are driven by elevated PCB concentrations in fish. These BUIs are: (1) Restrictions on Fish and Wildlife Consumption; (2) Degradations of Fish and Wildlife Populations; and (3) Bird and Animal Deformities or Reproductive Problems. Brown bullhead fillets and sunfish whole-body composite samples were collected and analyzed for PCB Aroclors and congeners to provide data that could be used to evaluate the status of these BUIs and evaluate spatial and temporal trends in PCB levels in fish from the creek. These species were chosen based on the site-specific delisting criteria for the above-mentioned BUIs and availability of historical data for these species that could be used as point of comparison. In addition, crayfish whole-body composite samples and largemouth bass whole-body samples were collected and analyzed for PCB Aroclors and congeners to provide data that may be useful for the Trophic-Trace model recently developed for Eighteenmile Creek by the United States Army Corps of Engineers (USACE). The bullhead, sunfish, and crayfish samples were collected from three reaches of Eighteenmile Creek: (1) downstream of Burt Dam, (2) between Newfane and Burt dams, and (3) upstream of Newfane Dam. Largemouth bass samples were collected only upstream of Newfane Dam.

Average total Aroclor concentrations in the bullhead, crayfish, and largemouth bass samples exceeded the critical tissue concentration for PCBs for effects on fish (0.44 milligrams per kilogram [mg/kg] wet weight [Dyer et al. 2000]) in all reaches from which these species were collected. The average total Aroclor concentration in sunfish upstream of Newfane Dam also exceeded the critical tissue concentration, but the average concentration in sunfish between the two dams and below Burt Dam did not. Total Aroclors and total congeners in sunfish and crayfish were significantly greater upstream of Newfane Dam than in the two other creek reaches. No differences among reaches were observed for total Aroclors or total congeners in bullhead fillets. In general, 2012 data were comparable to historical data, with the exception that the sunfish congener concentrations from 2012 were lower than sunfish congener concentrations from 2010 collected for the USACE Trophic-Trace studies (von Stackelberg and Gustavson 2012). This difference between studies may be due to lower lipid levels in sunfish from 2012 (average 0.45%) compared with sunfish from 2010 (average 2.4%).

1 Introduction

This report describes the results of a study designed to provide baseline (pre-remedial) data on the concentrations of polychlorinated biphenyls (PCBs) in aquatic biota from Eighteenmile Creek, Niagara County, New York. Specifically, the study objectives were to:

- Collect and analyze fish and crayfish for PCB Aroclors and congeners to support development of a baseline dataset regarding PCB levels in fish from different trophic levels and crayfish throughout Eighteenmile Creek;
- Provide data that may be used to re-evaluate the status of fish consumption advisories for Eighteenmile Creek; and
- Generate data that may be used to further populate the Trophic Trace Model initiated by the United States Army Corps of Engineers (USACE) – Engineering Research and Development Center (ERDC) (von Stackelberg and Gustavson 2012).

The baseline sampling study described in this report was first identified in the *Eighteenmile Creek Area of Concern (AOC) Strategic Plan for Beneficial Use Impairment (BUI) Delisting* (E & E 2011) and described in detail in the *Quality Assurance Project Plan* (E & E 2012a) prepared to guide the work. This work was supported by a grant from the United States Environmental Protection Agency (USEPA) Great Lakes Restoration Initiative (GLRI) to the Niagara County Soil and Water Conservation District (NCSWCD).

This remainder of this report is organized as follows:

- Section 2 describes field and laboratory methods;
- Section 3 describes the study results;
- Section 4 provides a summary and recommendations; and
- Section 5 provides references.

Appendix A includes a copy of the project Quality Assurance Project Plan (QAPP) and appendices B through F include field data collection forms, observations, and full analytical results from the laboratories that supported the project.

1.1 Background on Eighteenmile Creek AOC Status and BUIs

In 1987, the International Joint Commission (IJC) identified 43 AOCs in the Great Lakes Basin where the beneficial uses of the water body were considered impaired. Eighteenmile Creek was identified as one of the 29 United States AOCs. The creek has been polluted by past industrial and municipal discharges, the disposal of waste, and the use of pesticides. Currently, there are five documented BUIs at the Eighteenmile Creek AOC: (1) restrictions on fish and wildlife consumption; (2) degradation of fish and wildlife populations; (3) bird or animal deformities or reproductive problems; (4) degradation of benthos; and (5) restrictions on dredging activities (USEPA 2010). These five BUIs are largely driven by elevated levels of PCBs in sediment and fish (E & E 2011). Table 1-1 lists the site-specific BUI delisting criteria developed by the NCSWCD for the Eighteenmile Creek system.

Table 1-1 Beneficial Use Impairments and Delisting Criteria for the Eighteenmile Creek AOC

BUI	BUI Status	Delisting Criteria
1. Restrictions on Fish and Wildlife Consumption	Impaired	There are no AOC-specific fish and wildlife consumption advisories issued by New York State; **AND**
		Contaminant levels in fish and wildlife must not be due to contaminant input from the watershed upstream of Burt Dam
2. Degradation of Fish and Wildlife Populations	Impaired	Fish and wildlife diversity, abundance and condition are statistically similar to diversity, abundance and condition of populations at non-AOC control sites; **AND**
		PCB levels in bottom-dwelling fish do not exceed the critical PCB tissue concentration for effects on fish (440 µg/kg wet weight ; Dyer et al. 2000)
3. Bird or Animal Deformities or Reproduction Problems	Impaired	No reports of wildlife population deformities or reproductive problems from wildlife officials above expected natural background levels; **AND**
		Contaminant levels in bottom-dwelling fish do not exceed the level established for the protection of fish-eating wildlife (NYSDEC Fish Flesh Criteria); **OR**
		In the absence of fish data, the toxicity of sediment-associated contaminants does not exceed levels associated with adverse effects on wildlife (NYSDEC Fish & Wildlife Bioaccumulation Sediment Criteria)

Table 1-1 Beneficial Use Impairments and Delisting Criteria for the Eighteenmile Creek AOC

BUI	BUI Status	Delisting Criteria
4. Degradation of Benthos	Impaired	Benthic macroinvertebrate communities are "non-impacted" or "slightly impacted" according to NYSDEC indices; **OR**
		In the absence of NYSDEC data, riffle habitats require benthic macroinvertebrate communities with a species richness higher than 20, EPT richness greater than 6, a biotic index value greater than 4.51, and a percent model affinity greater than 50; **OR**
		In the absence of benthic community data, this use will be considered restored when the level of toxic contaminants in sediments is not significantly higher than controls.
5. Restrictions on Dredging Activities	Impaired	When contaminants in AOC sediments (located within the actual or potential dredging areas identified for the improvement of ship navigation) do not exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.

Source: USEPA 2010a

Key:

AOC	=	Area of Concern
BUI	=	Beneficial Use Impairment
EPT	=	Ephemeroptera, Plecoptera, and Trichoptera
µg/kg	=	micrograms per kilogram
NYSDEC	=	New York State Department of Environmental Conservation
PCB	=	Polychlorinated Biphenyl

Both human and ecological receptors using the Eighteenmile Creek system may be at risk from PCBs and perhaps other chemicals in fish based on recent investigations (E & E 2009a) and current fish consumption advisories (NYSDOH 2011). Elevated levels of PCBs in fish in Eighteenmile Creek appear to be the result of bioaccumulation from sediment (USACE 2004a, b; von Stackelberg and Gustavson 2012). Recent sediment data from the Remedial Investigation (RI) for Eighteenmile Creek show that surface sediment PCB levels are greater in the portion of the creek near the source areas in Lockport, New York, compared with downstream reaches (E & E 2012b). Source areas along the creek in Lockport were characterized by the New York State Department of Environmental Conservation (NYSDEC 2006) and Ecology and Environment, Inc. (E & E; 2009b). Remediation of upstream source areas and contaminated sediment throughout the creek are necessary to eliminate BUIs in the Eighteenmile Creek system and eventually delist this Great Lakes AOC (E & E 2011).

1.2 Site Location and Description

The Eighteenmile Creek AOC is located in Niagara County, New York (see Figure 1-1). The creek flows generally north through central Niagara County and discharges via Olcott Harbor into Lake Ontario, approximately 18 miles east of the mouth of the Niagara River. The AOC includes Olcott Harbor and extends upstream to the farthest point at which backwater conditions exist during Lake

Ontario's highest monthly average lake level (see Figure 1-1). This point is located just downstream of Burt Dam, approximately 2 miles south of Olcott Harbor. This portion of the watershed is a unique gorge habitat that attracts recreational boaters, anglers, birders, and waterfowl hunters.

Only a small portion of the Eighteenmile Creek basin was originally designated an AOC by the IJC. However, for two reasons, since the Eighteenmile Creek Remedial Action Plan (RAP) process began, the AOC has been considered the impact area and the upper watershed as the source area (NYSDEC 1997). First, except for potential impacts from agricultural operations adjacent to the current AOC boundary, there are no documented sources or source areas of contamination within the AOC. Second, various investigations conducted over the past 35 years have suggested that contaminants may enter the AOC from upstream areas. Specifically, PCBs, copper, lead, and other metals have been found in creek sediment and bank fill in Lockport, New York, at concentration well above applicable New York State Department of Environmental Conservation (NYSDEC) standards, indicating that contaminant sources exist in that area (NYSDEC 2006; E & E 2009b and 2012b). Other contaminant source areas may exist along the creek between Lockport and the AOC (NYSDEC 2001).

