

EIGHTEENMILE CREEK REMEDIAL ACTION PLAN COORDINATION

SEMI-ANNUAL PROGRESS REPORT

01/01/2012

Project No. GL 972925-07-1

ACCOMPLISHMENTS TO DATE

On January 1, 2007, the Niagara County Soil and Water Conservation District (NCSWCD) began its five year commitment to continue with the coordination and management of the Eighteenmile Creek Remedial Action Plan. Much work has been accomplished during this reporting quarter. The following list of deliverables reflects project direction and activities completed between 8/1/2011 and 12/31/2011.

- Submission of EPA Form 5700-52 A, "MBE/WBE UTILIZATION UNDER FEDERAL GRANTS, COOPERATIVE AGREEMENTS, AND INTERAGENCY AGREEMENTS" to EPA Region 2 prior to October 31, 2011.
- The Great Lakes Legacy Act investigation project is still ongoing for Eighteenmile Creek. A Data Summary Report was completed in March 2011. A Remedial Investigation (RI) Report was anticipated to be completed by 12/31/2011 but the complexity of the project in addition to the amount of data required to be reviewed, has pushed the finalization of the report back a few months. It is envisioned that a final RI document will be available for review sometime in March 2012.

As the Legacy Act project will cease after the completion of the RI document and with no Legacy Act remediation anticipated in the future, planning efforts have been redirected to coordinate with the Region 2 Superfund staff. The PI has been working with NYSDEC and a USEPA Superfund contractor to provide information to support the development of a Hazard Ranking document for Eighteenmile Creek. Considerable effort has been spent to assure that all pathways of contamination to Eighteenmile Creek have been identified so that the document is as comprehensive as it can be. In addition, the PI has been refocusing his efforts to assure that the Federal Superfund Program and any future remediation is consistent with the goals and objectives of the Remedial Action Plan to address Beneficial Use Impairments.

The PI has provided a formal comment to USEPA in support of listing Eighteenmile Creek to the National Priorities List (NPL). This comment is included as Appendix A.

- During the month of August 2011, the PI coordinated with USEPA Region 2 and USGS to assist the installation of a USGS Streamgage on Eighteenmile Creek. The new gage is called USGS 04219768 Eighteenmile Creek at Burt, NY and is located just downstream of the Burt Dam in Fisherman's Park. The equipment in the gage continuously (15 min.) records stage (water elevation) and transmits this data in near-real time (hourly) to the internet via satellite transmission. Hourly water-level data for this gage can be accessed by anyone by visiting the following website, http://waterdata.usgs.gov/ny/nwis/uv/?site_no=04219768&PARAMeter_cd=00065,00060.

The primary purpose of the project is to provide a current estimation of loadings of critical pollutants from tributary streams on the American side of Lake Ontario. Up to this point, Eighteenmile Creek was

the only major US tributary to Lake Ontario without a US Geological Survey (USGS) fixed gaging station. USGS hydrographers will manually measure streamflow (cubic feet per second) about seven times a year and more frequently during floods and droughts. Additionally, USGS personnel will collect water quality samples and measure in situ parameters (pH, temperature, conductivity, specific conductivity) at this site and five other NYS tributaries through 2012 as part of their support of the Lake Ontario LaMP and associated activities. The results of the field measurements and laboratory analyses will complement and augment Region 2's current Lake Ontario US Tributary monitoring program.

- In coordination with the American Littoral Society and Boy Scouts of America, an Area of Concern “Clean Sweep” was completed in October 8, 2011. Seventeen (17) scouts and parents from pack 4 in Lockport and Pack 44 in Newfane participated in the project by collecting approximately 120 pounds of trash, which included a tire, saw blades, food containers, angler debris, general debris, etc...
- During the fall of 2011, the PI coordinated with the Town of Newfane to complete enhancements to the storm drain system which are intended to improve the quality of storm water discharges to Eighteenmile Creek. Initially, the project intended to support the elimination of illicit discharges identified within the system. However, no illicit discharges were discovered. Therefore, the project re-directed its efforts to address and improve general storm water flow to Eighteenmile Creek. Sediment and debris was removed from 150 storm drain catch basins utilizing a Vactor vacuum truck. Also, Ultra-Passive Skimmers were placed into the same 150 catch basins which discharge to Eighteenmile Creek. Ultra-Passive Skimmers are intended to remove oil permanently from catch basins and storm basins. 1st priority catch basins were those present in parking lots and other areas with a large concentration of parked cars. 2nd priority catch basins were those that are present along roadways and side streets. To assure proper operation of the Ultra-Passive Skimmers, a physical inspection of the catch basins was completed a month after placement. The effort also included a education component which included the distribution of project information and general storm water information to Town residents.
- During the week of October 10, 2011, the PI travelled to Detroit Michigan where he attended the 2011 U.S. Areas of Concern Program Annual Meeting. The annual Areas of Concern (AOC) conference convened over 250 participants from the 30 U.S. AOCs to review recent developments affecting the AOC program; discuss approaches for implementing delisting targets; build capacity to implement on-the-ground restoration actions; identify opportunities to address AOC restoration priorities under the Great Lakes Restoration Initiative; improve linkages between the AOCs, LaMPs and other programs; and consider actions that will strengthen the regional U.S. AOC program.

During the same week in Detroit, MI, the PI also attended the 2011 International Joint Commission (IJC) Great Lakes Water Quality Biennial Meeting. The theme of the 2011 Great Lakes Water Quality Biennial Meeting was "H2O NOW" emphasizing the pressing need for action to protect and restore the Great Lakes. More than 600 activists, experts and interested members of the public from throughout the Great Lakes basin gathered to learn about the latest research regarding critical threats to water quality, to share ideas and solutions and to join in the collaborative process of producing the 16th Biennial Report.

- On October 31, 2011, the PI led a field trip of the Eighteenmile Creek AOC for a class of graduate students from University at Buffalo (UB). The class studies environmental planning and management issues with special attention to methods for preventing and ameliorating environmental problems. Each week students read about a generic environmental planning or management method like ‘stream restoration and remedial action planning’, have a field trip to see an example of this method in practice, discuss the method with an environmental professional involved with the field trip project, and finally to have a class discussion of how environmental planners and managers use the method. Twenty three (23) students were on hand to experience the AOC up close and learn about the issues relative to Eighteenmile Creek.

- With input from the RAC, the 2011 Eighteenmile Creek AOC Report Card was completed in December 2011. The purpose of the Report Card is to give a brief overview of the health, improvements and current conditions of Eighteenmile Creek during 2011. A copy of the Report Card has been made available on the AOC website and was also mailed to 4,500 residents in Niagara County. The Report Card offers six “indicators” related to the management of the creek’s overall health. They are: 1) Water Quality; 2) Contamination; 3) Fish & Wildlife; 4) Public Access & Recreation; 5) Remedial Action Plan and; 6) Environmental Education/Public Involvement. The Report Card is included with this progress reports as Appendix B.
- Over the past 12 months an enormous amount of data and reports have been developed in relation to the numerous projects that are ongoing in the AOC. In an effort to add all new data and reports to the existing catalog, an update to the RAP data repository was completed. The data repository, which is available on-line and in hard copy format in the SWCD office, is a complete listing and source for all data relevant to Eighteenmile Creek and its AOC. In addition, updates and additions to the Eighteenmile Creek website were completed to make this information available to the public.
- In coordination with the Eighteenmile Creek RAC, a Draft Remedial Action Plan Stage II Update has been completed and submitted to NYSDEC and USEPA for review. The IJC review of the original Stage I/II document recommended that a Stage II update be submitted when remediation needs were confirmed and remediation measures were chosen. This Stage II Update satisfies those recommendations. The Stage II Update: identifies and evaluates remedial programs and actions that have either been completed or are ongoing; identifies new potential remedial measures and actions that will assist in the delisting of use impairments; identifies selected remedial measures to restore beneficial uses and; provides a delisting strategy and timeline for the proposed actions. A good deal of time and resources were invested in the development and review of this document. The Stage II Update is included with the progress report as Appendix C.

PROJECT OBJECTIVES

<u>Activities</u>	<u>% Completed</u>
1. Continued coordination/management of the Remedial Action Plan (RAP) for the Eighteenmile Creek Area of Concern and the Remedial Advisory Committee	Ongoing
2. Research and evaluate the following Beneficial Use Impairments: - o (3) Degradation of fish and wildlife populations - o (4) Fish tumors or other deformities - o (5) Bird/Animal deformities or reproductive problems	100%
3. Complete a full Stage 2 Eighteenmile Creek RAP document to reflect research conducted and priorities established since 1997.	100%
4. Establish an updated remediation strategy for all impaired beneficial uses and the development of monitoring protocol necessary for delisting.	100%
5. Actively pursue resources to develop and implement Eighteenmile Creek RAP initiatives.	Ongoing
6. Continue local coordination of Eighteenmile Creek projects and identify and develop programs to address current data gaps or needed RAP initiatives.	Ongoing
7. Coordinate with other Great Lakes programs and agencies such as the Lake Ontario LAMP, International Joint Commission (IJC), EPA-GLNPO, EPA Region 2, Great Lakes Commission (GLC), and the Great Lakes Regional Collaboration (GLRC).	Ongoing

PROJECT FUNDING RATE

The following is a breakdown of budgeted dollars that have been spent between 8/1/2011 and 12/31/2011. It is apparent that the project funding rate does support project progress.

	<u>FEDERAL</u>	<u>NON-FEDERAL</u>
August 2011	\$ 24,530.80	\$0
September 2011	\$ 4,024.11	\$0
October 2011	\$ 12,093.18	\$0
November 2011	\$ 39,658.08	\$0
December 2011	\$ 22,197.51	\$0

Total Federal Share = \$102,503.68

APPENDIX A

PUBLIC SUBMISSION

As of: 3/30/12 3:52 PM Tracking No. 80f2422d Comments Due: November 15, 2011

Docket: [EPA-HQ-SFUND-2011-0650](#)

National Priorities List, Notice of Proposed Rulemaking (Eighteenmile Creek)

Comment On: [EPA-HQ-SFUND-2011-0650-0001](#)

National Priorities List, Proposed Rule No. 55

Document: [EPA-HQ-SFUND-2011-0650-0005](#)

Comment submitted by Victor DiGiacomo, Eighteenmile Creek Remedial Action Plan Coordinator, Niagara County Soil & Water Conservation District

Submitter Information

General Comment

On behalf of the Niagara County Soil & Water Conservation District, as lead agency for the management of the Eighteenmile Creek Area of Concern, I am commenting to confirm our support of the proposed addition of Eighteenmile Creek to the National Priorities List (NPL).

Eighteenmile Creek has been designated as a Great Lakes Area of Concern within the Great Lakes Water Quality Agreement between the United States and Canada. The Eighteenmile Creek Area of Concern is one of the most toxic "hot spots" in the Great Lakes Basin. Located in Lockport, NY the Eighteenmile Creek Corridor Site has been identified by NYSDEC as a Class 2 Inactive Hazardous Waste Disposal Site and a source to the historic sediment contamination that is present in Eighteenmile Creek. The Eighteenmile Creek Corridor Site is contaminated primarily with lead and polychlorinated biphenyls (PCBs) which pose a significant threat to human health associated with current and potential exposure to soils and sediment and a significant environmental threat associated with current and potential impacts of contaminants to Eighteenmile Creek.

Attached you will find a draft Remedial Strategy developed to guide the delisting of impaired beneficial uses of Eighteenmile Creek. Sediment remediation work proposed under a potential NPL project for Eighteenmile Creek in Lockport, NY and Newfane, NY, is consistent with the identified and attached plan to delist Eighteenmile Creek as an Area of Concern.

We hope that the Area of Concern designation of Eighteenmile Creek and the overall goal of USEPA to delist Area's of Concern in the Great Lakes Basin will not only assist in the successful inclusion of the site to the NPL, but will also push the site to the top of the NPL listing as a PRIORITY.

Regards,

Victor DiGiacomo

Eighteenmile Creek Remedial Action Plan Coordinator

Attachments

Interim Eighteenmile Creek Area of Concern (AOC) Strategic Plan for Beneficial Use Impairment (BUI) Delisting

The attachment is restricted to show metadata only because it contains copyrighted data

APPENDIX B

REPORT CARD

The Eighteenmile Creek Area of Concern Report Card was created by the Eighteen-mile Creek Remedial Advisory Committee (RAC). **The purpose of this Report Card is to give a brief overview of the health, improvements and current conditions of Eighteenmile Creek during 2011.** The Eighteenmile Creek Watershed includes – the main branch of Eighteenmile Creek, Gulf Creek Tributary, East Branch of Eighteenmile Creek (Red Creek), and augmented flow from the NYS Erie Barge Canal.

Scientific data and research that was referenced during the development of this Report Card can be found at the Area of Concern website:

WWW.EIGHTEENMILERAP.COM

This Report Card offers six “indicators” related to the management of the creek’s overall health. They are: 1) Water Quality; 2) Contamination; 3) Fish & Wildlife; 4) Public Access & Recreation; 5) Remedial Action Plan; and 6) Environmental Education & Public Involvement.

Each indicator has been further divided into several “sub-categories” to assess how specific concerns are being addressed. Each sub-category has been assigned a **letter grade** based upon past successes, current health conditions, and trends over the past few years. The last column identifies action steps or immediate concerns to be addressed in order to meet restoration targets for the Area of Concern. This Report Card will be updated annually.

BENEFICIAL USE IMPAIRMENTS

- 1) Fish & Wildlife Consumption - **Impaired**
Delisting Targets → **Identified**
- 2) Degraded Benthic Populations - **Impaired**
Delisting Targets → **Identified**
- 3) Dredging Restrictions - **Impaired**
Delisting Targets → **Identified**
- 4) Animal Reproductive Issues - **Impaired**
Delisting Targets → **Identified**
- 5) Fish & Wildlife Populations - **Impaired**
Delisting targets → **Identified**

TRENDS		GRADING
Conditions Improving		A Excellent
Conditions Unchanged		B Good
Conditions Worsening		C Fair
		D Poor
		E Failure