Additional information regarding the characteristics of the Eighteenmile Creek AOC and watershed are available in the *Eighteenmile Creek State of the Basin Report* (E & E 2007), *Beneficial Use Impairment (BUI) Investigation Report for Eighteenmile Creek* (E & E 2009a), *Sediment Remedial Investigation Report* (E & E 2012b), and additional publications and factsheets available from the Eighteenmile Creek RAP Web site (www.eighteenmilecreekrap.com).

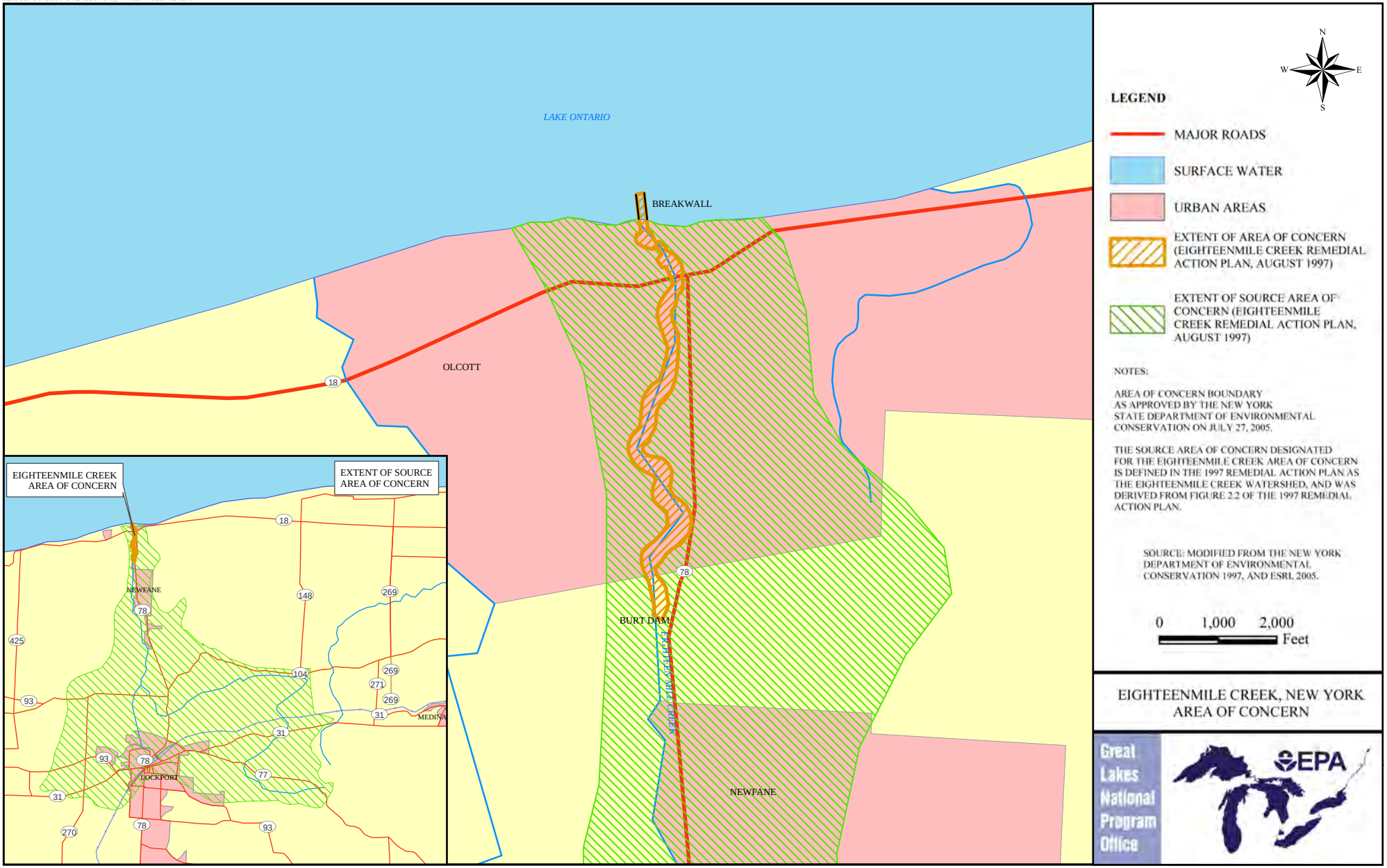

Figure 1-1 Eighteenmile Creek Area of Concern

2 Methods

2.1 Field Sampling Methods

Fish and crayfish were collected in August 2012. Individual brown bullhead (*Ameiurus nebulosus*) samples, composite samples of sunfish (pumpkinseed [*Lepomis gibbosus*] and bluegill [*L. macrochirus*] combined), and composite samples of crayfish (*Orconectes* spp. and *Cambarus* spp.) were collected from each of the three main reaches of Eighteenmile Creek: (1) downstream (below) of Burt Dam; (2) between Newfane and Burt dams; and (3) upstream from Newfane Dam. Additionally, individual largemouth bass (*Micropterus salmoides*) samples were collected from the reach upstream from Newfane Dam. Numbers of samples per reach and sampling dates are listed in Table 2-1. This section describes deviations from sampling methods outlined in the final QAPP (E & E 2012a; see Appendix A); sampling locations and dates; sample collection methods; the number and composition of samples collected; and sample handling and shipping methods.

2.1.1 Sampling Deviations from the Final QAPP

There were three deviations from the sampling methods described in the final QAPP. These deviations include a change to the species collected, the number of samples collected, and the number of individuals that defined a sample. These deviations were made in the field when it was determined that is was going to be too difficult to collect the specified number of pumpkinseeds and crayfish within a reasonable timeframe. Also, the number of individuals needed per composite sample was modified because the actual size of the collected specimens was different than anticipated. These deviations from the QAPP methodology are discussed below.

First, it was determined that it would not be possible given budgetary and time constraints, to collect sufficient numbers of the sunfish species pumpkinseeds within the required size range to reach the target sample weight. Therefore, bluegills, an alternate sunfish species that was approved in the QAPP, were also included in the whole-body composite sunfish samples for each reach. The individuals were not sorted to species per sample; rather each sample was a random mix of each species within the appropriate length range. The specific makeup of each sunfish sample can be found in Appendix B. Additionally, as approved in the QAPP, crayfish used in the composite samples were not identified to species because of the difficulty identifying them in the field.

Table 2-1 Sample Numbers Collected for Each Species by Reach for Eighteenmile Creek Baseline

Description	Species Sampled	Sample Type	QAPP Target	Samples Collected	Date Sampled
Upstream of Newfane Dam	Brown Bullhead	Fillet	5	5	8-21-12
	Sunfish[a] Composite	Whole-body composite	5	5	8-21-12
	Largemouth Bass	Whole-body	5	5	8-21-12
	Crayfish	Whole-body composite	3	2	8-24-12
Between Burt and Newfane Dams	Brown Bullhead	Fillet	5	5	8-22-12
	Sunfish[a] Composite	Whole-body composite	5	5	8-22-12
	Largemouth Bass	Whole-body	0	0	Not Applicable
	Crayfish	Whole-body composite	3	3	8-24-12
Downstream of Burt Dam	Brown Bullhead	Fillet	5	5	8-20-12
	Sunfish[a] Composite	Whole-body composite	5	5	8-20-12
	Largemouth Bass	Whole-body	0	0	Not Applicable
	Crayfish	Whole-body composite	3	3	8-23-12
		Total	**44**	**43**	**8-20-12 to 8-24-12**

Note:
[a] Sunfish composite includes pumpkinseed and bluegill.

Second, only two crayfish composite samples were collected (as opposed to three identified in the QAPP) in the reach upstream from Newfane Dam because of the lack of adequate habitat and the low collection numbers of crayfish per sampling effort expended. Above the Newfane Dam impoundment area, much of the creek channel is slow water and contains either a bedrock bottom or rocky substrate that is embedded with fines, limiting the availability of suitable crayfish habitat.

Third, the QAPP indicated that each composite sample of sunfish and crayfish would target 10 individuals per sample. In the case of the sunfish composite samples, the samples all contained less than the 10 individuals targeted and ranged from six to nine individuals. The crayfish samples contained many more than the 10 individuals targeted, and the samples ranged from 25 to 55 individuals to meet the minimum sample weight. In the case of the sunfish samples, fewer individuals were used once the minimum sample weight criterion was met. In the case of the crayfish composite samples, many more individuals were needed to meet the sample weight requirements because the captured crayfish size was smaller than initially anticipated.