	CATEGORIES	GRADE	SUCCESSSES & IMPROVEMENTS	CURRENT CONDITIONS	TREND	STEPS NEEDED FOR PROBLEM RESOLUTION
WATER QUALITY	Overall Water Quality	C	- Agricultural Environmental Management (AEM) Program has been deployed in the watershed to document and prioritize water quality impairments within agricultural areas. - Numerous best management practices (BMPs) were constructed for farms within the watershed which will reduce pollutant runoff to the creek.	- The AOC is a Class B/C stream indicating that the primary use is contact recreation and fishing. - NYSDEC monitors water quality through the Rotating Intensive Basin Study (RIBS) program and State Pollutant Discharge Elimination System (SPDES) program.	↔	- A citizen water quality campaign should be deployed within the watershed. - Contaminated sediments within the watershed must be remediated. - Annual “Clean-Sweep” events should continue to occur throughout the watershed. - Unknown sources of impairments must be identified.
	Quality of Storm Water	C	- Storm water education activities are ongoing. - Oil absorbent “skimmers” have been added to a number of Town of Newfane catch basins to improve storm water discharge to the creek.	5 Combined Sewer Overflow still discharge to the creek. - During storm events degraded water quality negatively impacts Olcott Beach along the shore of Lake Ontario, possibly causing beach closures.	↔	- Remaining Combined Sewer Overflows must be eliminated. - Continue with the storm water education campaign.
CONTAMINATION	Spills, Discharges & Leaching of Contaminants	C	- Four projects have been completed on farms in the watershed which reduce nutrient loadings. - A recent study ruled out the Erie Barge Canal as a source of PCBs to Eighteenmile Creek.	5 Inactive Hazardous Waste Sites in the watershed still have the potential to negatively influence the AOC. - Lockport continues to improve quality of WWTP discharge.	↔	- Continue to assist farms in the watershed via the NYS Agricultural Environmental Management (AEM) program. - Continue to remediate Inactive Hazardous Waste Sites and other sources of contamination.
	Contaminated Sediment	D	Eighteenmile Creek has been referred to the National Priorities List (Federal Superfund). This proposed designation includes the Eighteenmile Creek Corridor Site, Former Flintkote Plant Site, and down stream contaminated sediments already present in the creek system. A formal designation is anticipated in March 2012.	- Sediments in the AOC exceed NYS standards for a variety of contaminants, including PCBs, lead, etc. - Contaminated sediments within the watershed continue to influence the overall health of the AOC. - A number of historic power generation structures present in the creek act as “sinks” for contaminated sediment.	↔	- Utilize the Federal Superfund program to address the current sediment contamination. - Remediate all upstream sources of contamination, including the Eighteenmile Creek Corridor Site and Old Upper Mountain Road Site. - Continue to identify new funding sources.
FISH & WILDLIFE	Contaminant Levels in Fish & Wildlife	D	- A new fish consumption advisory pamphlet was recently completed by New York State Department of Health. - Funding has been secured to assess contaminant levels in fish and wildlife during the 2012 field season.	- Fish consumption advisories exist for the AOC, upper watershed and Lake Ontario. - PCBs in fish collected from the Creek were: 10 times greater than in fish collected from control sites; often exceeded the critical PCB tissue concentration for effects on fish and; great enough to possibly affect reproduction of fish-eating mammals	↔	- Remediate upstream sources and contaminated sediments. - Monitor contaminant levels in fish and wildlife present in the AOC and watershed in an attempt to establish a more current baseline of data prior to any potential remediation. - Monitor contaminant levels present in the benthic population.
	Fish & Wildlife Diversity & Populations	B	Over 130,000 Chinook and Coho salmon and 7,000 Steelhead stocked by NYSDEC in 2011.	Large concentrations of Coho and Chinook salmon and brown trout migrate from Lake Ontario each fall. The area also supports natural reproduction by bass, northern pike and black crappie.	↔	- Continue to support Olcott Pen Rearing Project. - Contaminated sediments affecting fish & wildlife require special attention.
PUBLIC ACCESS & RECREATION	Public Access to the Creek & Adjacent Areas	A	Access to Eighteenmile Creek via Fisherman’s Park continues to be maintained by the Town of Newfane.	- The AOC is accessible for anglers and general recreation activities from Fisherman’s Park and Olcott Harbor. - Majority of the AOC is secluded by a steep ravine.	↔	Investigate options for public access improvements to the creek in the City and Town of Lockport, NY.
	Aesthetics of the Creek & Adjacent Riparian Areas	B	Cub Scouts participated in a “Clean-Sweep” of the AOC which yielded the collection of 65 lbs of trash from creek banks/riparian areas.	The Town of Newfane routinely monitors Fisherman’s Park and Olcott Harbor for garbage and large debris.	↔	- Continue with annual AOC “Clean-Sweep” events. - Educate and encourage recreational users to “Pitch-In” and promote a healthy creek ecosystem.
REMEDIATION ACTION PLAN	RAP Management	B	- A New York AOC workshop occurred in 2011 which provided a forum to discuss mutual goals & objectives across all NY AOCs. - A Stage 2 RAP update was completed in 2011.	- EPA Region 2 has funded Niagara County SWCD to oversee the Eighteenmile RAP through the end of 2016. - New York AOCs have begun to collaborate as a group to identify common challenges and goals to AOC recovery.	↔	- Regular Status Reports and updates should continue to be completed. - Grant fund acquisition should continue to be ongoing. - Continue oversight of all AOC activities and projects.
	RAC Management	B	- RAC members worked with AOC partners to complete a remedial delisting strategy for current beneficial use impairments. - Assisted in completion of a Stage II RAP.	- The RAC is comprised of a diverse group of original members and representatives from newer interests. - The RAC meets to discuss various aspects of the RAP and to explore new opportunities to de-list the AOC.	↔	- Focus on monitoring needs and protocols to effectively assess progress post remediation. - Continue to assess the status of active BUIs. - Utilize the updated Stage 2 RAP as a plan for the future.
ENVIRONMENTAL EDUCATION	Public Awareness	A	- A social media campaign is ongoing which incorporates a website, ‘Facebook’ & other media. - A number of student classes visit the AOC to learn about critical AOC issues.	- Despite a fish consumption advisory, the AOC is visited by 12,000 anglers annually. - Every year the AOC is utilized as an “outside classroom” for elementary, secondary and collegiate classes.	↔	Continue to engage the public utilizing educational tools like the annual report card, various education events, internet mapping database, AOC website, newsletters and press releases.
	Watershed Stewardship	B	Cub Scouts participated in a “Clean-Sweep” of the AOC which yielded the collection of 65 lbs of trash from creek banks/riparian areas.	- There is an increasing but still limited amount of participation from the public related to the AOC. - The Marsh Monitoring Program has attracted volunteers interested in environmental issues.	↔	- Partner with sportsmen clubs/local residents to promote AOC stewardship. - Continue with annual AOC “Clean-Sweep” and education events to keep youth interested in stewardship.

WHAT IS THE EIGHTEENMILE CREEK AREA OF CONCERN (AOC) ?

Local, state and federal officials identified a section of Eighteenmile Creek as one of 42 “Areas of Concern” (AOC) in the Great Lakes Basin. Eighteenmile Creek received this designation because of poor water quality and contaminated sediments present throughout the watershed. Eighteenmile Creek’s long history of use by major industries in the area, especially near the City of Lockport and Town of Newfane, has played a large role in the present condition of the creek.

WHAT IS THE EIGHTEENMILE CREEK REMEDIAL ACTION PLAN (RAP) ?

A RAP is an integrated, whole ecosystem approach to remediating impaired water bodies. The RAP first identifies use impairments, their causes, and contaminant sources, using existing studies and data. Next, existing cleanup and regulatory programs which apply to the water body are identified. A coordinated cleanup strategy is then developed to eliminate the use impairments. The NYS Department of Environmental Conservation produced the Stage 1/2 RAP in 1997 in an effort to restore the integrity of the creek’s ecosystem.

WHAT IS THE EIGHTEENMILE CREEK REMEDIAL ADVISORY COMMITTEE (RAC) ?

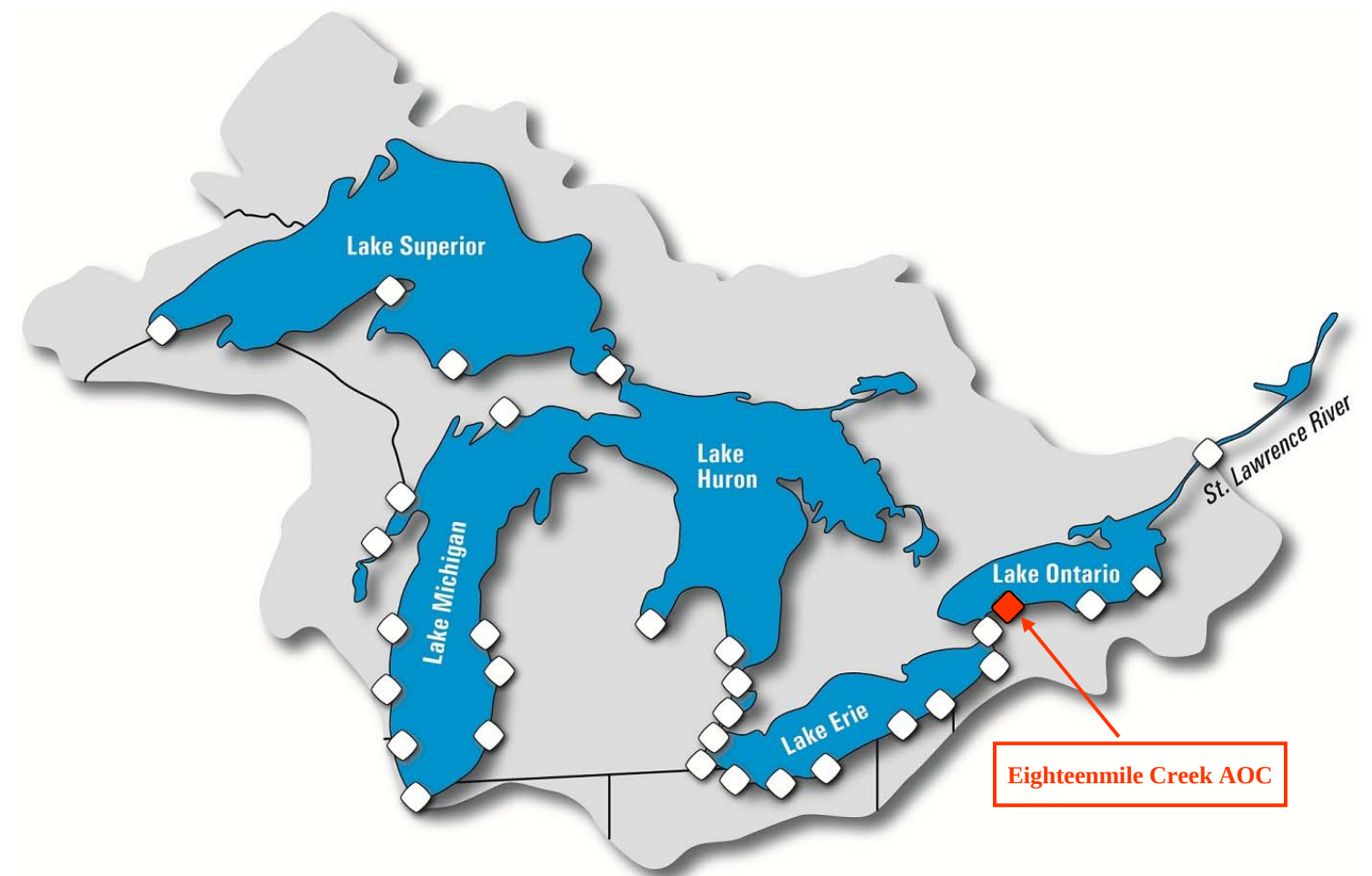
The Eighteenmile Creek RAC is comprised of a group of local, state and federal stakeholders, representing industries, organizations and local communities with a vested interest in the health of Eighteenmile Creek. The RAC is responsible for implementing the RAP, monitoring restoration efforts, and assessing ongoing needs and conditions. After a brief hiatus, the RAC reconvened in 2005 and is currently making progress in moving the RAP forward.



FOR MORE INFORMATION
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U.S.D.A. Service Center
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Website: www.eighteenmilerap.com



EIGHTEENMILE CREEK AREA OF CONCERN



2011 REPORT CARD



A COMPILATION OF SUCSESSES, IMPROVEMENTS & CURRENT CONDITIONS



APPENDIX C

EIGHTEENMILE CREEK REMEDIAL ACTION PLAN

STAGE II - UPDATE



NIAGARA COUNTY SOIL AND WATER CONSERVATION DISTRICT

DECEMBER 2011
FINAL DRAFT



FUNDING PROVIDED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EIGHTEENMILE CREEK

REMEDIAL ACTION PLAN

STAGE II - UPDATE

DECEMBER 2011
FINAL DRAFT

NIAGARA COUNTY SOIL AND WATER CONSERVATION DISTRICT

The Eighteenmile Creek Remedial Action Plan, Stage II Update, was prepared by Niagara County Soil & Water Conservation District in cooperation with the Eighteenmile Creek Remedial Advisory Committee and New York State Department of Environmental Conservation.

Members of the Eighteenmile Creek Remedial Advisory Committee (RAC)

Victor DiGiacomo – Chairman

Pam Cook

Ronald Gwozdek

Timothy Horanburg

Roy Knapp

Paul Lehman

Paula Sattelberg

Mark Seider

Gregory Tessmann

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CHAPTER 1

STAGE II INTRODUCTION

CHAPTER 1: Stage II Introduction

Introduction

The International Joint Commission (IJC) has identified 43 Areas of Concern (AOC) in the Great Lakes drainage basin where pollutants are impairing beneficial uses of a waterbody. Eighteenmile Creek is one of these AOCs because: 1) past municipal and industrial discharges have contaminated the creek and its bottom sediment; 2) the disposal of waste and; 3) the use of pesticides.

Under the 1987 Amendments to the United States – Canada Great Lakes Water Quality Agreement (GLWQA), Remedial Action Plans (RAPs) are to be developed by the States and Province of Ontario for the AOCs under their jurisdiction. The plans are to serve as an important step toward restoring and maintaining the chemical, physical, and biological integrity of the AOC and the entire Great Lakes Basin Ecosystem. They are to define environmental problems in the AOC, identify remedial measures needed to restore beneficial uses, and identify a monitoring process needed to track remediation progress. The RAP is to be submitted to the IJC in three stages:

- 1) When the problem has been defined;
- 2) When remedial measures are selected and;
- 3) When monitoring indicates beneficial uses have been restored

At the inception of the AOC program, the New York State Department of Environmental Conservation (NYSDEC) was the lead agency for the Eighteenmile Creek RAP. NYSDEC's Division of Water, in concert with other NYSDEC Divisions, was responsible for the development of a combined Stage I/II RAP document which was completed in August 1997. The Stage I/II RAP provided an impressive array of water quality monitoring and sediment sampling data that document contaminant levels resulting in beneficial use impairments. The document confirmed the restrictions on fish and wildlife consumption, degradation of benthos, and restrictions on dredging activities use impairments. Bird or animal deformities or reproductive problems was judged as a likely impairment and the status of degradation of fish and wildlife populations, fish tumors and other deformities, and degradation of phytoplankton and zooplankton populations were classified as unknown. Given the existing data gaps at the time, the document also lacked a number of crucial components required to be considered a complete Stage II RAP: an evaluation of in-place remedial measures; an evaluation of alternative additional measures and; selection of additional remedial measures required to restore beneficial uses. This Stage II RAP Update serves to satisfy the completion of these missing plan components.

As of January 1, 2005, the Niagara County Soil & Water Conservation District (NCSWCD) has assumed the role of coordinator for Eighteenmile Creek's RAP. NCSWCD also assists the Eighteenmile Creek Remedial Advisory Committee (RAC) by facilitating their quarterly meetings and providing staff support towards the implementation of the creek's RAP. The Eighteenmile Creek RAC is a group of local officials, landowners, and stakeholders selected by the commissioner of the NYSDEC to provide a balanced representation of various segments of the community along the creek. Initially, the RAC worked cooperatively with the NYSDEC to organize, develop and review the RAP and create public awareness and support for Eighteenmile Creek. Additionally, it is the responsibility of the RAC to:

- Advise in identifying and updating priorities for RAP implementation activities;

- Advise in the preparation and approval of RAP documents;
- Assist in building a stakeholder base for implementation of RAP recommendations;
- Review and comment on current environmental initiatives and issues affecting the RAP;
- Assist in developing and seeking funding for a list of activities requiring funding; and
- Assist with social and economic impacts of RAP implementation.

The RAC was instrumental in the development of the original RAP, the Stage II Update and the implementation of various public outreach activities over the years. These activities have maintained the continued involvement and interest of the organizations represented on the RAC and built general interest and support for the RAP in the overall community.

NCSWCD, as the lead agency, intends to use this RAP as a management document to guide and coordinate remedial actions for Eighteenmile Creek initiated by various agencies to create and improved federal, state, and local partnership in addressing the goals of the plan. A timeline of significant investigations and events can be found in Appendix C of this document.

1.1 AREA OF CONCERN CHARACTERISTICS

1.1.1 Area of Concern Background

The Eighteenmile Creek AOC is located in Niagara County, New York (see Figure1-1). 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. 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.

Eighteenmile Creek was designated as an AOC because of water quality and bottom sediment issues associated with past industrial and municipal discharge practices, the disposal of waste and the use of pesticides. Over the years, numerous contaminants have been identified in creek sediments which have a detrimental effect to the AOC and Lake Ontario. These contaminants include but are not limited to; Polychlorinated Biphenyls (PCBs); Mercury; Dioxins and Furans; Dieldrin; Mirex; DDT; Lead; and Copper. Sediments contaminated with these substances have contributed to restrictions on fish and wildlife consumption, degradation of benthic organisms, and restrictions on dredging activities in the AOC. It is also suspected that these contaminated sediments contribute to a degradation of fish and wildlife populations, the presence of fish tumors, and the prevalence of bird and animal deformities or reproductive problems.

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 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 be entering the AOC from upstream areas. Specifically, PCBs, copper, lead, and other metals have been found in creek sediment

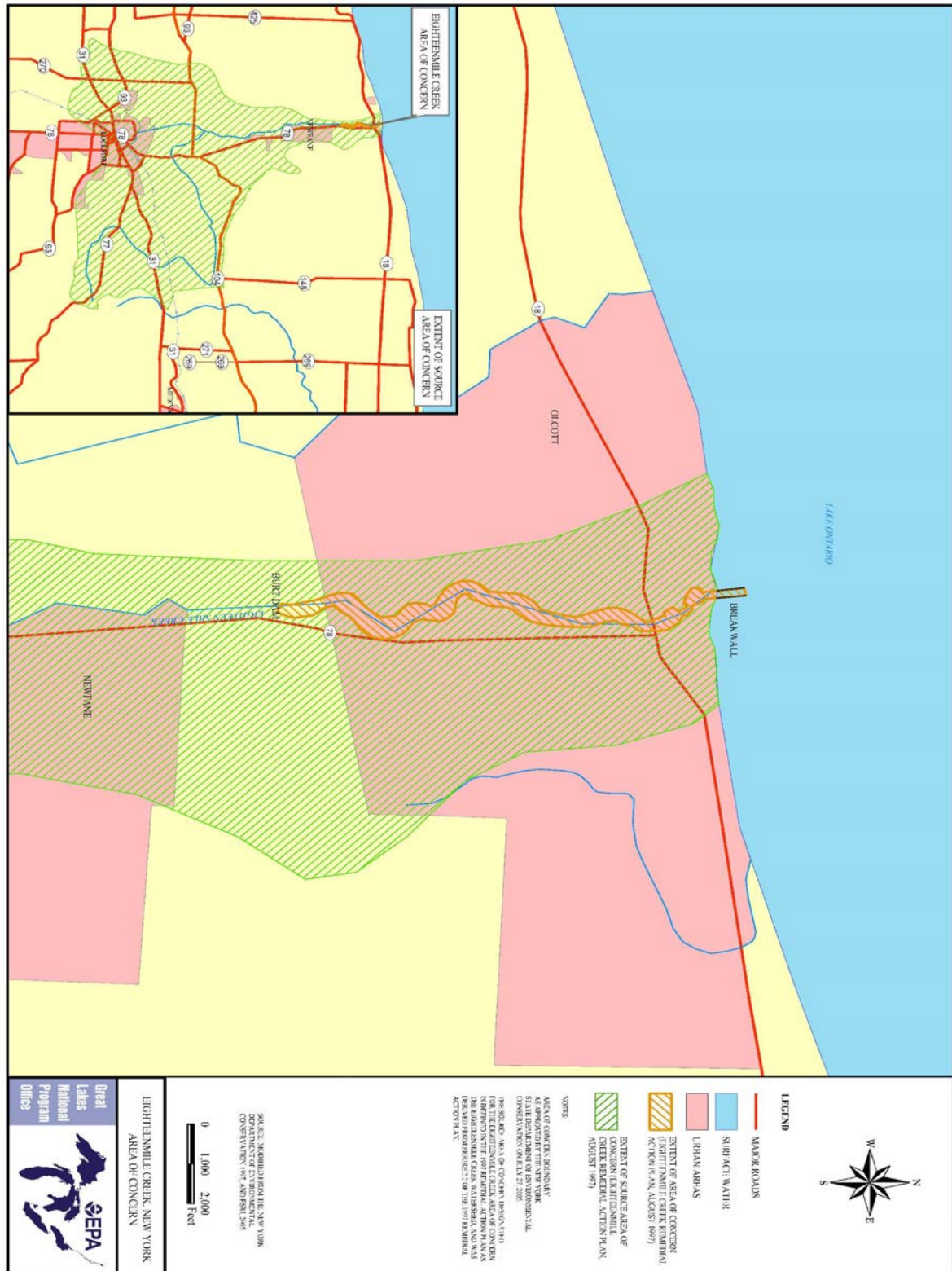
and bank fill in Lockport, New York, at concentrations well above applicable NYSDEC standards, indicating that contaminant sources exist in this area (NYSDEC 2006a, E & E 2009a). Other contaminant source areas may exist along the creek between Lockport and the AOC (NYSDEC 2001).

Sportfishing and recreational boating have been and continue to be important uses of the AOC. Most of the land bordering Olcott Harbor is occupied by marine-related commercial enterprises with service marine docking facilities occupying extensive water areas in the harbor. This is a regional harbor in that it draws small boat owners from areas throughout Western New York and Southern Ontario.

Despite access to the creek being limited by steep banks and private landownership, Eighteenmile Creek is one of the most popular fishing streams on Western Lake Ontario primarily due to the fact that it provides a habitat for major spawning runs for salmonids and other lake-based fish populations. The New York State Department of Environmental Conservation stocks the creek with chinook and coho salmon. The creek also provides a high quality warmwater fishery, particularly in the more natural stream reach south of the Hamlet of Olcott upstream to the Burt Dam. This area supports substantial natural reproduction of smallmouth bass, northern pike, rock bass, black crappie, brown bullhead and largemouth bass.

A single coastal wildlife habitat zone borders the creek between the Route 18 bridge at Olcott and the dam at Burt. The variety of species include: blue heron; mallard; marsh wren; swamp sparrow; muskrat, mink and raccoon. Thus, besides fishing, the area is also utilized by local residents to a limited extent for waterfowl hunting and fishing.

FIGURE 1-1 EIGHTEENMILE CREEK AREA OF CONCERN



1.1.2 Watershed

General Description

The Eighteenmile Creek watershed is centrally located within the bounds of Niagara County. (Figure 1-2) It is the largest drainage basin within Niagara County, covering an area of 58,056 acres within the towns of Newfane, Hartland, Royalton, Lockport, Cambria, and Wilson. The watershed includes The Gulf creek (The Gulf), East Branch Eighteenmile Creek and augmented flow from the New York Barge Canal. Downstream of the Burt Dam is primarily composed of cropland, orchards and residential areas. Upstream of the Burt Dam, the watershed is composed mainly of cropland and orchards, with residential and commercial areas like the historically industrialized City of Lockport. (Figure 1-3)

The main branch of the creek originates southeast of the City of Lockport, and travels westerly and northwesterly through the city. Over the years the creek has become “tunneled” and is completely underground through the City. The creek “daylights” just south of the New York Barge Canal, where it proceeds to go under the Canal accompanied by augmented flow from the Canal. From its resurfacing north of the Canal to its junction with The Gulf, Eighteenmile Creek cascades the Niagara Escarpment descending approximately 240 feet. The creek continues in a northerly direction through the Town of Newfane, to its mouth at Olcott along Lake Ontario.

Topography

Topography defines the limits of the watershed and influences the direction of surface drainage patterns and groundwater flow, land development patterns, vegetation community types, and cultivation practices. The Eighteenmile Creek watershed is located within both the Ontario and Huron Plains, two relatively flat plains that are separated by the Niagara Escarpment, which runs generally east/west along the northern portion of the City of Lockport. Within the Ontario Plain (from Lake Ontario to the Niagara Escarpment) elevations range from 245 feet above mean sea level (amsl) at the shoreline to approximately 400 feet amsl at the toe of the escarpment. Within the watershed area the escarpment ranges from 100 to 175 feet high. Maximum elevations within the watershed occur within the Huron Plain in the southern portion of the watershed and are approximately 635 feet amsl in the southwestern portion and approximately 655 feet amsl along the southeastern extent.

Drainage within the watershed can be described as generally flowing to the north. The East Branch of Eighteenmile Creek initially flows to the northeast, before turning west and joining with the main branch. This change in direction is caused by a topographic high point located in the southeastern portion of the watershed. The Gulf and the main branch of Eighteenmile Creek are both located within well-incised, steeply sloped channels for most of their lengths. The channel walls range in height but average approximately 35 feet. The East Branch lacks the incised channel characteristic of the rest of Eighteenmile Creek.

Hydrology

The Eighteenmile Creek watershed comprises approximately 230 miles of streams, both perennial and intermittent. In general, the smaller tributaries drain to the east or west into the main branch of Eighteenmile Creek. Water then flows to the north into Lake Ontario. The exception is the Erie Canal, a

manmade structure that runs east to west through the City of Lockport. During normal operations and drawdown periods water is discharged from the canal into Eighteenmile Creek, resulting in an increase in natural flow volumes. During dry periods, the canal contributes the majority of the flow for Eighteenmile Creek in the City of Lockport (NYSDEC 1997 and 2001).

Four large aquifers are in the Eighteenmile Creek watershed: one carbonate rock aquifer and three unconsolidated sand and gravel aquifers (USGS 2000). The New York and New England carbonate rock aquifer is found in the southern portion of the watershed. This aquifer extends eastward from the shore of Lake Erie near the City of Niagara Falls to just south of Utica, New York and, within the watershed, is bound on the north by the Niagara Escarpment. Most carbonate rock aquifers consist of limestone; however, marble and dolomite may also be found (USGS 2006).

Three unconsolidated sand and gravel aquifers also are found within the watershed: a small isolated aquifer at the toe of the escarpment east of Lockport, a larger isolated aquifer area near the shore of Lake Ontario, and a third area that encompasses much of the main branch of Eighteenmile Creek and spans an area from the confluence of The Gulf and the East Branch of Eighteenmile Creek northwest to Rochester. These aquifers were formed by glacial or alluvial deposition and are highly productive (USGS 2006). Groundwater flow is primarily local, originating from recharge areas near stream valley walls and discharging in the streams. Hydraulic conductivity (the capacity of the material to transmit fluids) of the unconsolidated sand and gravel aquifers is generally high.

The primary source of drinking water for municipalities within the Eighteenmile Creek watershed is the Niagara County Water District, which supplies water to most of Niagara County from the West Branch of the Niagara River. The District serves the Towns of Cambria, Hartland, Lockport, Newfane and Royalton. The East Branch of the Niagara River is the source of drinking water for the City of Lockport. According to the 2005 Annual Drinking Water Quality Reports for both the Niagara County Water District and the City of Lockport Department of Public Utilities there are no violations of drinking water quality standards in either drinking water supply.

FIGURE 1-2 EIGHTEENMILE CREEK WATERSHED

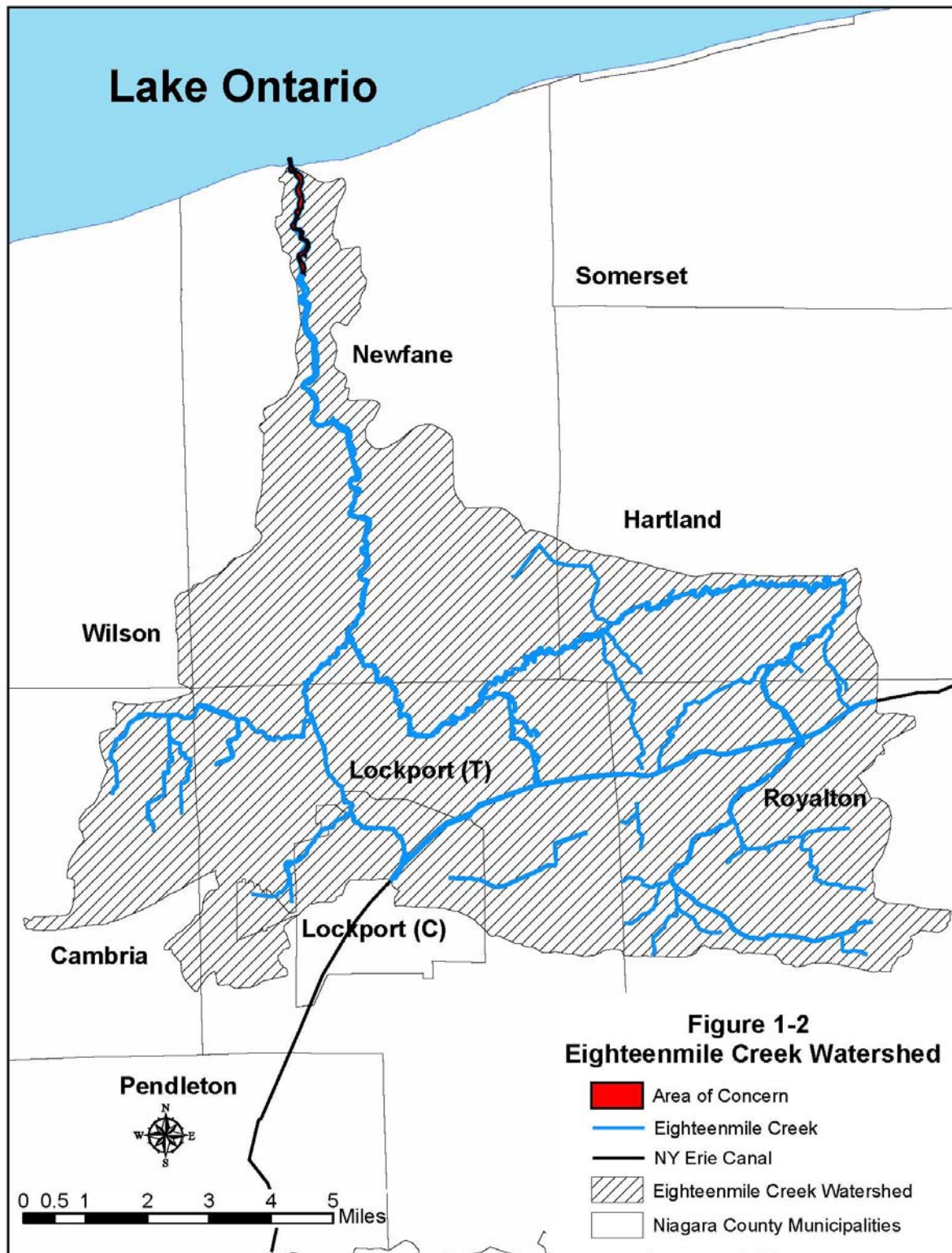
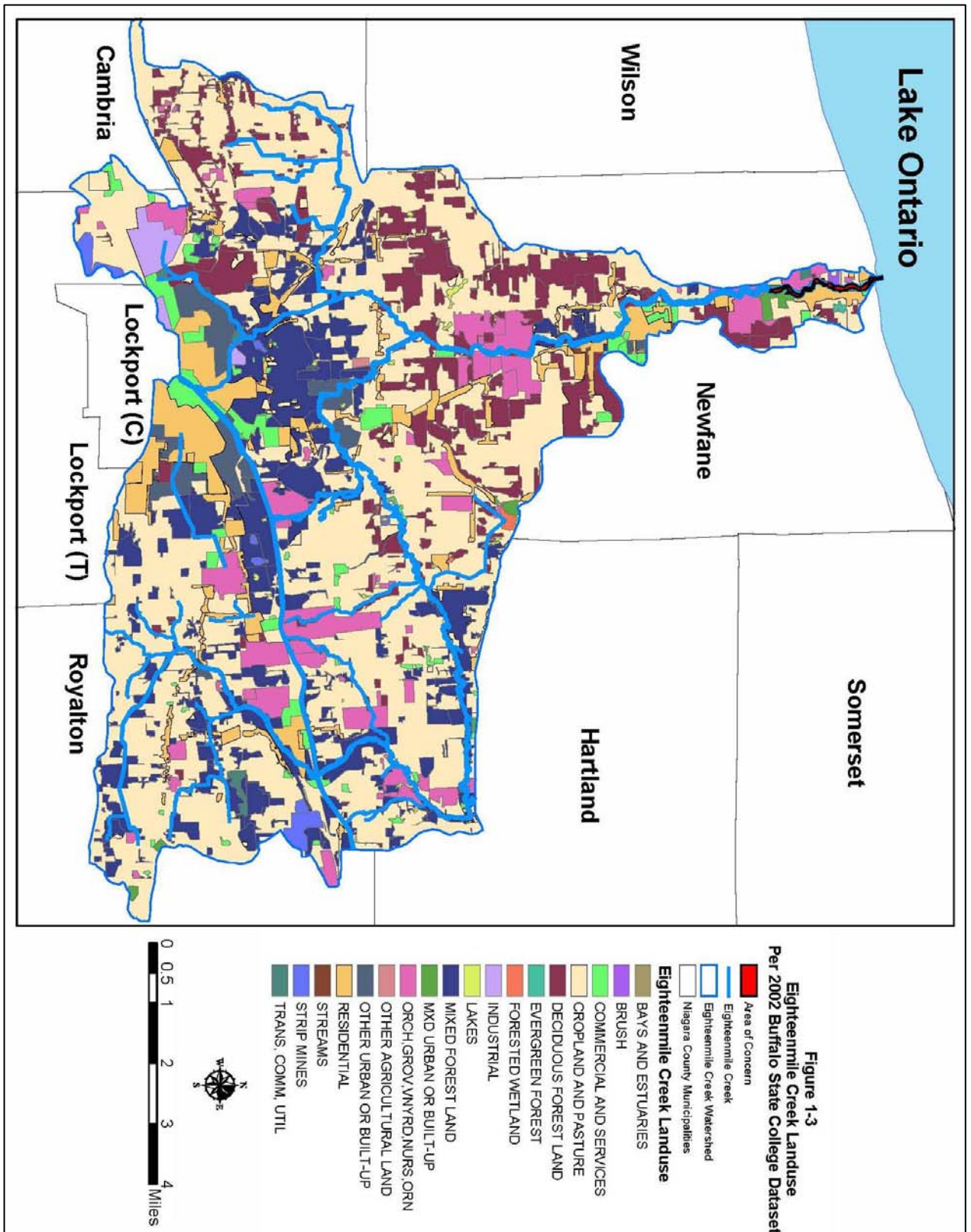