2.1.2 Sampling Locations and Dates

2.1.2.1 Downstream of Burt Dam

All fish collection in this reach took place on August 20, 2012, while crayfish collection took place on August 23, 2012. The approximate collection locations are shown in Figure 2-1. All but one of the individual bullhead samples were captured in the shallow, fast-flowing water located directly downstream of the old railroad trestle. The water in the area the bullhead were collected was approximately 1 to 2 feet deep and the bottom was almost entirely covered by American eelgrass (*Vallisneria americana*). One of the bullhead samples within this reach was collected in a small, shallow bay along the right descending bank approximately 0.6 miles downstream of the old railroad trestle. The area of this additional bullhead capture was also dominated by American eelgrass. Individual specimens used for the sunfish composite samples within this reach were collected along the vegetated edges of the main channel of the creek starting approximately 0.75 miles upstream of the mouth of the creek to just below the old railroad trestle at Fisherman's Park (see Figure 2-1). Individual specimens used for the crayfish composite samples within this reach were all captured in a riffle area which begins approximately 200 feet downstream of Burt Dam and continues downstream approximately 0.2 miles to just upstream of the old railroad trestle.

2.1.2.2 Between Newfane and Burt Dams

All fish collection in this reach took place on August 22, 2012, while crayfish collection took place on August 24, 2012. The approximate capture locations are shown in Figure 2-2. Individual specimens used for the sunfish composite samples within this reach were collected along the vegetated edges of the main and side channels of the creek starting approximately 250 feet upstream of the Ide Road Bridge to approximately 0.75 miles downstream of the Ide Road Bridge. All individual bullhead samples within this reach were captured within the shallow, fast-flowing water located directly downstream, and within approximately 300 feet, of the Ide Road Bridge. The habitat in this area was similar to that of the bullhead capture locations downstream of Burt Dam (i.e., 1 to 2 foot water depths with large patches of American eelgrass). All bullheads captured in this reach emerged directly from the beds of American eelgrass. Individual specimens used for the crayfish composite samples within this reach were all captured in the same section of the reach as the bullhead samples; however they were located closer to the shoreline in areas without submerged aquatic vegetation, approximately 0.5 to 1.5 feet deep.

2.1.2.3 Upstream of Newfane Dam

All fish collections in this reach took place on August 21, 2012, while all crayfish collections took place on August 24, 2012. The approximate capture locations are shown in Figure 2-3. Individual specimens used for the sunfish composite samples within this reach were collected along the vegetated edges of the main channel of the creek starting approximately 150 feet upstream of the Newfane Dam to approximately 0.7 miles upstream of the Newfane Dam. All individual bullheads were collected from shallow, fast-flowing water located approximately 0.6 miles to 0.7 miles upstream of the Newfane Dam. The area in which the bullheads were

found in this reach was again similar to the other two reaches (i.e., 1 to 2 feet deep water with extensive beds of American eelgrass). All bullheads captured in this reach emerged directly from the beds of American eelgrass. Individual largemouth bass collected in this reach were captured beginning approximately 0.6 miles upstream of Newfane Dam and continuing downstream to approximately 0.4 miles upstream of the dam within the main channel. The largemouth bass were typically captured near submerged woody debris. Crayfish within this reach were all captured in an area of rocky substrate beginning approximately 1.2 miles upstream of Newfane Dam (approximately at the old Condren Road Bridge) and continuing downstream to approximately one mile upstream of the Newfane Dam.

2.1.3 Sample Collection Methods

Fish Collection

All fish collections conducted during this effort were performed using a Smith-Root, Inc. (Smith-Root) Type VI-A electrofisher along with a Smith-Root "Catfish Zapper." E & E biologists used a 14 foot Jon boat with the Smith-Root, Type VI-A boat electrofisher with two boom arrays mounted to the bow section of the boat. The "catfish zapper" was also used, which is an additional sampling device designed to distribute a weak electrical field in the deeper waters or near a river/lake bottom to help facilitate the capture of bottom-dwelling fish, which are often difficult to capture with normal electrofishing techniques. In deeper water, an outboard motor was used to maneuver the boat to position the arrays over the target areas. In shallow areas, the butt ends of the dip nets were used to push the boat around with the outboard motor lifted out of the water.

A team of two E & E biologists operated the electrofishing boat at all times. One biologist was in the stern controlling the outboard motor and generator while the second was in the bow controlling the electrofisher. Most fish were collected by the biologist in the bow section using a dip net; however, the biologist in the stern section also had a dip net to collect any fish that were missed by the other biologist. To maximize the effectiveness of the electrofisher on small sunfish, the settings on the Type VI-A electrofisher were set to approximately 8 amps at 120 volts during the entire sampling period.

Collected fish were immediately placed into a cooler with ice. Once sampling was completed, all individual brown bullhead and largemouth bass samples were weighed to the nearest gram and the total length measured to the nearest millimeter and recorded. Sunfish for inclusion in composite samples were measured to the nearest millimeter for total length. For each sunfish composite sample, the number of individual fish in each composite sample, the length of the shortest and longest individual, and the total weight to the nearest gram were recorded on field datasheets. In some instances, because sample processing was conducted outdoors and the scale would flutter slightly due to the winds, the weights were recorded to the nearest 5 grams.

Figure 2-1. Biota Sampling Areas Downstream of Burt Dam, Eighteenmile Creek, Niagara County, NY.

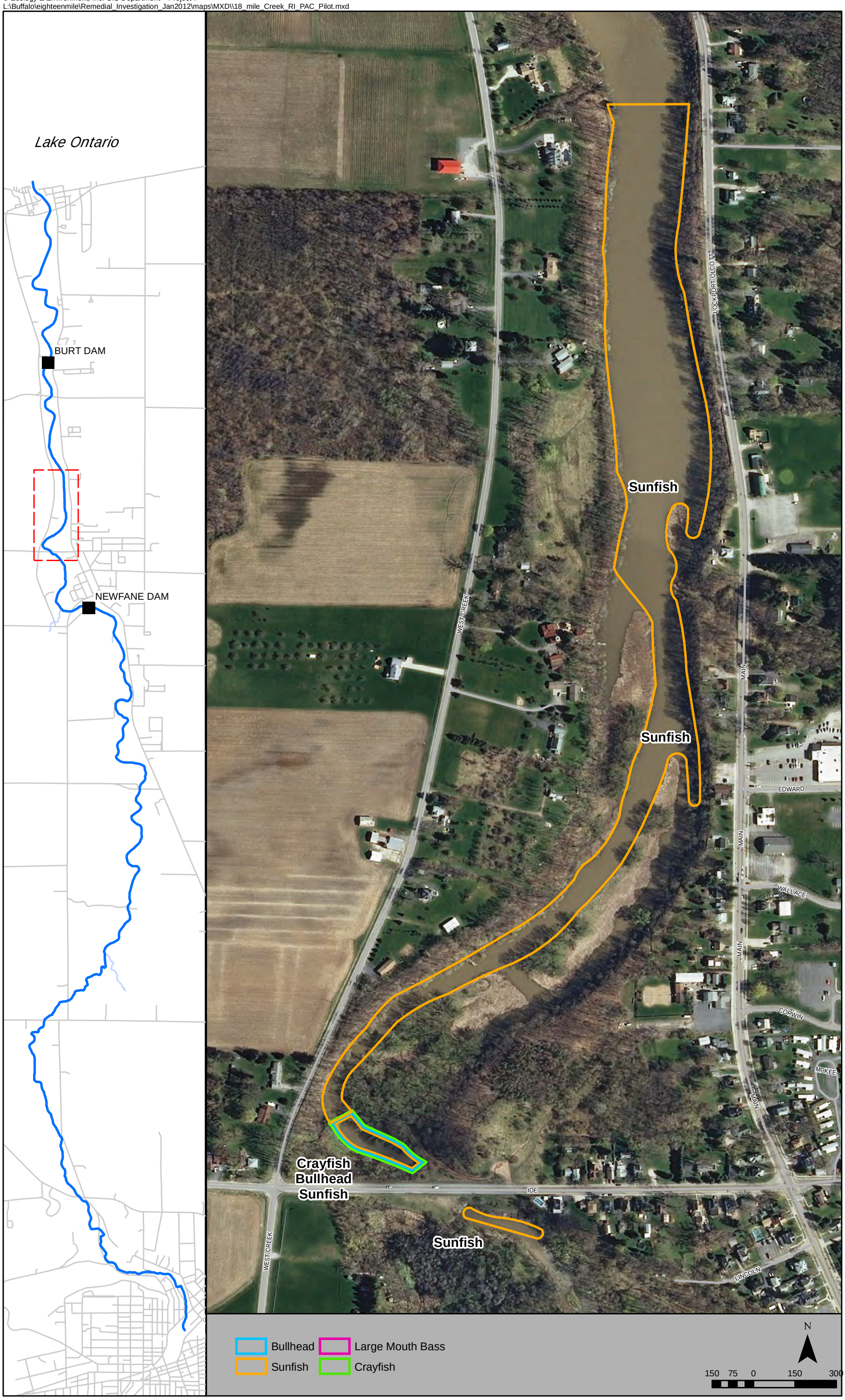

Figure 2-2. Biota Sampling Areas Between Newfane and Burt Dam, Eighteenmile Creek, Niagara County, NY.