FIGURE 1-3 EIGHTEENMILE CREEK WATERSHED LANDUSE



Historical Overview

Three major cultural traditions manifested in western New York State during the pre-contact period including the Paleo-Indian (ca. 10,000 – 8,000 BC), the Archaic (ca. 8,000 – 1,500 BC), and the Woodland (1,000 BC – 1,600 AD) traditions. The earliest people were nomadic big game hunters; adaptations led to hunter-gatherer societies with a less nomadic lifestyle and a shift in technology. Later societies relied upon hunting and gathering combined with agriculture. A more settled village life arose with increased dependence on agriculture. At the same time, population increased, technology changed, warfare changed, and social and political changes occurred.

During the late 16th century, prior to European contact, at least three Haudenosaunee groups occupied the 18 mile creek watershed – the Neutral, the Wenro, and the Eries. Warfare between these groups and the Seneca resulted in the absorption of these people into the Seneca Nation sometime around 1600. Excavations of Haudenosaunee sites near Eighteenmile Creek have revealed unusually large villages that grew through the adoption of large population segments.

The earliest Europeans visited the Niagara Frontier area as early as the 1610s; however for most of the seventeenth and eighteenth centuries, European activities involved limited commercial, religious, and military endeavors. Settlement in the area began in the early nineteenth century, but the regions' growth was slowed by the War of 1812. Permanent Haudenosaunee settlements in the region began around 1800 when the Tuscarora Nation, to the west, and the Tonawanda Seneca Nation, to the south, settled on federally-recognized reservations.

The region received a tremendous economic boost when the Erie Canal was routed through what was to become the village of Lockport in 1829 (the first village in Niagara County) and later the city of Lockport in 1829 (the first city in Niagara County). By 1830, Niagara County had a population of 18,000, and the economy of the northern watershed included farmsteads and ancillary agricultural activities as well as milling and tanning industries.

Around 1835, rail lines began to supplement transportation provided by the canal and roads, and farmers used railroads to ship lumber and food to markets east and west. Beginning in 1900, an electric trolley line was operated between Lockport and Olcott. Toward the end of the eighteenth century, roadways improved in some areas, and bridges were erected. Around the turn of the century, telephone service, cheap electricity, and reliable water supplies improved living conditions in the area. Development in the watershed accelerated after World War II.

Agriculture remains the dominant land use within the watershed to this day. Currently, residential uses are concentrated in the City of Lockport and Village of Newfane and otherwise are confined to areas along roadways. Commercial and industrial uses are concentrated primarily in the City of Lockport.

During the 1800s, numerous millraces and millponds provided power for a variety of industries located along the banks of Eighteenmile Creek. Multiple mills for flour rolling and paper utilized the power of Eighteenmile Creek at its descent of the Niagara Escarpment as did the Cowells Electric Smelting and Aluminum Company. In the City of Lockport, clustered mill districts formed where millraces were constructed to take advantage of water from the canal traveling down the escarpment. The millraces

flowed into Eighteenmile Creek and the waterway provided power for pulp mills, gristmills, tanneries, and sawmills.

Dams were constructed to provide power in more level areas near Newfane and in the Town of Royalton. A dam was built in the 1830s near the end of McKee Street and Ewings Road in Newfane to provide power for the Newfane mill district. In the 1850s, a mill was built by D. VanHorn, near Ide Road in Newfane to provide power for sawmills. The remains of this dam were still in existence in 1988. Around 1875, another dam was built near Condren Road in Newfane for a saw- and gristmill. The Burt Dam was built in 1924 creating a 95-acre reservoir within the creek gorge for approximately 2 miles upstream. The original mill generated power until the 1950s and was restored in 1988. In Royalton, two dams were built near Slayton Settlement Road in the 1850s to provide power for mills. A wooden dam continued to provide power for a gristmill into the late 1960s.

1.2 Beneficial Use Impairments

Areas of Concern (AOC) are geographic areas where severe water quality degradation has resulted in the impairment of beneficial uses of the environment (typically referred to as beneficial use impairments) and which contribute adversely to the overall quality of the Great Lakes. These Beneficial Use Impairments (BUIs) are the tools utilized to measure the current health of an AOC.

There are a maximum of 14 BUIs applied by the IJC to an AOC (IJC 1991). These BUIs can be classified as: impaired, impairment in-conclusive, needs further assessment, not impaired, in recovery, or being addressed by another responsible party. Currently, five beneficial uses are considered impaired for the Eighteenmile Creek AOC (EPA 2010). The BUIs and their delisting criteria for Eighteenmile Creek are listed in Table 1-1.

The process of delisting or re-designating an AOC begins with re-designating or delisting each individual BUI. Individual BUIs can be re-designated to one of three re-designations (NYSDEC 2010a):

- Not impaired – delisting criteria achieved to the maximum extent practicable and environmental program oversight and monitoring are identified;
- In recovery – remedial measures and RAP process work accomplished to the maximum extent possible; oversight and longer term monitoring identified; or
- Referred to be resolved by another responsible party – the RAP process collaborates to assign responsibility to address the resolution of a concern to another responsible environmental program and/or management plan.

Once all of the individual BUIs have been re-designated, the entire AOC can be re-designated as “delisted” or “in-recovery” (NYSDEC 2010a). An area in recovery should be re-evaluated periodically to determine if the area has achieved the “delisted” goal. NYSDEC, EPA, and IJC concurrence is required to delist individual BUIs and the AOC as a whole. NYSDEC (2010a) and EPA (2001) describe the steps in the delisting process.

Table 1-1 Beneficial Use Impairment Status for the Eighteenmile Creek AOC

USE IMPAIRMENT	STATUS	CAUSES
1. Restriction on fish and wildlife consumption	Impaired	PCB's and Dioxins in sediment and fish flesh
2. Tainting of fish and wildlife flavor	Not Impaired	Non Applicable
3. Degradation of fish and wildlife populations	Impaired	PCB's and Dioxins in sediment and fish flesh
4. Fish tumors and other deformities	Not Impaired	Non Applicable
5. Bird or animal deformities/reproductive problems	Impaired	PCB's, DDT and metabolites, Dioxins and Dieldrin
6. Degradation of benthos	Impaired	PCB's and various metals in sediment
7. Restrictions on dredging	Impaired	PCB's, Chromium, Copper, Cyanides, Lead, Manganese, Mercury, Nickel, Zinc, and Dioxins in sediment
8. Eutrophication or undesirable algae	Not Impaired	Non Applicable
9. Restriction on drinking water consumption or taste and odor problems	Not Impaired	Non Applicable
10. Beach closings	Not Impaired	Non Applicable
11. Degradation of aesthetics	Not Impaired	Non Applicable
12. Added cost to agriculture and industry	Not Impaired	Non Applicable
13. Degradation of phytoplankton and zooplankton populations	Not Impaired	Non Applicable
14. Loss of fish and wildlife habitat	Not Impaired	Non Applicable

1.2.1 Restrictions on Fish & Wildlife Consumption

Status: Impaired

IJC Listing Guideline: *An impairment will be listed when contaminant levels in fish or wildlife populations exceed current standards, objectives or guidelines, or public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife must be due to contaminant input from the watershed.*

Impairment Rationale: Based upon data from New York State Department of Environmental Conservation (NYSDEC), the New York State Department of Health (NYSDOH) has issued a fish consumption advisory for Eighteenmile Creek. The NYSDOH advisory for the creek upstream of Burt Dam is to EAT NO FISH of any species, based upon elevated PCB levels in fish samples. Fish that migrate from Lake Ontario are present in the AOC downstream of Burt Dam. Therefore, the NYSDOH advisory for this area is the same advisory that applies to Lake Ontario waters which is based upon elevated levels of PCBs, Mirex and dioxins. The advisory is:

- Eat no America eel, channel catfish, carp, lake trout, Chinook salmon, rainbow trout, white perch, Coho salmon over 21", and brown trout over 20".
- Eat no more than one meal/month of white sucker, smaller Coho salmon, and smaller brown trout. (NYSDOH2010)

Table 1-2 illustrates that all samples, except for five samples downstream of Burt Dam, exceed the Food & Drug Administration (FDA) limit for human consumption of 2 mg/kg (2.0 ppm) for PCBs. However, all samples exceed the PCB critical tissue concentration for effects on fish (.440 mg/kg) (.440 ppm).

Table 1-2 PCB Concentrations of Eighteenmile Creek Fish

Sample Set	Species	# of Samples	Fish Part	Total PCBs (ppm)
July 1987 Downstream of Burt Dam	Carp	3	Whole Fish	9.31
July 1992 Downstream of Burt Dam	Lg. Mouth Bass	12	Standard Fillet	3.64
	Carp	10	Standard Fillet	6.80
	Sm. Mouth Bass	8	Standard Fillet	1.51
	Brown Bullhead	11	Standard Fillet	1.50
July 1992 Upstream of Burt Dam	Lg. Mouth Bass	11	Standard Fillet	3.81
	Black Crappie	12	Standard Fillet	6.54
	White Sucker	10	Standard Fillet	3.21
	Northern Pike	3	Standard Fillet	5.16
	Rock Bass	3	Standard Fillet	2.31
	Walleye	1	Standard Fillet	6.74
	Channel Catfish	2	Standard Fillet	15.3
August 2007 Downstream of Burt Dam	Bullhead 1	1	Whole Fish	3.2
	Bullhead 2	1	Whole Fish	1.8
	Bullhead 3	1	Whole Fish	0.890
	Bullhead 4	1	Whole Fish	3.7
	Bullhead 5	1	Whole Fish	6.1
	Bullhead 6	1	Whole Fish	4.7
	Bullhead 7	1	Whole Fish	1.4
	Bullhead 8	1	Whole Fish	4.1

KEY:

PCB = Polychlorinated biphenyls

Bold Numbers = Sample concentration equals or exceed the Food & Drug Administration (FDA) limit for human consumption of 2 mg/kg (2.0 ppm) for PCBs

IJC Delisting Guideline: *When contaminant levels in fish and wildlife populations do not exceed current standards, objectives or guidelines, and no public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife must not be due to contaminant input from the watershed.*

1.2.2 Degradation of Benthos

Status: Impaired

IJC Listing Guideline: *When the benthic macroinvertebrate community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when toxicity (as defined by relevant, field-validated, bioassays with appropriate quality assurance/quality controls) of sediment associated contaminants at a site is significantly higher than controls.*

Impairment Rationale: Measurements of benthic macroinvertebrates inhabiting Eighteenmile Creek were made in 1977 by the Army Corps of Engineers. NYSDEC also collected benthic samples on three occasions during 1989, 1990 and as part of the 1990 Rotating Intensive Basin Study (RIBS). All studies that applied ratings to the stream concluded that benthic populations were moderately impacted. In 1994, NYSDEC completed an inventory of benthic populations at a site within Olcott Harbor and an additional site upstream of the Route 18 Bridge. The assessment of the number and species diversity of the benthic organisms in the AOC indicated a slight to moderate impairment.

To assess the overall toxicological risk of surficial sediment contamination within the AOC that is currently exposed to the aquatic community, the U.S. Army Corps of Engineers (USACE), Buffalo District, collected sediment samples from 15 locations within the lower reach of Eighteenmile Creek in August 2003. Organic contaminant data indicated that levels of the pesticide dichlorodiphenyldichloroethylene (DDE) in surficial sediments within the AOC may be chronically toxic. Bioaccumulation data indicated that DDE was bio-available throughout AOC surface sediments (mean BSAF range = 1.21 to 5.41). The high bioavailability of DDE in surficial sediments located approximately .10 miles downstream of Burt Dam (BSAF = 4.60) and approximately .35 downstream of Burt Dam (BSAF = 5.41) indicate that it is bio-accumulating in benthic invertebrates, and is likely to bio-accumulate in predator fish and higher trophic levels. (Pickard 2006)

Both sediment and bioaccumulation data suggest that PCBs in surficial sediments throughout most or all of the AOC are being bio-accumulated to levels that pose a risk to aquatic organisms. PCB concentrations are bio-available in surface sediments throughout the AOC (mean BSAF range = 1.55 to 4.36). The high bioavailability of PCBs in the surficial sediments located approximately .10 miles downstream of Burt Dam (BSAF = 2.95) and approximately .35 miles downstream of Burt Dam (BSAF = 4.36) indicate that they are bio-accumulating in benthic invertebrates, and are likely to bio-accumulate in predator fish and higher trophic levels. The site-specific BSAFs determined in this investigation can be used in a model to conservatively predict the bioaccumulation of DDE and PCBs by indigenous benthic organisms from AOC sediments. PCDD/F contamination in surficial sediments throughout the AOC indicates a bioaccumulation risk to wildlife. (Pickard 2006)

IJC Delisting Guideline: *When the benthic macroinvertebrate community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when toxicity of sediment-associated contaminants is not significantly higher than controls.*

1.2.3 Restrictions on Dredging Activities

Status: Impaired

IJC Listing Guideline: *When contaminants in sediments exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.*

Impairment Rationale: Recreational boating is a beneficial use of Eighteenmile Creek that requires dredging of sediments. The outlet to Lake Ontario is protected by two piers and the navigation channel is periodically dredged by the U.S. Army Corps of Engineers. Other areas in the harbor have been periodically dredged by the Town of Newfane.

There have been some dredging restrictions placed on Eighteenmile Creek under the EPA's *Guidelines for the Pollution Classification of Great Lakes Harbor Sediments* and the NYSDEC guidance on freshwater navigational dredging. The area surrounding a Corps of Engineers site located approximately at the mid-point of the Olcott Harbor was classified as unsuitable for open lake disposal. The sediments from this site were classified as polluted with chromium, copper, lead, manganese, nickel, zinc, and cyanides. All dredging spoils from this area must be placed in a land based confined disposal facility. (NYSDEC 1997)

Other sediment studies had samples that exceeded either the EPA or NYSDEC guidance for one or more contaminants. The 1994 Lake Ontario Tributary Sampling has two samples from Olcott Harbor, one of which exceeded EPA guidelines for mercury and the other which exceeded DEC the guidance value for 2,3,7,8-TCDD toxicity equivalence. The 1994 Olcott Harbor Sediment Sampling Project had two sample sites in the harbor area, both of which had contaminant levels which exceed EPA and NYSDEC criteria for copper, chromium, lead, mercury, zinc, and benzo(a)anthracene.

To assess the overall toxicological risk of surficial sediment contamination within the AOC that is currently exposed to the aquatic community, the U.S. Army Corps of Engineers (USACE), Buffalo District collected sediment samples from 3 locations within Olcott Harbor in August 2003. A composite sample of those 3 sites exceeded EPA guidelines for copper, lead, manganese, and zinc. Furthermore, total PCB concentrations significantly exceeded lake reference levels. (Pickard 2006)

IJC Delisting Guideline: *When contaminants in sediments do not exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.*

1.2.4 Degraded Fish & Wildlife Populations

Status: Fish Populations: Impaired

Bird Populations: Not Impaired

Mammal Populations: Insufficient Data

Amphibian Populations: Not Impaired

IJC Listing Guideline: *When fish and wildlife management programs have identified degraded fish or wildlife populations due to a cause within the watershed. In addition, this use will be considered impaired when relevant, field-validated, fish or wildlife bioassays with appropriate quality assurance/quality controls confirm significant toxicity from water column or sediment contaminant.*

Impairment Rationale: Eighteenmile Creek is a significant Lake Ontario tributary fishery. Most angler effort has been directed at migratory trout and salmon. However, the creek also provides fishing opportunities for warm water species. An angler survey of all the major tributaries to Lake Ontario in New York was initiated in 2005 by the NYSDEC. Five NYSDEC technicians surveyed 28 Lake Ontario tributaries, including Eighteenmile Creek. NYSDEC estimated effort (numbers of angler hours and angler trips), catch and harvest (total numbers), and catch and harvest rates (fish per angler hour) for each species in each tributary. The total estimated effort for all 28 tributaries was 805,419 angler hours. Eighteenmile Creek accounted for 8.5% (69,111 hours) of the total angler hours calculated, ranked second behind the Salmon River which accounted for 60% of calculated angler hours. The total estimated angler trips from all 28 tributaries were 256,907. Eighteenmile Creek accounted for 12.5% (32,295 trips) of the total angler trips calculated, ranked third behind the Salmon River and Oak Orchard Creek. (Prindle 2005)

Sixteen of the 28 tributaries surveyed had reported catches of steelhead. For all tributaries surveyed, the total estimated catch was 28,245. The Salmon River had the highest estimated catch of 7,738 fish. Eighteenmile Creek ranked second with estimated catches exceeding 7,000 fish. Fifteen of the 28 waters surveyed had reported catches of brown trout. For all tributaries surveyed, estimated brown trout catches were 43,320. Catches of brown trout (22,684) on Eighteenmile Creek were markedly higher than for any other tributary. Twenty-three of 28 tributaries surveyed had reported catches of Chinook salmon. The estimated catch of Chinook salmon on all tributaries surveyed in 2005 was 158,029. Catches of Chinook salmon on Eighteenmile Creek (13,457) were second only to South Sandy Creek. (Prindle 2005)

In 2007, fish & wildlife populations were assessed by conducting seasonal fish and wildlife population surveys within the AOC and a control creek (Oak Orchard Creek). The results of this project are presented as Appendix D. The primary components of the investigation included: Conducting fish community surveys during two periods—early spring (May) and summer (late August); targeted sampling of brown bullhead for gross external and internal observations, excision of livers for pathological/histological examination, and preparing selected specimens for whole-body tissue chemical analyses (for PCBs and dioxin) (late August); and periodic bird, amphibian, and mammal surveys from May through September. The data generated by the field activities was used in a weight-of-evidence approach to determine the status of this beneficial use. (E&E 2008)

Four lines of evidence were examined to evaluate the potential impairment of fish populations in Eighteenmile Creek: (1) diversity, abundance, and condition of fish; (2) concentrations of PCBs and

dioxins/furans in bullheads; (3) the prevalence and severity of external tumors in bullheads; and (4) the prevalence and severity of liver tumors in bullheads. Three lines of evidence (1, 3, and 4) showed no impairment at Eighteenmile Creek. Impairment was noted at Eighteenmile Creek regarding the levels of PCBs in fish, which were highly elevated compared with the levels found in fish from Oak Orchard Creek. Whole-body PCB concentrations in bullheads were ten times greater in fish from Eighteenmile Creek compared with fish from Oak Orchard Creek and exceeded the critical PCB tissue concentration for effects on fish. Dioxins/furans also were elevated in fish from Eighteenmile Creek compared with fish from Oak Orchard Creek, but the critical tissue concentration for dioxins/furans was not exceeded. (E&E 2008)

Two lines of evidence were examined to evaluate the potential impairment of bird populations at Eighteenmile Creek: (1) the diversity and abundance of birds, and (2) the risk of reproductive impairment for fish-eating birds. No impairment was found.

Two lines of evidence were examined to evaluate the potential impairment of mammal populations at Eighteenmile Creek: (1) the diversity and abundance of mammals, and (2) the risk of reproductive impairment for fish-eating mammals. Insufficient data was available to evaluate the first line of evidence. Reproductive impairment potentially exists at Eighteenmile Creek for fish-eating mammals such as the mink due to the high levels of PCBs in fish.

Only a single line of evidence was examined to evaluate potential impairment of amphibian populations at Eighteenmile Creek—the diversity and abundance of amphibians. No impairment was noted.

IJC Delisting Guideline: *When environmental conditions support healthy, self-sustaining communities of desired fish and wildlife at predetermined levels of abundance that would be expected from the amount and quality of suitable physical, chemical and biological habitat present. An effort must be made to ensure that fish and wildlife objectives for Areas of Concern are consistent with Great Lakes ecosystem objectives and Great Lakes Fishery Commission fish community goals. Further, in the absence of community structure data, this use will be considered restored when fish and wildlife bioassays confirm no significant toxicity from water column or sediment contaminants.*

1.2.5 Bird or Animal Deformities or Reproductive Problem

Status: Impaired

IJC Listing Guideline: *When wildlife survey data confirm the presence of deformities (e.g. cross-bill syndrome) or other reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species.*

Impairment Rationale: There is no data available on the incidence of bird or animal deformities or reproductive problems in the AOC. There are however, contaminants in the creek that are known to bio-accumulate and possibly cause deformities or reproductive problems in wildlife. The creek is easily accessible to fish-eating wildlife.

To assess the overall toxicological risk of surficial sediment contamination within the AOC that is currently exposed to the aquatic community, the U.S. Army Corps of Engineers (USACE), Buffalo District collected sediment samples from 15 locations within the lower reach of Eighteenmile Creek in August 2003. Organic contaminant data indicated that levels of the pesticide dichlorodiphenyldichloroethylene (DDE) in surficial sediments within the AOC may be chronically toxic. Bioaccumulation data indicated that DDE was bio-available throughout AOC surface sediments (mean BSAF range = 1.21 to 5.41). The high bioavailability of DDE in surficial sediments located approximately .10 miles downstream of Burt Dam (BSAF = 4.60) and approximately .35 downstream of Burt Dam (BSAF = 5.41) indicate that it is bio-accumulating in benthic invertebrates, and is likely to bio-accumulate in predator fish and higher trophic levels. (Pickard 2006)

Both sediment and bioaccumulation data suggest that PCBs in surficial sediments throughout most or all of the AOC are being bio-accumulated to levels that pose a risk to aquatic organisms. PCB concentrations are bio-available in surface sediments throughout the AOC (mean BSAF range = 1.55 to 4.36). The high bioavailability of PCBs in the surficial sediments located approximately .10 miles downstream of Burt Dam (BSAF = 2.95) and approximately .35 miles downstream of Burt Dam (BSAF = 4.36) indicate that they are bio-accumulating in benthic invertebrates, and are likely to bio-accumulate in predator fish and higher trophic levels. The site-specific BSAFs determined in this investigation can be used in a model to conservatively predict the bioaccumulation of DDE and PCBs by indigenous benthic organisms from AOC sediments. PCDD/F contamination in surficial sediments throughout the AOC indicate a bioaccumulation risk to wildlife. (Pickard 2006)

Adult fish serve as a food source for piscivorous wildlife. In 2007, eight adult brown bullheads were analyzed for PCBs. The results of this project are presented as Appendix D. Total PCB concentrations in fish sampled ranged from .890 mg/kg to 6.10 mg/kg. All fish that were analyzed exceeded the NYSDEC level established for the protection of fish-eating wildlife (.11 mg/kg) and the PCB critical tissue concentration for effects on fish (.440 mg/kg). Because NYSDEC wildlife criteria for contaminant concentrations in adult fish flesh are exceeded for PCBs in all fish samples, the impairment of this beneficial use is considered likely.

IJC Delisting Guideline: *When the incidence rates of deformities (e.g. cross-bill syndrome) or reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species do not exceed background levels in inland control population.*

1.3 Delisting Criteria

In order to move towards formal delisting of the AOC, delisting targets are needed to gauge success of the restoration of beneficial uses. Delisting targets should be premised on local goals and related environmental objectives for the AOC. They should be consistent with the applicable federal and state regulations, objectives, guidelines, standards and policies, when available, and the principles and objectives embodied in Annex 2 and supporting parts of the GLWQA. Delisting targets should also have measurable indicators.

The delisting criteria presented in Table 1-3 was developed for each confirmed use impairment and, collectively, will provide a decision framework for delisting the Eighteenmile Creek AOC. The criteria will be used to guide the development of remedial actions, preventative measures, regulatory programs, and to direct monitoring efforts. In addition, they will assist in measuring progress towards achievement of water use goals and alleviating use impairments.

Delisting targets were developed locally through a thorough assessment process and are consensus-based. If warranted, the criteria may be revised by the RAC based on the results of future monitoring and assessment and/or unforeseen future developments in the AOC.

Table 1-3 Eighteenmile Creek Beneficial Use Impairment Delisting Criteria

USE IMPAIRMENT	STATUS	CAUSES
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.
3. 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 micrograms per kilogram [$\mu\text{g/kg}$] of weight; Dyer et al. 2000).
5. Bird or animal deformities or reproductive 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)
6. 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 less 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.
7. 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.

1.4 Pollutant Causes and Sources

In order to reduce and/or eliminate pollution impacting the AOC it is necessary to understand the causes and sources of the pollution for each use impairment.

Causes of impairment keep waters from meeting the criteria adopted to protect designated uses including: chemical contaminants (i.e. PCBs, metals, etc), physical conditions (i.e. temperature, excess siltation, alterations of habitat, etc.), and biological contaminants (i.e. bacteria, noxious aquatic weeds).

Sources of impairment are the activities, facilities or conditions that generate the pollutants including: municipal sewage treatment plants, factories, storm sewers, modifications of hydrology, agricultural runoff, etc.)

A number of contaminant sources contribute to the impairments listed in Section 1.2. A general overview of sources and their locations is presented in this section. The contaminants primarily responsible for the impacts listed in Section 1.2 are PCBs, dioxins, dibenzofurans and metals. Additionally, DDT and its metabolites and dieldrin are also impacting the creek. Sources of contaminants to Eighteenmile Creek include, municipal and industrial wastewater discharges, inactive hazardous waste sites, bottom sediments and combined sewer overflows.

In this section, general source categories are presented along with data on specific potential sources within each category. The relationship of the contaminant sources to the impairments is also discussed.

GENERAL OVERVIEW OF POLLUTION SOURCES

Industrial and Municipal Wastewater Discharges

Direct discharge of wastewater to the creek from industrial facilities and municipal wastewater treatment plants is a potential source of contaminants to Eighteenmile Creek. New York State regulates these discharges through the State Pollutant Discharge Elimination System (SPDES) program. SPDES permits specify the allowable volume, contaminant concentrations and physical characteristics (temperature and pH) of the discharge as well as reporting and monitoring requirements. There are five industrial and municipal facilities currently permitted to discharge to Eighteenmile Creek.

The five facilities permitted to discharge into Eighteenmile Creek are: Delphi Harrison Thermal Systems, Milward Alloys, Vanchem, the City of Lockport Wastewater Treatment Plant, and the Gasport Sewer District #1 Wastewater Treatment Plant. Delphi Harrison Thermal Systems has regular, though not continuous, discharges. Milward Alloys discharges only non-contact cooling water and is regulated for temperature, pH and flow. Vanchem also discharges only non-contact cooling water. The City of Lockport Wastewater Treatment Plant and Gasport Sewer District #1 have continuous treated wastewater discharges. There are no permitted discharges of pesticides, PCBs, dioxins or furans to the creek.

Inactive Hazardous Waste Sites

Contaminants in the ground water and soil at hazardous waste sites have the potential to migrate off site. Because of this, sites within the watershed of Eighteenmile Creek are potential sources of contaminants to the creek. Nineteen hazardous waste sites have been identified within the Eighteenmile Creek

watershed, fourteen of which have been remediated or de-listed. The remaining five sites have the potential to affect on- and off-site environmental media. Those sites include: Delphi Harrison/ TCE Site; Guterl Steel Plant Site; Guterl Steel Landfill Site; Old Upper Mountain Road Site and; the Eighteenmile Creek Corridor Site. Contaminated soils and water can migrate off site and affect the surrounding area. Some of the contaminants of concern that were indicated during initial investigations of these sites include PCBs and heavy metals. The locations of these sites are shown in Figure 2-1. A summary of their status is given in Table 1-4. A detailed description of the work completed and the sites which remain active can be found in Section 2.2.1 of this document.

TABLE 1-4 INACTIVE HAZARDOUS WASTE SITE PROGRESS CHART

SITE NAME	PHASE I	PHASE II	RI/FS	DESIGN	CONST.	REMEDiation COMPLETE OR NOT REQUIRED
Lockport City Landfill						
Diversified Manufacturing						
Dussault Foundry						
Harrison Radiator/Landfill						
Niagara County Refuse						
Norton Labs						
AKZO Chemical						
Guterl Steel/Landfill Site						
Guterl Steel/ Plant Site			USACE FUSRAP PROGRAM			
Van DeMark						
Wilson-Cambria Landfill						
Diamond Shamrock						
Flintkote/ Plant Building						
Niagara Materials						
Town of Lockport Landfill						
NYSEG Substation						
Delphi Harrison Systems						
Eighteenmile Corridor						
Old Upper Mountain Rd.						

Sediments

The Lakewide Management Plan for Lake Ontario has documented six critical pollutants that contribute to impairments based on their toxicity and persistence in the environment: PCBs, mercury, DDT, dieldrin, mirex, and dioxins. Numerous studies have revealed that sediments in Eighteenmile Creek are a source of these pollutants to Lake Ontario, most notably, PCBs. A recent investigation of sediment contaminants in Eighteenmile Creek by NCSWCD in the City of Lockport (E&E 2007) found that PCBs were present in sediments in most areas sampled. Samples were taken from Harwood Street, immediately downstream of the former Flintkote site, to Stone Road, which encompasses a stream length of approximately 8,000 feet (2,000 feet of this study area was omitted due to limited access and sediment accumulation). PCB concentrations were generally lower in deeper sediments, suggesting that there continues to be an active source of PCBs discharging to Eighteenmile Creek. Sediment studies have also revealed that heavy metal concentrations in sediments are also near or above TAGM criteria (Ecology and Environment, Inc. 2007) in the upper portion of the watershed.