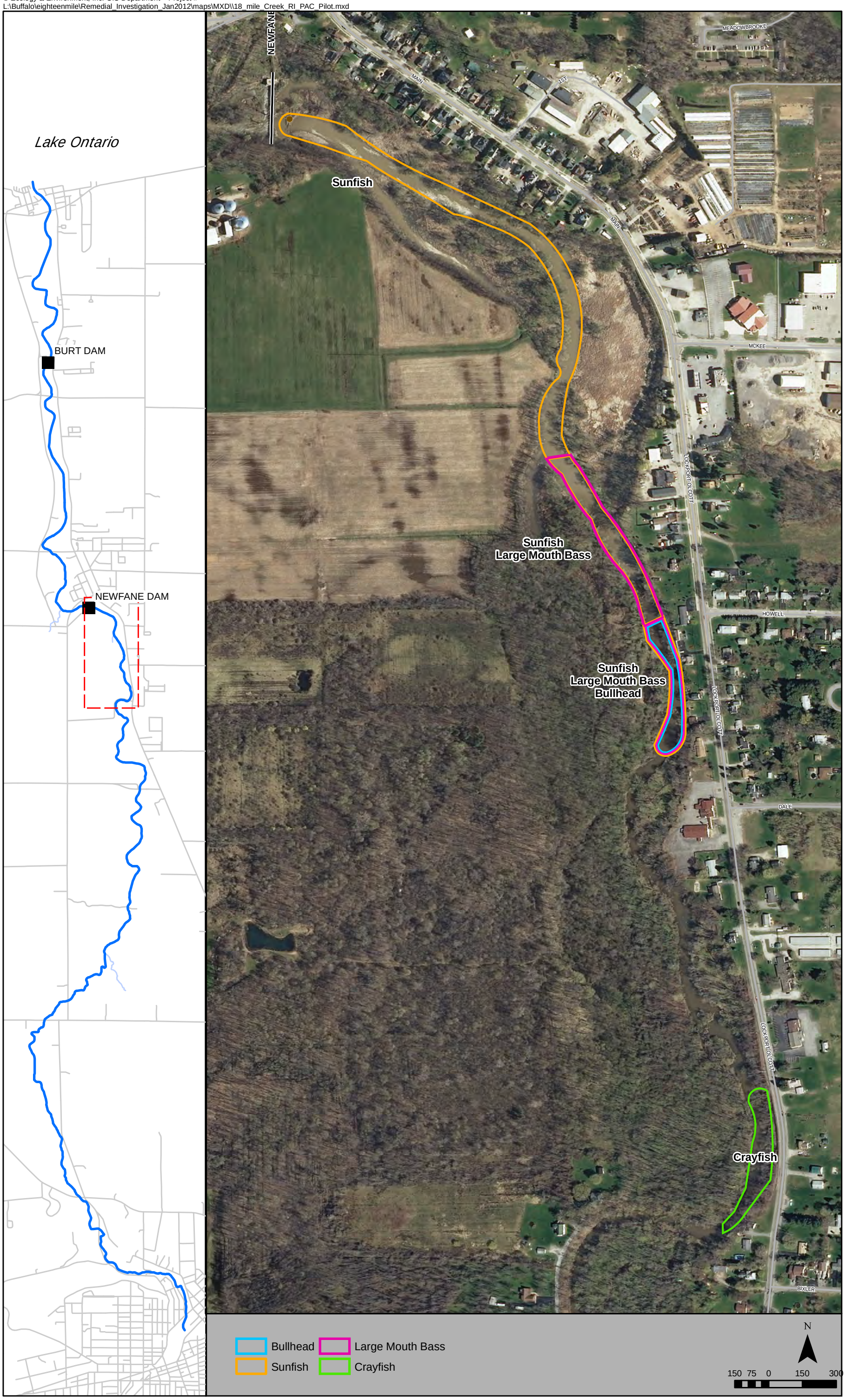

Figure 2-3. Biota Sampling Areas Upstream of Newfane Dam, Eighteenmile Creek, Niagara County, NY.

Crayfish Collection

On August 23, 2012, crayfish within the reach below Burt Dam were collected by hand. In some instances a net was also used. Within this reach, once the proper habitat was found, and where the conditions were most suitable for capture (e.g., not too deep for wading and hand collection), the crayfish were found in rather high abundance. On August 24, 2012, the remaining two reaches were sampled in a similar fashion. In the reach between Burt and Newfane Dams, crayfish were less abundant than in the reach below Burt dam, but were present in great enough numbers that the required sample mass could be collected in a reasonable time. Limited suitable habitat for crayfish was observed upstream of Newfane Dam. Much of the area consisted of exposed bedrock bottom, and the few areas with rocky substrate were often too embedded to provide quality habitat (e.g., it is difficult for crayfish to get underneath rocks that are embedded in sediments). As a result, only two crayfish composite samples could be collected from this reach.

Crayfish were measured to the nearest millimeter from the tip of the rostrum to the tip of the telson. Although that is not a standard length measurement for crayfish (typical is from tip of the rostrum to the posterior margin of carapace [standard length] or the posterior margin of ocular cavity to the posterior center margin of carapace [ocular length]), this measurement was used for ease of measurement in the field as well as grouping individuals of appropriate size classes into each sample. For each crayfish composite sample, the number of individual crayfish, the length of the shortest and longest individual, and the total weight to the nearest gram was recorded.

2.1.4 Summary of Samples Collected

Table 2-2 lists the fish and crayfish samples collected per reach and composition of each sample. Within each composite sample, the size of the smallest individual was no less than 75% of the size of the largest individual, as recommended by USEPA (2000). An attempt was made to keep all individuals across all samples in each reach, and across the different reaches, within this limit for purposes of comparability. All sunfish samples met this standard within each reach and were within 1% of this standard across reaches. The collected crayfish exhibited variable lengths. Consequently, although the standard was met for each composite sample, it was not met for different samples within the same reach or across reaches. Additional details regarding the samples collected for this study are provided in Appendix B.

Table 2-2 Summary of Samples by Reach for Eighteenmile Creek Baseline Fish Sampling Project

Reach	Species/Sample Number	Number of Individuals in Sample	Length or Length Range (mm)	Weight (g)
Upstream of Newfane Dam	Bullhead/1	1	266	255
	Bullhead/2	1	241	195
	Bullhead/3	1	246	195
	Bullhead/4	1	341	600

Table 2-2 Summary of Samples by Reach for Eighteenmile Creek Baseline Fish Sampling Project

Reach	Species/Sample Number	Number of Individuals in Sample	Length or Length Range (mm)	Weight (g)
	Bullhead/5	1	329	475
	Largemouth Bass/1	1	351	655
	Largemouth Bass/2	1	312	515
	Largemouth Bass/3	1	291	390
	Largemouth Bass/4	1	297	415
	Largemouth Bass/5	1	294	375
	Sunfish Composite/1	9	89 – 112	179
	Sunfish Composite/2	8	95 – 112	180
	Sunfish Composite/3	8	92 – 116	171
	Sunfish Composite/4	6	100 – 118	186
	Sunfish Composite/5	6	97 – 118	171
	Crayfish Composite/1	26	50 – 64	193
	Crayfish Composite/2	38	41 – 55	169
Between Newfane and Burt Dam	Bullhead/1	1	295	295
	Bullhead/2	1	353	615
	Bullhead/3	1	322	430
	Bullhead/4	1	314	387
	Bullhead/5	1	291	305
	Sunfish Composite/1	9	90 - 115	177
	Sunfish Composite/2	7	99 – 114	173
	Sunfish Composite/3	8	90 – 115	170
	Sunfish Composite/4	9	90 – 116	182
	Sunfish Composite/5	6	99 – 118	185
	Crayfish Composite/1	24	54 – 72	175
	Crayfish Composite/2	38	48 – 55	173
	Crayfish Composite/3	50	39 - 52	162
Downstream of Burt Dam	Bullhead/1	1	313	350
	Bullhead/2	1	333	510
	Bullhead/3	1	360	630
	Bullhead/4	1	361	700
	Bullhead/5	1	368	560
	Sunfish Composite/1	6	103 – 112	175
	Sunfish Composite/2	6	100 – 112	165
	Sunfish Composite/3	8	87 - 110	185
	Sunfish Composite/4	7	98 - 108	170
	Sunfish Composite/5	8	91 -103	170
	Crayfish Composite/1	25	56 – 74	210
	Crayfish Composite/2	34	51 – 60	201
	Crayfish Composite/3	55	43 - 55	202

2.1.5 Sample Handling and Shipping

Fish Collection

All collected fish were immediately placed on ice in a cooler in order to quickly chill the fish to below 4 degrees Celsius (°C). Once sampling was finished for the day, each sample was measured and documented as outlined in Section 2.1.3. Individual fish and the sunfish composite samples were double-wrapped in aluminum foil and then placed inside a large freezer bag. Each evening, the processed fish samples were taken to an off-site location where they were frozen and held for shipment. On August 23, 2012, all fish samples were shipped on dry ice to ALS Environmental, Kelso, Washington (ALS-Kelso).

Crayfish Collection

All crayfish that were captured were kept alive in a 5-gallon bucket of creek water until they could be processed. Once sampling was finished for the day, individuals were measured and sorted for each composite sample. The crayfish were measured and documented as outlined in Section 2.1.3. Each crayfish composite sample was double-wrapped in aluminum foil and then placed inside a large freezer bag. The processed crayfish composite samples were taken to an off-site location each evening where they were frozen and held for shipment. On August 27, 2012, all crayfish samples were shipped on dry ice to ALS-Kelso.

2.2 Laboratory Methodology

2.2.1 Sample Processing

Sunfish whole-body composite samples, crayfish whole-body composite samples, and largemouth bass whole-body samples were individually homogenized at ALS-Kelso using stainless-steel grinding equipment. Also at ALS-Kelso, a skin-off fillet was taken from each bullhead samples following NYSDEC (2008) guidance and homogenized using stainless-steel grinding equipment.

2.2.2 Sample Analysis

The fish and crayfish samples collected for this study were analyzed for PCB Aroclors and congeners using USEPA Method 8082, lipids (solvent-extraction method), and percent moisture (gravimetric method). Details are provided in the final QAPP (E & E 2012a). PCB congeners reported were based on the USEPA Method 8082 list. The laboratory provided divided the samples into sample delivery groups (SDGs) and provided electronic data deliverables (EDDs) and full data packages as PDF files.

E & E processed EDDs and laboratory reports to verify the data reported were compliant with the QAPP requirements. E & E checked the reports and case narratives and reviewed sample receipt, chain-of-custody and traffic report records; holding times; percent moisture; field and laboratory quality control (QC) sample frequencies; initial and continuing instrument calibration and performance check information; case narratives and QC summaries; field and laboratory QC sample results; detection and reporting limits; dilutions; other method-specific criteria; and whether target compounds were reported. E & E prepared data usability

summary reports (DUSRs) for each set of samples. E & E developed a project-specific database stored in Equis® format.

Appendix C includes field observations, Appendix D includes the laboratory EDD, and Appendix E includes the laboratory data report with quality assurance (QA)/QC results (electronically only). The DUSR is included in Appendix F.

Overall, the data quality was acceptable and the laboratory analysis and reporting procedures were representative of appropriate methodology for tissue samples.

2.3 Data Analysis

Results for PCBs, Aroclors, and individual congeners were summed to report total PCBs using both zero assigned to non-detect values and one-half the detection limit assigned to non-detect values. The results were converted to mg/kg wet weight by dividing by 1,000 and mg/kg of lipid by dividing by the lipid concentration (kg of lipids/kg wet weight). PCBs total were used to calculated summary statistics. Final results were reported to two significant figures for total PCBs, but summary statistics were calculated using unrounded values. The Mann-Whitney U-test was used to determine if concentrations differed by reach for a given species. Sample results also were compared with a PCB tissue screening concentration of 0.44 mg/kg wet weight (Dyer et al. 2000). This concentration is identified in delisting criteria for BUI No. 3 (see Table 1-1) and represents the Aroclor concentration in fish tissue below which no adverse effects to fish are expected from PCBs.

3 Results and Discussion

The analytical data indicate that PCBs continue to be present at elevated levels in fish in Eighteenmile Creek. In this report, PCB data are presented on a wet weight basis and lipid-normalized basis for both total Aroclors and congeners (see Tables 3-1 through 3-4). These data illustrate several trends in relation to the species which have the highest concentration of PCBs, as well as spatial differences among reaches.

3.1 Analytical Results for Total Aroclors and Congeners (Wet Weight Basis)

For total Aroclors expressed on a wet weight basis, bullhead fillets had the highest concentrations in all three reaches (see Table 3-1). However, the concentrations in bullhead fillets between reaches were not significantly different. Largemouth bass had the second highest average concentration, followed by crayfish and sunfish (*Lepomis sp.*). Sunfish had the lowest concentrations, as would be expected given that the juvenile sunfish collected for this investigation feed at a low trophic level and have little direct contact with contaminated sediments.

As footnoted on Table 3-1, total Aroclor levels in sunfish upstream of Newfane Dam were significantly greater than in sunfish from other creek reaches. Likewise, total Aroclor concentrations in crayfish upstream of Newfane Dam were significantly greater than in crayfish from other creek reaches. These results are not surprising given that sediment PCB levels in Eighteenmile Creek are greater upstream of Newfane Dam compared with downstream creek reaches (E & E 2012b).

For total congeners (USEPA Method 8082 list), similar species-specific trends were observed (see Table 3-2). Bullhead fillet samples contained the greatest average total congener concentration in all three reaches. Sunfish continued to have the lowest concentrations compared with the other species sampled, as would be expected for the reasons given above. As footnoted on Table 3-2, the total congener concentration in sunfish and crayfish collected upstream of Newfane Dam were significantly greater than in sunfish and crayfish from one or both downstream creek reaches. Again, these results are not surprising for the reason given above.

Table 3-1 Sum of Aroclors in Bullhead Fillets, Sunfish Whole-Body Composite Samples, Crayfish Whole-Body Composite Samples, and Largemouth Bass Whole-Body Samples Collected from Eighteenmile Creek, August 2012

Sample Type	Creek Segment	n	Sum of Aroclors (mg/kg wet wt.)					
			NDs = 0[a]			NDs = 0.5DL[b]		
			Minimum	Maximum	Average	Minimum	Maximum	Average
Bullhead (skin-off) Fillet	Upstream of Newfane Dam	5	0.69	5.4	2.8	0.70	5.5	2.9
	Between Dams	5	1.74	4	2.5	1.8	4.1	2.6
	Downstream of Burt Dam	5	0.94	3.8	2.0	0.95	3.8	2.0
Sunfish Whole-Body Composite	Upstream of Newfane Dam	5	0.59	0.79	0.69[c]	0.60	0.8	0.69[d]
	Between Dams	5	0.25	0.35	0.3	0.44	0.73	0.62[d]
	Downstream of Burt Dam	5	0.25	0.58	0.43	0.25	0.59	0.43
Crayfish Whole-Body Composite	Upstream of Newfane Dam	2	0.76	1.1	0.93[e]	1.4	2.2	1.8[e]
	Between Dams	3	0.48	0.51	0.5	0.71	0.77	0.75
	Downstream of Burt Dam	3	0.35	0.71	0.47	0.83	1.3	0.97
Largemouth Bass Whole-Body	Upstream of Newfane Dam	5	0.6	2.1	1.25	0.76	2.2	1.4
	Between Dams	0	--	--	--	--	--	--
	Downstream of Burt Dam	0	--	--	--	--	--	--

Notes:

[a] Results for non-detected Aroclors set equal to 0.

[b] Results for non-detected Aroclors set equal to 0.5 times method detection limit.

[c] Greater than sum of Aroclors in sunfish samples from both other creek segments ($p < 0.05$; Mann-Whitney U test).

[d] Greater than sum of Aroclors in sunfish samples from downstream Burt Dam ($p < 0.05$; Mann-Whitney U-test)

[e] Greater than sum of Aroclors in crayfish samples from both other creek segments ($p < 0.1$; Mann-Whitney U test).

Key:

DL = detection limit
n = number of samples
ND = non detect

Table 3-2 Sum of Congeners (USEPA Method 8082 List) in Bullhead Fillets, Sunfish Whole-Body Composite Samples, Crayfish Whole-Body Composite Samples, and Largemouth Bass Whole-Body Samples Collected from Eighteenmile Creek, August 2012

Sample Type	Creek Segment	n	Sum of Congeners (mg/kg wet wt.)					
			NDs = 0[a]			NDs = 0.5DL[b]		
			Minimum	Maximum	Average	Minimum	Maximum	Average
Bullhead (skin-off) Fillet	Upstream of Newfane Dam	5	0.15	0.79	0.4	0.16	0.79	0.45
	Between Dams	5	0.33	0.81	0.5	0.33	0.81	0.5
	Downstream of Burt Dam	5	0.19	0.63	0.4	0.2	0.66	0.38
Sunfish Whole-Body Composite	Upstream of Newfane Dam	5	0.14	0.20	0.18[c]	0.15	0.21	0.18[c]
	Between Dams	5	0.11	0.17	0.13	0.11	0.18	0.14
	Downstream of Burt Dam	5	0.05	0.14	0.1	0.06	0.15	0.11
Crayfish Whole-Body Composite	Upstream of Newfane Dam	2	0.25	0.42	0.34[d]	0.25	0.42	0.34[d]
	Between Dams	3	0.19	0.20	0.19	0.19	0.2	0.19
	Downstream of Burt Dam	3	0.17	0.25	0.21	0.17	0.25	0.21
Largemouth Bass Whole-Body	Upstream of Newfane Dam	5	0.19	0.49	0.34	0.19	0.49	0.34
	Between Dams	0	--	--	--	--	--	--
	Downstream of Burt Dam	0	--	--	--	--	--	--

Notes:
[a] Results for non-detected congeners set equal to 0.
[b] Results for non-detected congeners set equal to 0.5 times method detection limit.
[c] Greater than sum of congeners in sunfish samples from downstream of Burt Dam ($p < 0.05$; Mann-Whitney U test) and Between Dams ($p < 0.1$; Mann-Whitney U-test).
[d] Greater than sum of congeners in crayfish samples from Between Dams ($p < 0.1$; Mann-Whitney U-test).