Sediment PCB concentrations are generally higher above Burt Dam, which acts as a sediment sink within the ecosystem. High PCB levels found above the dam indicate that pollution sources are in the upper portion of the watershed. However, sediment contaminants are also found downstream within the AOC. In 2004, the Army Corps of Engineers analyzed sediments from 15 sites in the vicinity of the Village of Olcott near the outlet to Lake Ontario, and used sediment toxicity levels to determine bioaccumulation rates of these pollutants by exposing benthic oligochaetes (*Lumbriculus variegates*) to sediments for 30 days. Various pollutants were found in the tissues of these organisms depending on which sediment sample they were exposed to. Pollutants included chlorinated pesticides, PCBs, and heavy metals (USACE – ERDC 2004).

The results of the bioaccumulation study together with a recent study below Burt Dam (USEPA 2006a) indicate the continual transfer of these pollutants to the water column. PCBs, mercury, and dioxins were all detected in the ambient water. Ambient water PCB concentrations were significantly higher in Eighteenmile Creek than any other tributaries to Lake Ontario (Black River, Salmon River, Oswego River, and Genesee River).

Investigations completed in the 1980s and 1990s indicated that the sediments of Eighteenmile Creek and within the AOC may be contaminated with polychlorinated biphenyls (PCBs). PCBs are factors in restrictions on fish and wildlife consumption, bird and animal deformities, or reproductive problems and degradation of benthos. A surface sediment sample collected in 1994 from Olcott Harbor contained PCBs at a concentration greater than the NYSDEC guidance for screening of contaminated sediments. Ten of 15 fish flesh samples from the creek contained PCBs at levels above the U.S. Food and Drug Administration action level of 2.0 milligrams per kilogram (mg/kg). Sediment samples collected during NYSDEC investigations in the upstream portion of the creek (Flintkote Site) contained PCBs at 49 mg/kg (TVGA 2005).

NY State Barge Canal

Canal locks are operational during the navigation season from early May to mid November. During this summer operating season, it has been reported by Canal personnel that two of the three sluice structures are opened 5 inches each. When open, the sluice structures draw canal water off near the bottom of the canal and discharge it into the Hall Spillway on the south side of the canal. There the canal waters combine with flow from Eighteenmile Creek. The flow from the canal has been previously reported to be approximately 50 cubic feet per second (cfs); however, flow measurements conducted in 2008 as part of a Supplemental Remedial Investigation for the Eighteenmile Creek Corridor Site, measured this combined dry weather flow to be approximately 200 cfs. (NYSDEC 2010) Flow measurements of the East Branch were also measured by the NYSDEC during the Fall of 2009. The average flows for October 29, 2009 and November 12, 2009 were determined to be 91 and 108 cfs, respectively. During dry weather periods, the Barge Canal provides a significant portion of the creek's flow. (NYSDEC 2010)

The canal is drained every year for the non-navigational season to minimize the potential for freeze/thaw effects on the canal's elevated embankments and to perform routine maintenance on the system structures. The Barge Canal is drained annually at several locations along its length. In Lockport, NY, it is drained directly to the East Branch of Eighteenmile Creek through a spillway on the southern side of the canal, just west of Mill Street. If maintenance is needed in the canal, the water level in the canal is

further lowered by removing a “plug” located in the middle of the canal bottom. The plug drains into the tunnel that connects the headwaters of the East Branch with the junction of the spillway and the upstream waters of Eighteenmile Creek. Maintenance is performed as needed; therefore, the plug is only removed when maintenance requirements dictate that an extreme low water level is necessary. (NYSDEC 2010)

Water quality sampling completed in the past has shown that PCB levels are above aquatic water quality standards with the Canal. (NYSDEC 1997) Two Passive In Situ Chemical Extraction Sampler (PISCES) samples taken in the canal, as part of a 1994 Lake Ontario Tributary Sampling, contained aqueous phase PCBs at estimated concentrations of 0.0185 ug/l (parts per billion) and 0.0143 ug/l. This is above the aquatic water quality standard of 0.001 ug/l. (NYSDEC 1997) It should be noted that PISCES sampling is only semi-quantitative and direct comparison to water quality standards is not definitive.

During April 2005, nine sediment samples were collected from five locations in the Barge Canal immediately upstream of Eighteenmile Creek. These samples were collected as part of the Remedial Investigation of the NYSEG Substation at South Transit Street and State Road in the City of Lockport, Niagara County, New York. PCBs were detected in all nine samples at concentrations ranging from 7.01 to 310,000 µg/l. The principal aroclors detected were 1248 and 1254, although aroclor 1242 was detected in three of the samples. Six of the samples contained PCBs at concentrations that exceeded the NYSDEC sediment criterion for chronic toxicity to benthic aquatic life (606 µg/l) and the NYSDEC Part 375 surface soil cleanup objective (1,000 µg/l). Additionally, two contained PCBs at concentrations that exceeded the 50,000 µg/l hazardous waste criterion. (NYSDEC 2010)

These past investigations all but confirmed the NY Barge Canal as a potential source of PCBs to Eighteenmile Creek. However, in 2010 as part of NYSDEC's Supplemental Remedial Investigation of the Eighteenmile Creek Corridor Site, further sampling of sediment in the Canal was completed to evaluate possible discharge into Eighteenmile Creek. PISCES sampling was conducted in the Barge Canal at the confluence of the two channels downstream of the lock and Power Plant, and near the spillway to Eighteenmile Creek. PISCES were also deployed in Eighteenmile Creek in approximately the midpoint of the East Branch, the midpoint of the West Branch, and downstream of the Clinton Street Dam. PISCES deployment was timed so that the samplers were in place two weeks before the canal was drained.

The results of the PISCES sampling determined there were no PCBs detected above the reporting limit of 500 nanograms per sample (ng/sample) for the five PISCES samples. To confirm these results, the sample collected near the Clinton Street Dam was analyzed for additional low PCBs (congener analysis). This sample was selected for the PCB congener analyses because it was collected adjacent to a previously identified transect line that exhibited the highest PCB concentrations in the sediment samples collected during a 2010 Supplemental Remedial Investigation for the Eighteenmile Creek Corridor Site. Congener analysis identified one congener (PCB52) in the sample at a concentration of 11 ng/sample, just above the reporting limit of 10 ng/sample. (NYSDEC 2010) The PISCES technique identifies the dissolved or soluble PCBs that can pass through the apparatus membrane and provide an indication of the PCB concentrations in the surface water. This technique does not capture PCBs transported on suspended solids. PISCES results are an indication of potential exposure of fish to PCBs in the water column. The data indicated no potential exposure. (NYSDEC 2010)

Additional PCB sampling efforts included: surface water suspended solids in the NY Barge Canal; surface water in the NY Barge Canal and Eighteenmile Creek and; suspended sediments in NY Barge Canal discharge to Eighteenmile Creek. The results of the collection and analysis of water samples from the Barge Canal showed low levels of Suspended Sediments at a concentration of 6.0 mg/l. It should be noted that there is no water quality standard for Total Suspended Solids (TSS). The results of the collection and analysis of water samples from both the Barge Canal and Eighteenmile Creek showed low concentrations of PCBs (aroclor 1248) within the water column downstream of Flintkote. Samples collected from the Barge canal and upstream of Flintkote did not detect PCBs at levels above the reporting limit of 0.050 ug/l. The results of the collection and analysis sediment suspended in NY Barge Canal discharge to Eighteenmile Creek did not detect PCBs at levels above the reporting limit of 0.050 ug/l. (NYSDEC 2010)

Given these recent results and the fact that PCBs are not present in the suspended sediment and therefore are not being conveyed into Eighteenmile Creek under normal operational flow conditions, the NY Barge Canal can be ruled out as a source of PCBs to Eighteenmile Creek.

CHAPTER 2

COMPLETED AND ONGOING REMEDIAL MEASURES

CHAPTER 2: Completed and Ongoing Remedial Measures

Introduction

As defined in 4(a)(iii) of Annex 2 of the Great Lakes Water Quality Agreement, as amended in 1987, Stage 2 RAPs are to be submitted to the International Joint Commission for review and comment and are to contain an evaluation of remedial measures in place.

This chapter describes and briefly evaluates remedial programs and actions that have either been completed or are ongoing in the Eighteenmile Creek Area of Concern.

Completed and ongoing remedial measures have been separated into two categories, peripheral and direct measures. Peripheral measures are activities or programs which have assisted in achieving progress in the Area of Concern but were not specifically intended for Eighteenmile Area of Concern restoration. Direct measures are activities or programs which have commenced that directly assist in the restoration of the Eighteenmile Creek Area of Concern.

2.1 PERIPHERAL REMEDIAL MEASURES

2.1.1 Polychlorinated biphenyl (PCB) Production Ban

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organization: U.S. Environmental Protection Agency

Measure

Polychlorinated biphenyls (PCBs), originally termed "chlorinated diphenyls," were commercially produced as complex mixtures containing multiple isomers at different degrees of chlorination. In the United States, commercial production of PCBs was taken over in 1929 by Monsanto Company from Swann Chemical Company. Manufacturing levels increased in response to the electrical industry's need for a "safer" (than flammable mineral oil) cooling and insulating fluid for industrial transformers and capacitors.

PCBs are persistent organic pollutants and have entered the environment through both use and disposal. In the past PCBs entered the environment in wastewater directly discharged into surface waters from various industries or as treated wastewater from municipal or industrial treatment plants. They also entered the environment via accidental spills and leaks, during transport, or from leaks and/or fires in products and equipment which contained PCBs.

PCBs were used as coolants and insulating fluids (transformer oil) for transformers and capacitors, especially in components of early fluorescent light fittings and electrical transformers, and as plasticizers in paints and cements, stabilizing additives in flexible PVC coatings of electrical wiring and electronic components, pesticide extenders, cutting oils, reactive flame retardants, lubricating oils, hydraulic fluids, and sealants (for caulking in schools and commercial buildings), adhesives, wood floor finishes (such as Fabulon and other products of Halowax in the U.S.), paints, de-dusting agents, water-proofing compounds, casting agents, vacuum pump fluids, fixatives in microscopy, surgical implants, and in carbonless copy paper.

In 1977, Monsanto Chemical Company, producers of approximately 99% of the PCBs used by industry in the U.S., voluntarily halted production. Also in 1977, the U.S. Environmental Protection Agency issued final regulations prohibiting manufacturers and producers of transformers and capacitors from discharging PCBs in waterways, and limiting the level of PCBs in ambient water samples to <.001 micrograms per liter (mg/l). In 1978, the U.S. began to regulate the storage and disposal of PCBs.

Congress enacted the Toxic Substances Control Act (TSCA) on October 11, 1976 as a supplement to other federal environmental regulations. The TSCA established requirements for identifying and controlling toxic chemical hazards to human health and the environment. It is a tool by which the EPA regulates all aspects of the testing, reporting, manufacturing, processing, distribution in commerce, use, and disposal of toxic chemical substances and mixtures that pose an unreasonable risk to health or the environment. A major benefit of the TSCA was quality management of chemicals, which brought about a change in the way companies organize and track information on chemicals and caused them to seek ways to prevent releases and negative impacts to human health and the environment.

Since 1979 PCBs have been regulated primarily under TSCA, which dictates restrictions on the manufacture, sale, use, disposal, import and export of PCBs. Section 6(e) of the TSCA specifically addressed PCB's and banned the manufacture, processing, distribution, and use of PCBs other than in a totally enclosed manner, unless authorized by the EPA. This section of the TSCA requires the EPA to establish rules for the manufacture, processing, distribution in commerce, use, storage, disposal, and marking of PCB's and equipment contaminated with PCB's. The rules (40 CFR Part 761) were first published in the Federal Register on May 31, 1979 and on August 28, 1998 received their first major revision, known as the Mega Rule, which consumed 91 pages in the Federal Register.

Revisions incurred a year later (June 24, 1999) included: procedures for requesting approval for risk-based sampling, cleanup, storage, or disposal of PCB remediation waste; procedures for risk-based decontamination or sampling of decontaminated material where those activities occur in more than one EPA Region; and several technical corrections. In addition, the EPA published several Information Collection Requests that have not resulted in any further rules. However, on March 30, 2001, an interpretive final rule was published that narrowed the interpretation of "import" to allow PCB waste in U.S. territories and possessions outside the U.S. to be transported to the U.S. for destruction or disposal. In 2010, U.S. EPA published an Advance Notice of Proposed Rulemaking (ANPRM) which focuses upon a Reassessment of Use Authorizations.

On June 29, 1998, the EPA promulgated the Final Rule (Mega Rule) for the Disposal of PCBs, which became effective on August 28, 1998. The Mega Rule specifically addresses the natural gas pipeline systems and allows for the characterization of natural gas pipeline systems and components based on the actual PCB concentrations at removal, rather than former presumptions or historical data. This rule provides more flexibility in PCB disposal practices while continuing to provide protection from unreasonable risk.

PCB Classifications

The regulatory requirements that apply to materials containing PCBs depend on the PCB concentration. The three classifications based on PCB concentrations are: (i) <50 parts per million (ppm) or the equivalent <10 ug/100cm², (ii) >50 ppm and <500 pp2m or the equivalent 10 - 100 ug/100 cm², and (iii) >500 ppm or the equivalent >100 ug/100 cm . PCBs under 50 ppm are not regulated by TSCA. The EPA has used various administrative mechanisms to declassify or decontaminate pipeline systems and components. Several methods for determining PCB concentration are described in the Mega Rule.

Manufacturing, Processing, Distribution in Commerce, and Use of PCBs and PCB Items

Natural gas pipeline systems contaminated in the past with PCBs >50 ppm are authorized for use and reuse, provided the owner or operator notifies the EPA of the contamination, characterizes its extent, samples and analyzes potential sources of contamination, and takes remedial measures such as removing the contamination sources or reducing the PCB concentration to <50 ppm and documents these actions. However, the EPA does not allow the introduction of PCBs into natural gas pipeline systems at any concentration.

Marking of PCBs and PCB Items

Marking is required for all PCB items, containers, storage units or areas, and transport vehicles. Due to potential exposure to PCB liquids, natural gas pipeline companies are required to mark all aboveground sources containing PCB liquids at concentrations >50 ppm. The EPA has established specific marking requirements, including size, color, and location of the marks.

Storage and Disposal

All PCB wastes generated from natural gas pipelines, such as liquids and solids contaminated with PCBs, must be stored in accordance with EPA requirements. PCB articles and containers must be dated and properly labeled when placed in storage for disposal and must be disposed within one year, or longer with EPA approval. The facility used for storage must comply with the storage for disposal requirements. Temporary storage areas can be used for up to 30 days. Generator Long-Term Storage Facilities may be used to store PCBs for up to nine (9) months.

The EPA specifies requirements for disposal of all PCB wastes, including used pipe, condensate, and other liquids and solids contaminated with PCBs at levels >50 ppm or 10 ug/100 cm². The disposal options are based on the PCB concentration. All PCB articles stored for reuse are required to be properly marked/labeled, indicating the date of removal and intended future use and can be stored at the facility not more than five years. After five years, these articles must be moved to an EPA-approved storage facility. This requirement is due to the concern that long-term storage may result in deterioration of PCB articles and release of PCBs.