Key:
DL = detection limit
n = number of samples
ND = non detect

Table 3-3 Sum of Aroclors (Lipid-Normalized) in Bullhead Fillets, Sunfish Whole-Body Composite Samples, Crayfish Whole-Body Composite Samples, and Largemouth Bass Whole-Body Samples Collected from Eighteenmile Creek, August 2012

			Sum of Aroclors (mg/kg lipid)					
			NDs = 0[a]			NDs = 0.5DL[b]		
Sample Type	Creek Segment	n	Minimum	Maximum	Average	Minimum	Maximum	Average
Bullhead (skin-off) Fillet	Upstream of Newfane Dam	5	58	500	247	58	506	250
	Between Dams	5	137	338	209[c]	141	349	215[d]
	Downstream of Burt Dam	5	126	158	141	128	160	142
Sunfish Whole-Body Composite	Upstream of Newfane Dam	5	151	214	185[e]	153	215	186[e]
	Between Dams	5	61	108	84[f]	133	205	169[e]
	Downstream of Burt Dam	5	54	85	67	56	86	68
Crayfish Whole-Body Composite	Upstream of Newfane Dam	2	69	79	74[g]	124	154	139[g]
	Between Dams	3	81	84	82[h]	122	125	124[h]
	Downstream of Burt Dam	3	29	59	41	69	105	85
Largemouth Bass Whole-Body	Upstream of Newfane Dam	5	221	404	330	223	464	382
	Between Dams	0	--	--	--	--	--	--
	Downstream of Burt Dam	0	--	--	--	--	--	--

Notes:

[a] Results for non-detected Aroclors set equal to 0.

[b] Results for non-detected Aroclors set equal to 0.5 times method detection limit.

[c] Greater than sum of Aroclors in bullhead fillet samples from downstream of Burt Dam ($p < 0.1$; Mann-Whitney U-test).

[d] Greater than sum of Aroclors in bullhead fillet samples from downstream of Burt Dam ($p < 0.05$; Mann-Whitney U-test

[e] Greater than sum of Aroclors in sunfish samples from between Newfane and Burt Dam and downstream of Burt Dam ($p < 0.01$; Mann-Whitney U test).

[f] Greater than sum of Aroclors in sunfish samples from downstream of Burt Dam ($p < 0.1$; Mann-Whitney U-test).

[g] Greater than sum of Aroclors in crayfish samples from downstream of Burt Dam ($p < 0.05$; Mann-Whitney U-test).

[h] Greater than sum of Aroclors in crayfish samples from downstream of Burt Dam ($p < 0.1$; Mann-Whitney U-test).

Key: DL = detection limit; n =number of samples; ND = non-detect.

Table 3-4 Sum of Congeners (USEPA Method 8082 List, lipid-normalized) in Bullhead Fillets, Sunfish Whole-Body Composite Samples, Crayfish Whole-Body Composite Samples, and Largemouth Bass Whole-Body Samples Collected from Eighteenmile Creek, August 2012

Sample Type	Creek Segment	n	Sum of Congeners (mg/kg lipid)					
			NDs = 0[a]			NDs = 0.5DL[b]		
			Minimum	Maximum	Average	Minimum	Maximum	Average
Bullhead (skin-off) Fillet	Upstream of Newfane Dam	5	13	75	39	14	76	39
	Between Dams	5	27	60	40	27	63	41
	Downstream of Burt Dam	5	18	34	28	19	36	29
Sunfish Whole-Body Composite	Upstream of Newfane Dam	5	40	54	47[c]	42	56	49[c]
	Between Dams	5	32	42	36[d]	34	45	38[d]
	Downstream of Burt Dam	5	13	20	16	15	21	17
Crayfish Whole-Body Compo-site	Upstream of Newfane Dam	2	23	31	27[e]	23	30	27[e]
	Between Dams	3	31	32	32[e]	31	32	32[e]
	Downstream of Burt Dam	3	16	21	18	16	21	18
Largemouth Bass Whole-Body	Upstream of Newfane Dam	5	55	132	95	57	134	96
	Between Dams	0	--	--	--	--	--	--
	Downstream of Burt Dam	0	--	--	--	--	--	--

Notes:
[a] Results for non-detected congeners set equal to 0.
[b] Results for non-detected congeners set equal to 0.5 times method detection limit.
[c] Greater than sum of congeners in sunfish samples from both other creek segments ($p < 0.05$; Mann-Whitney U test).
[d] Greater than sum of congeners in sunfish samples from downstream of Burt Dam ($p < 0.05$; Mann-Whitney U-test).
[e] Greater than sum of congeners in crayfish samples from downstream of Burt Dam ($p < 0.1$; Mann-Whitney U-test).

Key:
DL = detection limit
n = number of samples
ND = non detect

Figures 3-1 to 3-3 present box-whisker plots for total Aroclors in bullhead fillets, sunfish whole-body composite samples, and crayfish. In these figures, non-detected Aroclors were set equal to zero. The figures also show the critical tissue concentration for Aroclors for effects on fish (0.44 mg/kg wet weight) from Table 1-1 (BUI No. 3).

Brown Bullhead Fillets

The sum of Aroclors in all reaches exceeded the critical tissue concentration (see Figure 3-1). The average concentration for all reaches combined (2.4 mg/kg wet weight) was more than five times greater than the critical concentration. Above Newfane Dam, the average and maximum concentrations were more than six and 12 times greater, respectively, than the critical concentration. The minimum concentration (0.69 mg/kg wet weight) in the reach above Newfane Dam was still above the critical concentration.

Sunfish Whole-Body Composite Samples

The reach above the Newfane Dam contained the highest Aroclor concentrations, but the maximum concentration (0.79 mg/kg wet weight) was only about a factor of two higher than the critical value (see Figure 3-2). For the reach between Burt and Newfane dams, the concentration in all samples was below the critical value. Downstream from Burt Dam, the average concentration was less than the critical value, but the maximum (0.58 mg/kg wet weight) was slightly greater.

Crayfish Whole-Body Composite Samples

The reach above the Newfane Dam contained the highest Aroclor concentrations and the maximum concentration (1.1 mg/kg wet weight) was 2.5 times higher than the critical value (see Figure 3-3). All samples collected between Newfane and Burt dams exceeded the critical value, but only slightly. The Aroclor concentrations in one of three crayfish samples from below Burt Dam exceeded the critical value.

Largemouth Bass Whole-Body Samples

Aroclor levels on largemouth bass collected above Newfane Dam were all above the critical value, with the maximum concentration being about five times greater and the average concentration being about three times greater (see Table 3-1). The minimum Aroclor concentration (0.6 mg/kg wet weight) exceeded the critical value by about 30%.

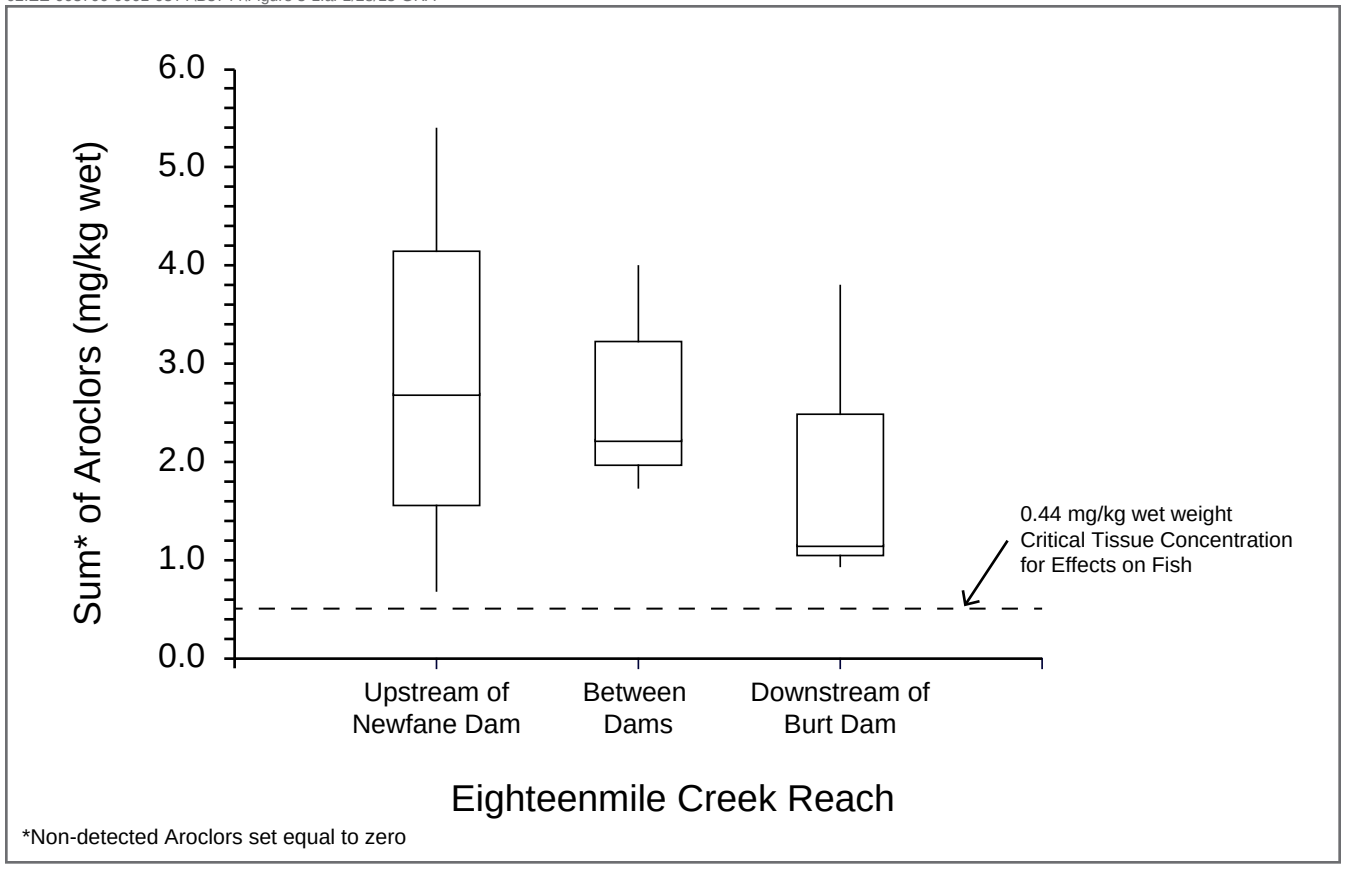

Figure 3-1 Box-Whisker Plots for Brown Bullhead Skinless Fillets by Reach (August 2012)

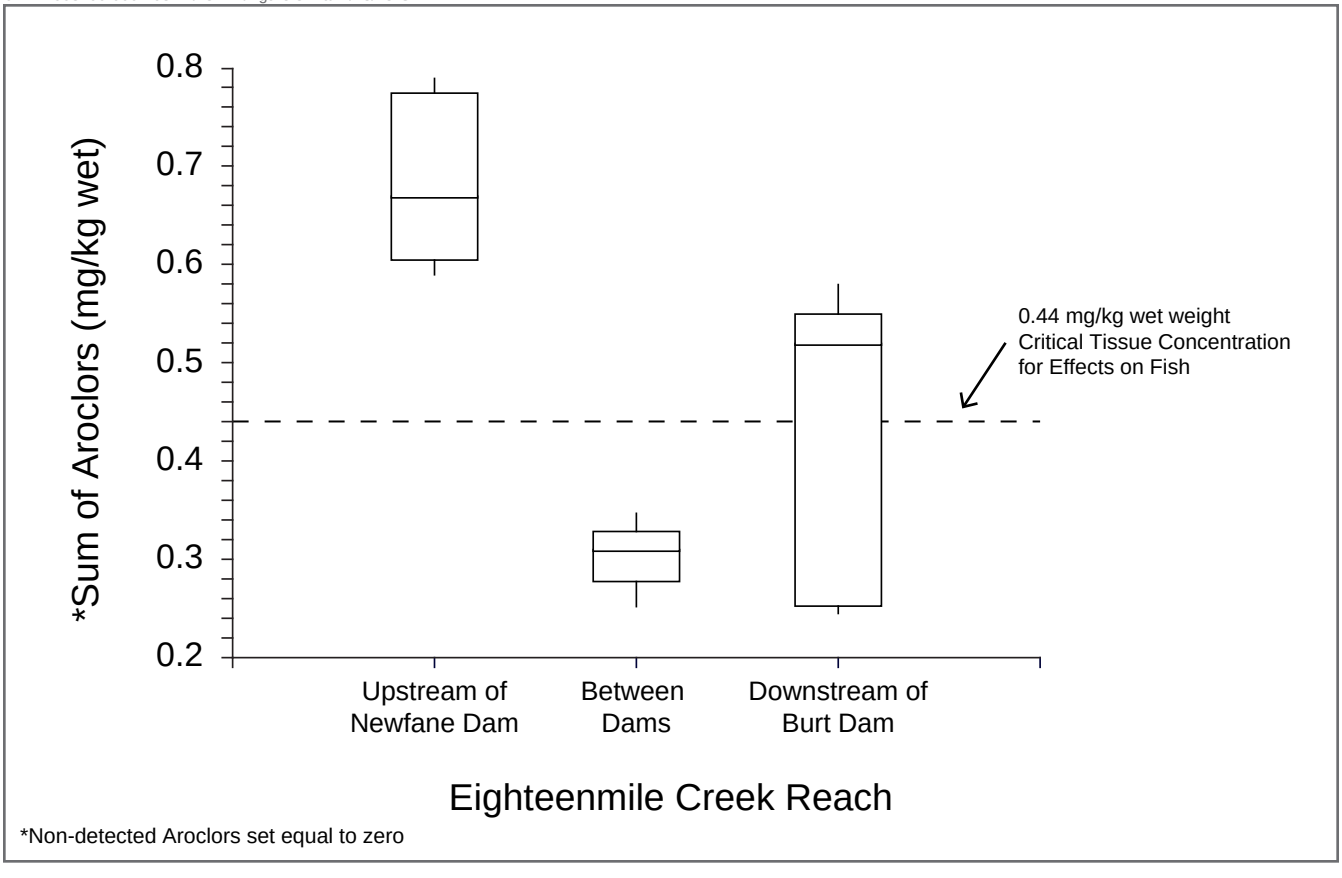

Figure 3-2 Box-Whisker Plots for Sunfish Whole-Body Composite Samples by Reach (August 2012)

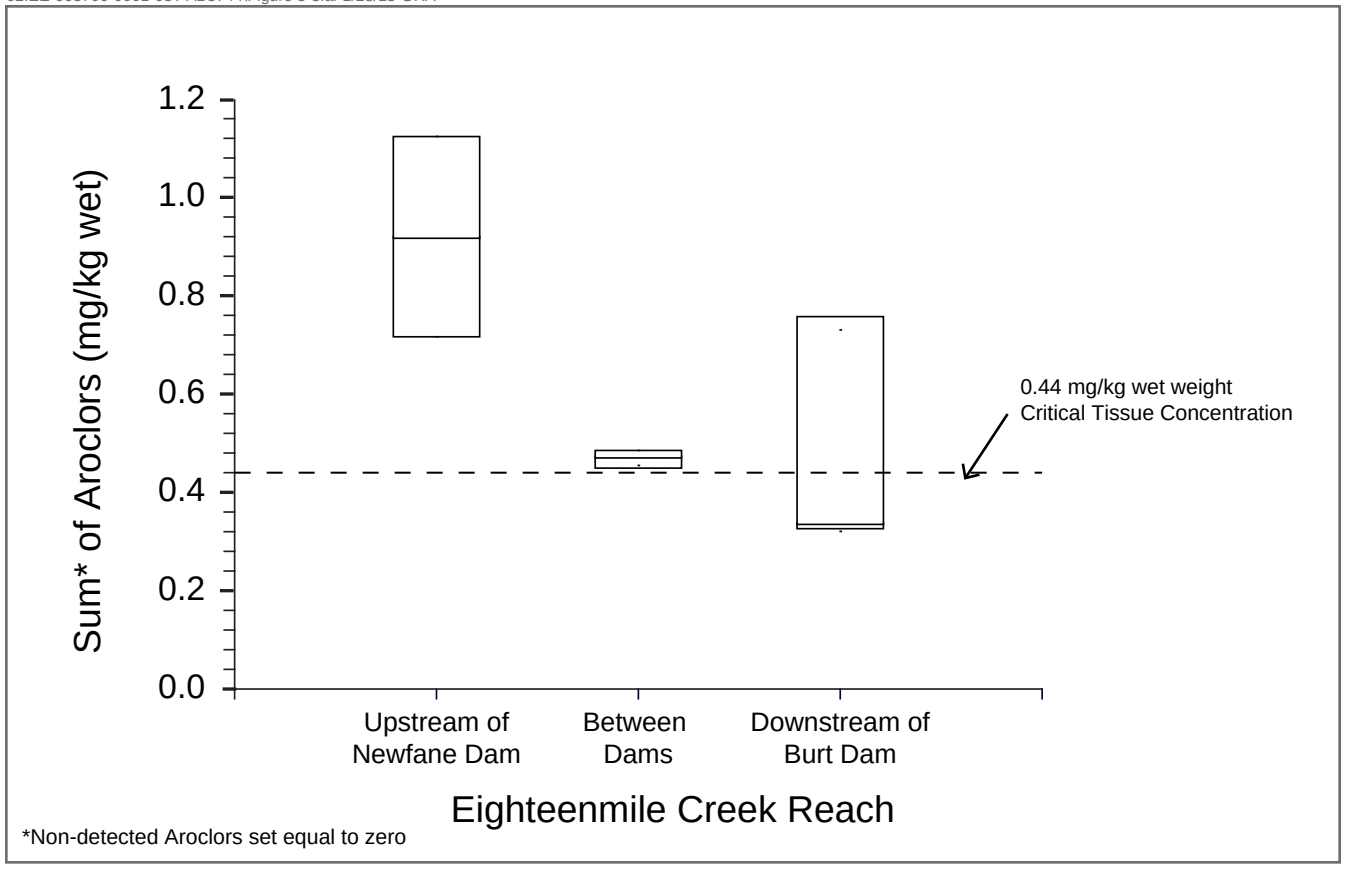

Figure 3-3 Box-Whisker Plots for Crayfish Whole-Body Composite Samples by Reach (August 2012)

3.2 Analytical Results for Aroclors and Congeners Normalized to Lipid Content

PCB results often are normalized to lipid content because PCBs accumulate in fatty tissues. This approach removes a principal source of variability in wet-weight PCB results—the organism lipid content—thereby simplifying comparisons between fish with different lipid concentrations.