PCB Cleanup

The PCB Spill Cleanup Policy establishes methods of cleanup and cleanup levels of spills containing PCBs at concentrations of 50 ppm or greater. It specifies cleanup of PCBs to different levels depending on the spill location, the potential for exposure to residual PCBs remaining after the cleanup, the concentration of the PCBs initially spilled, and the nature and size of the population potentially at risk of exposure. The Policy imposes the most stringent requirements in areas of greatest potential for human exposure to spilled PCBs, less stringent requirements where the type and degree of contact present lower potential exposure, and even less stringent requirements where there is little potential for any direct human exposure.

Record Keeping and Reporting

The EPA requires that records be maintained for the storage, transportation, disposal of PCBs, or any other activity involving PCBs, for tracking from generation to disposal in a cradle-to-grave fashion. Records to be maintained include annual activity logs, correspondence with the shipper of the waste, certificates of disposal, and volumes and weights of all PCB waste shipped during the year. All records are to be maintained for at least three years.

2.1.2 DDT Usage Ban

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organization: U.S. Environmental Protection Agency, York State Department of Environmental Conservation

Measure

Dichlorodiphenyltrichloroethane (DDT) is one of the most well-known synthetic insecticides. It is a chemical with a long, unique, and controversial history. First synthesized in 1874, DDT's insecticidal properties were not discovered until 1939, and it was used with great success in the second half of World War II to control malaria and typhus among civilians and troops. The Swiss chemist Paul Hermann Müller was awarded the Nobel Prize in Physiology or Medicine in 1948 for his discovery of the high efficiency of DDT as a contact poison against several arthropods. After the war, DDT was made available for use as an agricultural insecticide, and soon its production and use skyrocketed.

DDT is the best-known of several chlorine-containing pesticides used in the 1940s and 1950s. With pyrethrum in short supply, DDT was used extensively during World War II by the Allies to control the insect vectors of typhus — nearly eliminating the disease in many parts of Europe. In the South Pacific, it was sprayed aerially for malaria and dengue fever control with spectacular effects. While DDT's chemical and insecticidal properties were important factors in these victories, advances in application equipment coupled with a high degree of organization and sufficient manpower were also crucial to the success of these programs. In 1945, it was made available to farmers as an agricultural insecticide, and it played a minor role in the final elimination of malaria in Europe and North America. By the time DDT was introduced in the U.S., the disease had already been brought under control by a variety of other means. One CDC physician involved in the United States' DDT spraying campaign said of the effort that "we kicked a dying dog."

In the 1970s and 1980s, agricultural use was banned in most developed countries, beginning with Hungary in 1968, Norway and Sweden in 1970, Germany and the United States in 1972, but not in the United Kingdom until 1984. Vector control use has not been banned, but it has been largely replaced by less persistent alternative insecticides. Despite the worldwide ban, agricultural use continues in India, North Korea, and possibly elsewhere.

As early as the 1940s, scientists in the U.S. had begun expressing concern over possible hazards associated with DDT, and in the 1950s the government began tightening some of the regulations governing its use. However, these early events received little attention, and it was not until 1957, when the New York Times reported an unsuccessful struggle to restrict DDT use in Nassau County, New York, that the issue came to the attention of the popular naturalist-author, Rachel Carson. William Shawn, editor of *The New Yorker*, urged her to write a piece on the subject, which developed into her famous book *Silent Spring*, published in 1962. The book argued that pesticides, including DDT, were poisoning both wildlife and the environment and were also endangering human health.

Silent Spring was a best seller, and public reaction to it launched the modern environmental movement in the United States. DDT became a prime target of the growing anti-chemical and anti-pesticide movements, and in 1967 a group of scientists and lawyers founded the Environmental Defense Fund (EDF) with the specific goal of winning a ban on DDT. Victor Yannacone, Charles Wurster, Art Cooley and others associated with inception of EDF had all witnessed bird kills or declines in bird populations and suspected that DDT was the cause. In their campaign against the chemical, EDF petitioned the government for a ban and filed a series of lawsuits. Around this time, toxicologist David Peakall was measuring DDE levels in the eggs of peregrine falcons and California condors and finding that increased levels corresponded with thinner shells.

In response to an EDF suit, the U.S. District Court of Appeals in 1971 ordered the EPA to begin the de-registration procedure for DDT. After an initial six-month review process, William Ruckelshaus, the Agency's first Administrator rejected an immediate suspension of DDT's registration, citing studies from the EPA's internal staff stating that DDT was not an imminent danger to human health and wildlife. However, the findings of these staff members were criticized, as they were performed mostly by economic entomologists inherited from the United States Department of Agriculture, whom many environmentalists felt were biased towards agribusiness and tended to minimize concerns about human health and wildlife. The decision not to ban thus created public controversy.

The EPA then held seven months of hearings in 1971–1972, with scientists giving evidence both for and against the use of DDT. In the summer of 1972, Ruckelshaus announced the cancellation of most uses of DDT—an exemption allowed for public health uses under some conditions. Immediately after the cancellation was announced, both EDF and the DDT manufacturers filed suit against the EPA, with the industry seeking to overturn the ban, and EDF seeking a comprehensive ban. The cases were consolidated, and in 1973 the U.S. Court of Appeals for the District of Columbia ruled that the EPA had acted properly in banning DDT.

The U.S. DDT ban took place amidst a growing public mistrust of industry, with the Surgeon General issuing a report on smoking in 1964, the Cuyahoga River catching fire in 1969, the fiasco surrounding the use of diethylstilbestrol (DES), and the well-publicized decline in the bald eagle population.

Environmental Impact

DDT is a persistent organic pollutant that is extremely hydrophobic and strongly absorbed by soil. Depending on conditions, its soil half life can range from 22 days to 30 years. Routes of loss and degradation include runoff, volatilization, photolysis and aerobic and anaerobic biodegradation. When applied to aquatic ecosystems it is quickly absorbed by organisms and by soil or it evaporates, leaving little DDT dissolved in the water itself. Its breakdown products and metabolites, DDE and DDD, are also highly persistent and have similar chemical and physical properties. DDT and its breakdown products are transported from warmer regions of the world to the Arctic by the phenomenon of global distillation, where they then accumulate in the region's food web.

Because of its lipophilic properties, DDT has a high potential to bio-accumulate, especially in predatory birds. DDT, DDE, and DDD magnify through the food chain, with apex predators such as raptor birds concentrating more chemicals than other animals in the same environment. They are very lipophilic and are stored mainly in body fat. DDT and DDE are very resistant to metabolism; in humans, their half-lives are 6 and up to 10 years, respectively. In the United States, these chemicals were detected in almost all human blood samples tested by the Centers for Disease Control in 2005, though their levels have sharply declined since most uses were banned in the US. Estimated dietary intake has also declined, although FDA food tests commonly detect it.

In 2003, the U.S. Army Corps of Engineers assessed the bioavailability of surficial sediments within the AOC. With respect to organic compounds, DDE concentrations in surficial sediments were found to be chronically toxic. DDE was also found to be highly bioavailable in certain areas of the AOC. This indicates that DDE is accumulating in benthic organisms, and is likely to bioaccumulate in predator fish and higher trophic levels.

2.1.3 Lake Ontario Lakewide Management Plan

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organization: U.S. Environmental Protection Agency, York State Department of Environmental Conservation, Government of Canada

Measure

A Lakewide Management Plan (LaMP) is a plan of action to assess, restore, protect and monitor the ecosystem health of a Great Lake. It is used to coordinate the work of all the government, tribal, and non-government partners working to improve the Lake ecosystem. A public consultation process is used to ensure that the LaMP is addressing the public's concerns.

The Lake Ontario Lakewide Management Plan (LaMP) is a bi-national plan to restore and protect the health of Lake Ontario by reducing chemical pollutants entering the lake and addressing the biological and physical factors impacting the lake. The LaMPs activities are coordinated by Canadian and U.S. federal, state and provincial government agencies.

The Lake Ontario LaMP includes ecosystem goals, objectives and indicators. Ecosystem objectives have been identified for aquatic communities, wildlife, human health and stewardship. The twelve indicators are designed to track progress towards achieving the ecosystem objectives.

The Lake Ontario LaMP focuses on resolving:

- Lakewide beneficial use impairments as defined in the Great Lakes Water Quality Agreement (Annex 2) and described in Chapter 4 of this report;
- Critical pollutants contributing to, or likely to contribute to, these impairments despite past application of regulatory controls, due to their toxicity, persistence in the environment, and/or their ability to accumulate in organisms; and
- Physical and biological problems caused by human activities.

The LaMP addresses sources of lakewide critical pollutants, which are those substances responsible, either singly or in synergistic or additive combination, for beneficial use impairments in the open lake waters of both countries, as well as those substances that exceed criteria and are therefore likely to impair such uses, which require bi-national actions for resolution. This plan is to be coordinated with AOC Remedial Action Plans (RAPs) within the Lake Ontario drainage basin and other localized efforts which are best suited to address issues of local concern. In addition, this Plan is to utilize linkages to other natural resource management activities, such as the development of Lake Ontario fish community objectives by the Great Lakes Fishery Commission and the Lake Ontario Committee of fisheries managers. The LaMP addresses impairments found in open waters of the lake and nearshore areas, without duplicating the efforts of localized remedial action plans. Tributaries, including the Niagara River, are treated as inputs to the lake. The St. Lawrence River is treated as an output from the lake.

There are connections between the Lake Ontario LaMP and Lake Ontario RAPs. Local RAP strategies for remediation and prevention can provide information about each AOC that is fundamental to the development and successful initiation of the LaMP. In contrast, policies and programs that may be developed under the LaMP will provide the AOCs with possible avenues to address problems that can't be addressed at the sub-basin or local level.

The Lake Ontario LaMP Committee is continuing its efforts to restore and protect the lake's ecosystem. The LaMP continues to work on the implementation of the Lake Ontario Bi-national Biodiversity Conservation Strategy, establishing monitoring programs for coastal wetlands indicators, determining the research and monitoring needs for the next bi-national cooperative intensive study of the lake, and undertaking programs that lead to the reduction of toxic chemicals and sediments impacting the nearshore.

2.1.4 Fish Health Monitoring and Advisories

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations

Measure Status: Ongoing

Lead Organization: New York State Department of Environmental Conservation

Measure

The New York State Department of Environmental Conservation (DEC) routinely monitors contaminant levels in fish and wildlife. The New York State Department of Health (DOH) issues an advisory on eating sportfish and wildlife taken in New York State because some of these foods contain potentially harmful levels of chemical contaminants.

Based on the results of various sampling programs, the NYSDOH annually generates a recreation fishery health advisory in consultation with NYSDEC. To help anglers choose which fish to keep for food, NYSDOH has two types of health advice:

(1) General advice: The general health advisory for sportfish is that people can eat up to four one-half pound meals a month (which should be spaced out to about a meal a week) of fish from all New York State fresh waters and some marine waters near the mouth of the Hudson River. If there is no specific advice for a particular waterbody, follow this general advice for these waters.

(2) Specific advice: For some waterbodies in New York, NYS DOH issues stricter advice (eat a limited amount or none at all) because contaminant levels in some fish are higher. To be more protective, NYS DOH advises that infants, children under the age of 15 and women under age 50 should not eat any fish from these waterbodies.

The primary contaminants of concern in New York State fish are mercury and PCBs. Other contaminants such as cadmium, chlordane, DDT, dieldrin, dioxin and mirex are also concerns in fish from some of the State's waterbodies. These chemicals build up in your body over time. Health problems that may result from these contaminants range from small changes in health which are hard to detect to birth defects and cancer. Women who eat highly contaminated fish and become pregnant may have increased risk of having children who are slower to develop and learn. Chemicals may have a greater effect on developing organs in young children or in the unborn child. Some chemicals may be passed on in mother's milk. Women beyond their childbearing years and men face fewer health risks from contaminants than do children.

Specifically for Eighteenmile Creek, contaminants of greatest concern in the creek are PCBs. Over the past 15 years, all past fish samples collected from above Burt Dam and 40% of samples collected from below the dam exceeded the Food and Drug Administration (FDA) limit for human consumption of 2 mg/kg for PCBs. Of the fish analyzed for dioxins, two whole fish samples (a carp and a brown trout both

from Olcott area) exceeded the New York State guideline concentration of 0.00001 mg/kg with concentrations of 0.0000432 mg/kg and 0.000012 mg/kg respectively.

There are actually two consumption advisories for Eighteenmile Creek. The area downstream stream of the Burt Dam to Olcott Harbor follows the guidance set forth for Lake Ontario. The 2010-2011 advisory gives the following advice:

- **DO NOT EAT** Channel Catfish, Carp, lake trout over 25” and brown trout over 20” due to PCBs, Mirex and Dioxins.
- **EAT UP TO ONE MEAL PER MONTH** of Chinook salmon, rainbow trout, white sucker, smaller lake trout, smaller brown trout and Coho salmon over 25” due to PCBs, Mirex and Dioxins.

The rest of the creek upstream of the Burt Dam has its own separate guidance. The 2010-2011 advisory gives the following advice:

- **DO NOT EAT** any species of fish (regardless of size) due to PCBs.

2.1.5 Annual Fish Stocking and Pen Rearing

Use Impairments Addressed:

#3 Degradation of Fish and Wildlife Populations

Measure Status: Ongoing

Lead Organization: New York State Department of Environmental Conservation

Measure

The NYSDEC in conjunction with Niagara County Federation of Conservation Clubs conducts an annual fish stocking program for various bodies of water throughout Niagara County. Each year NYSDEC releases over one million pounds of fish into more than 1,200 public streams, rivers, lakes and ponds across the state. These fish are stocked for two main purposes-- to enhance recreational fishing and to restore native species to waters they formerly occupied. Table 2-1 reflects the fish stocked in Eighteenmile Creek from 2003 through 2010.

TABLE 2-1 EIGHTEENMILE CREEK FISH STOCKING EFFORT

Species	Size in Inches	2003	2004	2005	2006	2007	2008	2009	2010	2011
Chinook Salmon	3-3.5	122,000	134,000	67,100	134,200	134,200	67,100	130,637	134,200	No data available
Coho Salmon	5	30,000	30,000	30,000	30,000	30,000	19,500	30,000	3,000	No data available
Brown Trout	3	0	0	0	25,000	0	0	0	0	No data available
Rainbow Trout	3	0	7,000	0	12,500	7,000	7,000	7,000	7,660	No data available

2.1.6 Development of Fish Consumption Information Pamphlet

Use Impairments Addressed:

#1 Restrictions on Fish and Wildlife Consumption

Measure Status: Ongoing

Lead Organization: New York State Department of Health

Measure

A Western New York region fish advisory pamphlet was developed by New York State Health Department. The brochure provides health advice on eating fish caught from waters in seven counties of western New York State. It provides advice for women over age 50 and men, and special advice for women of childbearing age (under age 50) and children (under age 15). It includes a map showing all waters with health advisories. Consumption advisories for Eighteenmile Creek and Lake Ontario are listed in the pamphlet. The pamphlet also highlights why fish advisories exist, the risk associated with eating certain fish and provides tips for healthier eating and ways to minimize exposure to harmful chemicals present in fish caught in New York.

The purpose of the pamphlet is to provide information to those groups which most likely consume the largest amount of fish from within the targeted area. The target audience is the general public, often of low socio-economic status, who consume locally caught fish as a regular part of their diet. Specific to Eighteenmile Creek, a larger number of anglers (approximately 10,000 annually) from other States and regions of New York travel to Eighteenmile Creek to take advantage of the world class salmon fishery during the fall migration season. It is a goal of the RAC to target this audience as well because they are most likely not familiar with local consumption advisories.

The pamphlet has been widely distributed in the local community with an emphasis on reaching the targeted groups whenever possible. Locations where the pamphlet has been distributed include: town halls; libraries; community centers and; bait shops. The pamphlet has also been distributed at various education and outreach events in the area and is available at a number of informational/education kiosks located in high traffic areas within the Eighteenmile Creek watershed.