Average lipid-normalized Aroclor concentrations typically were greatest in largemouth bass whole-body samples, followed by bullhead fillet samples, sunfish whole-body composite samples, and crayfish whole-body composite samples (see Table 3-3). For the bullhead, sunfish, and crayfish samples, the greatest concentrations typically were found upstream of Newfane Dam and the lowest concentrations were found downstream of Burt Dam. This is the same spatial trend observed for Aroclors on a wet weigh basis and, as mentioned above, mirrors the pattern of Aroclor contamination in sediment in Eighteenmile Creek. Significant differences between reaches for a given sample type are footnoted in Table 3-3.

Regarding lipid-normalized total congener concentrations, the greatest concentrations were observed in largemouth bass and the lowest concentrations were observed in crayfish (see Table 3-4). Lipid-normalized congener concentration in bullhead fillets and sunfish whole-body composite samples were similar and generally intermediate between the levels observed in largemouth bass and crayfish. For sunfish, the greatest lipid-normalized total congener concentrations were observed upstream of Newfane Dam and lowest concentrations occurred below Burt Dam. For crayfish, the concentrations upstream of Newfane Dam and between Newfane and Burt dams were similar and greater than the concentrations downstream of Burt Dam. Significant differences between reaches for sunfish and crayfish are footnoted in Table 3-4. There was no significant difference in lipid-normalized congener concentration in bullhead fillet samples among reaches.

3.3 Comparisons with Recent Historical Datasets

As summarized in NCSWCD (2008), fish from Eighteenmile Creek have been analyzed for PCBs since the late 1980s. In 1992, brown bullhead and largemouth bass were sampled both above and below Burt Dam, and in 2007, a total of eight bullhead whole-body samples from below Burt Dam were sampled for PCBs (total Aroclors) (NCSWCD 2008). In 2010, the USACE engaged in a bioaccumulation modeling and ecological risk assessment exercise for the Eighteenmile Creek AOC (von Stackelberg and Gustavson 2012). To assist in the modeling effort, brown bullhead, largemouth bass, and composite sunfish (pumpkinseed and bluegills) samples were collected from both above and below Burt Dam and analyzed for PCBs. Results for the model were reported as total PCBs based on the sum of congeners (mg/kg wet weight). The sums were based on analysis for all 209 PCB congeners. The tissue samples also were analyzed for USEPA Method 8082 Aroclors and the raw data was provided to the NCSWCD as the sponsor. Because the PCB congener's analysis was a significantly different list, the USEPA Method 8082 PCB Aroclors were used for comparison.

Table 3-5 presents a comparison of brown bullhead data collected during this investigation with earlier studies. The average concentration of PCBs in 2012 was lower than those resulting from the 2007 and 2010 sampling efforts, but similar to the 1992 data. The 2012 data are comparable to the 2007 and 2010 data in the expected range of PCB concentrations, but the 2007 and 2010 samples exceeded the maximum reported concentration from 2012. However, the 2007 and 2010 data were based on a whole body analysis, compared to the skinless fillet analysis in 2012, which may have led to slightly higher concentrations in larger, more fat-laden fish. Indeed, the average percent lipids in the 2012 bullhead fillet samples (1.3%) was more than two times less than the average percent lipids in the 2010 bullhead whole-body samples (3.1%). Therefore, the results from lipid normalized concentrations also were compared in Table 3-5. The lipid normalized results show smaller differences in the concentrations between data sets.

Table 3-6 presents a summary of data collected in 2010 compared to the 2012 data for sunfish composites and largemouth bass whole-body samples. The sunfish samples in both years were based on whole-body composites and samples consisted of similar size ranges (all of 2010 samples were less than 4 inches in length, and 2012 samples were all less than 4.5 inches in length). The results for the 2012 samples are much lower than the results from 2010 for comparable samples. The sample preparation procedures between the studies were different and, therefore, the results may be different. The 2010 study used a more aggressive sample preparation method and no gel penetration chromatography (GPC) clean-up, which may be why these results were higher. To help assess that, the results from lipid normalized concentrations are compared in Table 3-6. The lipid normalized results show smaller differences in the concentrations between datasets. However, additional statistical analysis outside the scope of this report would be needed to determine if the datasets can be used together. Finally, it is noteworthy that the average percent lipids in the 2012 sunfish (0.45%) and largemouth bass (0.36%) samples was considerably less than the average percent lipids in the 2010 sunfish (2.4 %) and largemouth bass (2.9%) samples. Lower lipid levels in 2012 compared with 2010 likely are in part responsible for the lower PCB levels observed in 2012 compared with 2010.

Table 3-5 Comparison of Brown Bullhead PCB Concentrations as Sum of Aroclors (ND= 0.5 DL)

Species	1992 Data (N = 11)[1]	2007 Data (N = 8)[2]	USACE 2010 Bioaccumulation Model Study[2]	Current Study (N = 5)[1]
Brown Bullhead (mg/kg wet weight)				
Upstream of Newfane Dam	NA	NA	NA	2.9 (0.70 – 5)
Between Dams			4.9 (2 – 10)	2.6 (1.8 - 4.1)
Downstream of Burt Dam	1.5	3.2 (0.9 - 6.1)	3.4 (1.3 to 4.9)	2.0 (0.9 - 3.8)

Table 3-5 Comparison of Brown Bullhead PCB Concentrations as Sum of Aroclors (ND= 0.5 DL)

Species	1992 Data (N = 11)[1]	2007 Data (N = 8)[2]	USACE 2010 Bioaccumulation Model Study[2]	Current Study (N = 5)[1]
Brown Bullhead (mg/kg lipid)				
Upstream of Newfane Dam	NA	NA	NA	250 (58 – 506)
Between Dams			160 (42 – 237)	215 (141 - 349)
Downstream of Burt Dam	NA	96 (69 – 140)	133 (65 -309)	142 (51 - 160)

Notes:
[1] Skin-off fillet samples
[2] Whole body samples

Key:
NA = Not available

Table 3-6 Comparison of Fish Tissue Data from the USACE 2010 Bioaccumulation Study and the Current Study Data as Sum of Aroclors (ND = 0.5 DL)

Sample Location	USACE 2010 Bioaccumulation Model Study	Current Study
Sunfish Whole-Body Composite (mg/kg wet weight)		
Upstream of Newfane Dam	NA	0.69 (0.6 – 0.8)
Between Dams	5.5 (2.2 – 10)	0.62 (0.44- 0.73)
Downstream of Burt Dam	4.2 (1.7 - 5.9)	0.43 (0.25- 0.59)
Largemouth Bass Whole-Body (mg/kg wet weight)		
Upstream of Newfane Dam	NA	1.4 (0.76 – 2.2)
Between Dams	16 (2.8 – 45)	NA
Downstream of Burt Dam	4.6 (0.55 – 11)	NA
Sunfish Whole-Body Composite (mg/kg lipid)		
Upstream of Newfane Dam	NA	186 (153 -215)
Between Dams	343 (108 – 602)	169 (133 – 205)
Downstream of Burt Dam	138 (57 – 225)	68 (56 – 86)
Largemouth Bass Whole-Body(mg/kg lipid)		
Upstream of Newfane Dam	NA	382 (223 – 464)
Between Dams	606 (55- 1200)	NA
Downstream of Burt Dam	208 (11- 758)	NA

Notes:
[1] Whole body sample.
[2] Skin-off fillet sample.

Key:
NA = Not available

4 Conclusions

Beneficial uses affected by elevated levels of PCBs in fish continue to be impaired at Eighteenmile Creek. Total Aroclor concentrations (mg/kg wet weight) in brown bullhead throughout the creek were greater than the critical tissue concentration for effects on fish (0.44 mg/kg wet weight). Total Aroclor concentrations in largemouth bass, sunfish, and crayfish upstream of Newfane Dam also exceeded the critical tissue concentration. In sunfish and crayfish, total Aroclor and congener concentration upstream of Newfane Dam were significantly greater than concentrations in one or both downstream reaches (between Newfane and Burt dams and downstream of Burt Dam) sampled for this study. The spatial pattern of contamination in sunfish and crayfish is not surprising given that sediment PCB levels in Eighteenmile Creek are greater upstream of Newfane Dam compared with downstream reaches (E & E 2012b). The fish tissue results obtained through this study are the first for a portion of Eighteenmile Creek upstream of Newfane Dam and indicate impacts to fish throughout the creek. Fish tissue analyses should continue in Eighteenmile Creek in conjunction with future remedial activities.

5 References

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A Final QAPP

See attached CD.

B Final Data Sheets

See attached CD.

C Field Observations

See attached CD.

D Complete Analytical Data

See attached CD.

E

Laboratory Data Report with QA/QC Results (ALS-Kelso)

See attached CD.

F

Data Usability Summary Report (DUSR)

See attached CD.