2.2 DIRECT REMEDIAL MEASURES

2.2.1 New York State's Inactive Hazardous Waste Disposal Site Remedial Program

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organization: New York State Department of Environmental Conservation

Background

The Inactive Hazardous Waste Disposal Site (IHWDS) Program, also known as Superfund, is the State's program for identifying, investigating and cleaning up sites where consequential amounts of hazardous waste may exist. These sites go through a process of investigation, evaluation, cleanup and monitoring that has several distinct stages.

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) is made aware of potential hazardous waste sites in a variety of ways, including notification by the responsible party and citizen complaints. An environmental investigation called a Site Characterization (SC) is performed when DER is made aware that hazardous waste has or may have been disposed of at a site. The goal of the SC is to determine whether a site meets the state's definition of an inactive hazardous waste disposal site by confirming the presence of hazardous waste and determining the threat posed by the site to public health or the environment. DER or the potentially responsible party performs the SC.

Once the presence of a consequential amount of hazardous waste is confirmed at a site, the site is added to the State's official list of sites and is given one of the following classification codes presented in Table 2-2. After listing, a site goes through several steps in the process of assessment and remediation. The first is a Phase I investigation where the site history is checked and a physical survey of the site is conducted. The second step is a Phase II investigation in which the health and environmental impact of the site is assessed through sampling, various geophysical techniques and study of the site's geology and geography. For sites where remediation is required, a remedial investigation/feasibility study (or RI/FS) is undertaken to complete the site characterization and to evaluate remedial alternatives. Design and construction follow after selection of a remedial alternative.

TABLE 2-2 SITE CODES FOR HAZARDOUS WASTE SITES

Class 1 Site	Causing, or presenting an imminent danger of causing, irreversible or irreparable damage to the public health or the environment - immediate action is required.
Class 2 Site	Significant threat to the public health or environment - action required
Class 2a Site	Temporary classification assigned to sites where there is confirmed disposal of hazardous waste but there is inadequate data on hazardous waste impact to the environment and human health to assign them to the five classifications specified by law
Class 3 Site	Does not present a significant threat to the environment or public health - action may be deferred
Class 4 Site	Site properly closed - requires continued management
Class 5 Site	Site properly closed - does not require continued management
Class D	Site delisted, no hazardous waste present on site

Sites that receive a classification of 2 (representing a significant threat to public health and/or the environment and requiring action) usually undergo a detailed environmental investigation, called a remedial investigation. When the parties responsible for the contamination are known, the responsible parties often pay for and perform the investigation and evaluation of cleanup options. At sites where responsible parties cannot be found or are unable or unwilling to fund an investigation, the State pays for the investigation using money from the 1986 Environmental Quality Bond Act, also known as the "State Superfund." The State may try to recover costs from a responsible party after the investigation and cleanup are complete.

Each class 2 site is assigned a project manager. Regional IHWDS Program staff serves as project managers for many inactive hazardous waste disposal sites in their respective regions. Staff members in DEC's Albany office serve as project managers for the remaining sites. For sites where state money pays for an investigation, the project manager oversees the investigation and evaluation of cleanup options directly, or he may supervise a consultant hired to do the work. When a responsible party performs an investigation, the project manager reviews and approves investigation work plans and reports and ensures the responsible party performs a thorough and proper investigation. The project manager also works closely with New York State Department of Health staff who ensure that public health concerns are addressed.

The project manager writes the Proposed Remedial Action Plan (PRAP) that outlines the State's preferred method to address the site. The project manager presents the proposed plan at a public meeting and responds to public comments. After a final plan is selected and the Record of Decision (ROD) is approved, DER staff may remain involved with the design and implementation of the cleanup.

Measure

The initial Stage I/II Eighteenmile Creek RAP document completed in 1997 identified 15 inactive hazardous waste sites within the Eighteenmile Creek watershed. Subsequently, four additional sites were identified after the completion of the document, which include: Delphi Harrison/ TCE Site; Guterl Steel/

Plant Site and; Old Upper Mountain Road Site and; the Eighteenmile Creek Corridor Site. All inactive hazardous waste site locations are presented in Figure 2-1

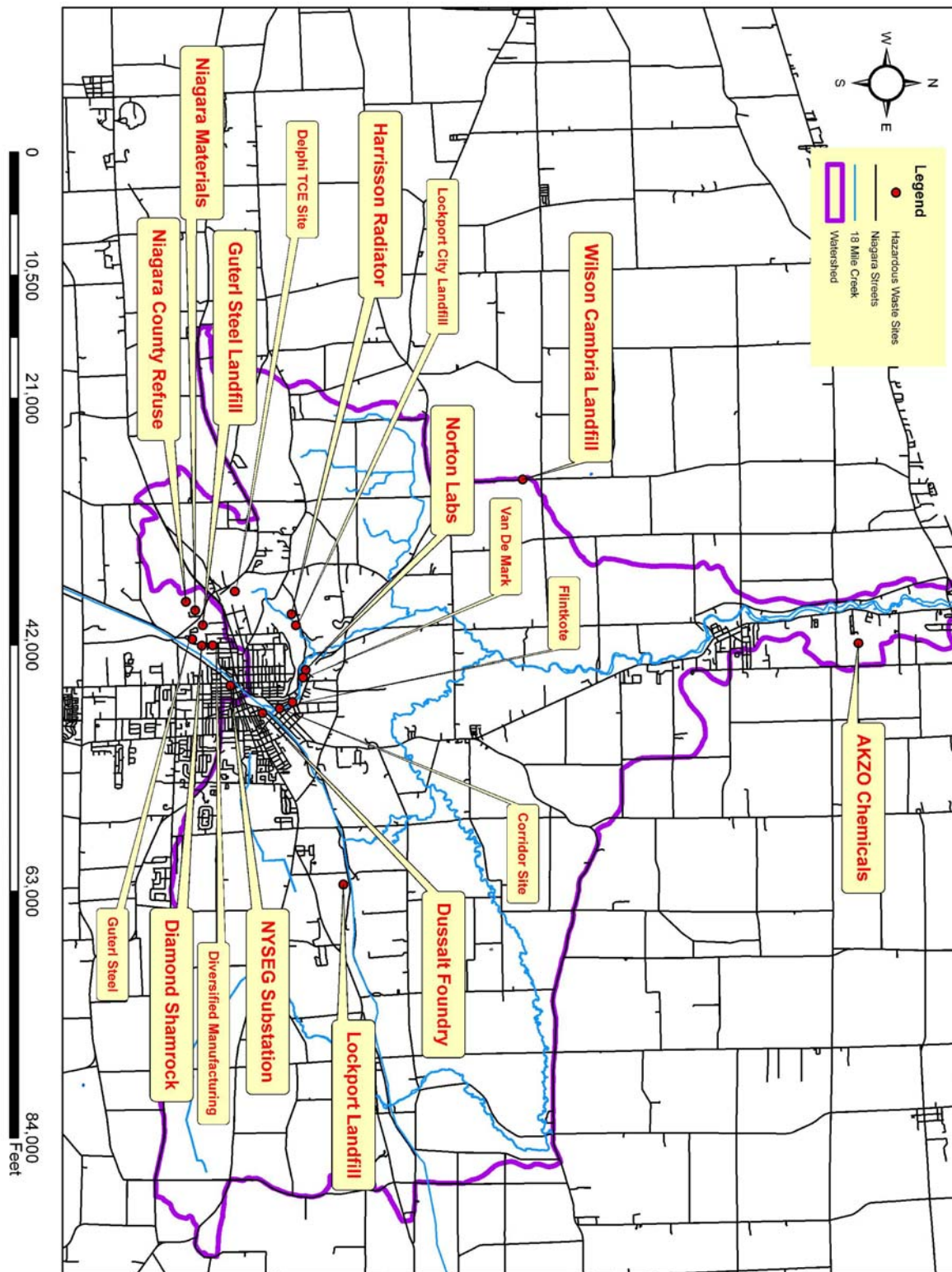
Phase I and II studies have been completed at all of the hazardous waste sites in the Eighteenmile Creek drainage basin. Following Phase II site investigations, five sites were delisted because the investigations indicated no hazardous waste to be present. These sites are: Diversified Manufacturing, Dussault Foundry, Niagara Materials, Flintkote and the Town of Lockport landfill.

The Harrison Radiator (the company name has been changed to Delphi Harrison Thermal Systems), Lockport City Landfill, Niagara County Refuse Disposal District, Van De Mark Chemical and the Wilson-Cambria-Newfane Landfill sites have been remediated. The status and progress of all inactive hazardous waste sites present in the Eighteenmile watershed were presented previously in Table 1-4.

Currently, the NYSDEC has designated the following 14 sites as ‘Remediation Complete or Not Required’:

1. Lockport City Landfill
→ Remedial construction complete; Long term maintenance underway.
2. Diversified Manufacturing
→ Delisted. No significant contamination found at the site.
3. Dussault Foundry
→ Delisted. DEC sampling found no hazardous waste at this site.
4. Harrison Radiator/Landfill
→ Delisted. Remedial action complete; no waste remains at site.
5. Niagara County Refuse Disposal District
→ Long term operation & maintenance underway.
6. Norton Labs
→ Delisted. No significant amount of hazardous waste found at site.
7. Van De Mark
→ Landfill closed & groundwater monitoring ongoing.
8. Wilson-Cambria Landfill
→ Closure completed. Groundwater monitoring underway.
9. Diamond Shamrock
→ Delisted. Clay barrier installed to bedrock to prevent groundwater migration.
10. Flintkote/Plant Site
→ Delisted. No evidence of release to environment. 7 drums of PCB oil removed.
11. Niagara Materials
→ Delisted. No significant contamination of soil or groundwater revealed.
12. Town of Lockport Landfill
→ Delisted. No hazardous waste found at site.
13. NYSEG Substation
→ Delisted. Materials on site do not meet hazardous waste criteria.
14. Akzo Chemical Plant Site
→ Site properly closed - requires continued management

FIGURE 2-1 INACTIVE HAZARDOUS WASTE SITE LOCATIONS



2.2.1.1 Akzo Chemical Plant Site

The 350 acre AKZO plant site is located in a rural, agricultural setting outside the Hamlet of Burt, Niagara County, New York. Numerous orchards, as well as small residential sections, surround and abut the facility property. To the west of the Facility is Eighteenmile Creek that flows to Lake Ontario located about 2 miles to the north. Located immediately to the north is the small Hamlet of Burt. The nearest residential homes are approximately 1500-2000 feet from the production area of the Facility. To the south and east the lands are agricultural.

AKZO produced organic peroxides including benzoyl peroxide, methyl ethyl ketone peroxide, acetyl acetone peroxide, 2,4-dichlorobenzoyl peroxide, and parachlorobenzoyl peroxide at the production facility that represents approximately 30 of the 350 acre size of the ANC site. In April 2003, all chemical production ceased. Since that time, most of the buildings on-site have been razed. The AKZO site now serves as a warehouse and distribution center for their products.

AKZO has a 6NYCRR 373 Permit which requires proper closure of the hazardous waste units subject to the Permit. The permit also required that AKZO perform a RCRA Facility Assessment (RFA) and RCRA Facility Investigation (RFI) to determine the nature and extent of contamination associated with the Facility. The RFA began in 1994 and identified 37 solid waste management units (SWMUs) and 5 Areas of Concerns (AOCs). The RFI began in 1995 and was completed in 2002. The RFI determined that 31 SWMUs and the 5 AOCs required no further action. The remaining 10 SWMUs were subject to a Corrective Measures Study (CMS) or required sampling at closure.

The CMS report was submitted in May 2003 and approved in March 2004. NYSDEC has determined that the presence of contaminants in the groundwater represents a potential threat to human health and the environment. Corrective measures are required to mitigate that threat. The remedy includes: Institutional controls consisting of deed restrictions or covenants to restrict activities on the site; Monitored natural attenuation which includes a comprehensive groundwater monitoring program that will determine the long term effectiveness of natural attenuation. Evaluation of the performance objectives or achievement of groundwater standards will be performed on an annual basis to determine the effectiveness of the proposed remedy. The remedy was completed in late 2005. Long term operation and maintenance activities are currently being performed. A property survey was completed in the Spring of 2009. The Deed Restriction was filed with the Niagara County Clerk on December 3, 2009. The site was reclassified to a Class 4 site on June 14, 2010.

2.2.1.2 Guterl Steel Landfill Site

The Guterl Site was a steel manufacturing facility encompassing a 70-acre parcel in the southwest portion of the city of Lockport, Niagara County, New York. Site Features: The Guterl Site is bordered by Ohio Street to the east, Simonds and Crosby Streets to the north, and Route 93 to the west. Residential and commercial properties are located to the north along Simonds and Corby streets, while commercial properties are located east of the Guterl Site along Ohio Street. To the west are the Frontier Stone Products Quarry and the Niagara County Refuse Disposal District Landfill. The Erie Barge Canal is located several hundred feet to the southeast.

The property is currently divided into three parcels; a manufacturing facility operated by Allegheny Ludlum (not included in this investigation), the former Guterl production areas known as the Excised Area, and a former landfill located at the northwest corner of the property. Allegheny Ludlum presently leases the remaining lands of the original Guterl tract from the Niagara County Industrial Development Agency (NCIDA) and operates an active metal processing facility adjacent to the former Guterl production buildings. The Excised Area is located in the eastern quadrant of the Guterl Site and encompasses nine-acres of the former plant adjacent to Ohio Street. Nine abandoned and deteriorating buildings occupy the Excised area. The Landfill is located in the northwest corner of the Guterl Site. The landfill is bordered by the New York State Electric and Gas Corporation to the north and west, the City of Lockport water line easement to the south, and the active Allegheny Ludlum facility to the east. Private residences are located approximately 600 feet northeast of the Landfill.

Historical use(s): Between 1948 and 1956, the New York Operations Office of the Atomic Energy Commission (AEC) managed contracts with Simonds Saw and Steel, a previous owner of the property, to roll uranium steel billets into rods. The uranium metal billets were received from offsite sources via rail car and were shipped back offsite via rail car after rolling to contract specifications. Records indicate that Simonds Saw and Steel processed between 25 million and 35 million pounds of natural uranium metal and approximately 30,000 to 40,000 pounds of thorium metal between 1948 and 1956.

A Remedial Investigation / Feasibility Study (RI/FS) utilizing the State Superfund Program has been completed in November 2006. Based on the results of the RI, the groundwater contamination seems to be migrating from upgradient of the excised area which is owned by Allegany Corp. The phase II RI planned for the site involves working this upgradient property. The groundwater investigation was completed and the results indicate that the groundwater plume is extending south of the site. Additional groundwater monitoring needs to be installed to define the extent of groundwater plume. The groundwater contamination is designated as OU3. The report evaluating the remedial alternatives for OU1 and OU2 was approved. The alternatives proposed include capping the landfill and excised area with appropriate capping material. The US Army Corp of Engineers (USACE), under the FUSRAP program, is performing an investigation of the radioactive contamination at the site. Currently, DEC is waiting for the USACE to complete their RI and evaluate the fate of the buildings with radiological contamination that are in disrepair. The RI report prepared by the Corps did not address the concerns of DEC that will help to determine the next course of actions. For DEC's RI/FS study we need to conduct additional investigation inside the buildings to identify a source area, if any exists. If any contaminated soil needs to be excavated from the excised area (OU2) that soil is proposed to be consolidated in the existing landfill prior to placing cover. USACE is planning to undertake a groundwater investigation in July 2011 to determine the extent of contamination. In addition to completing an analysis of the groundwater for radioactive materials, the Corps has plans to analyze for volatile organics also that will be the investigation of the groundwater contamination. Since USACE's study will take a minimum of two years to complete the FS the schedule for all DEC's RI/FS will be moved to 2013.

2.2.1.3 Guterl Steel Plant Site

In 2000, The United States Department of Energy declared the Guterl Site eligible for the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a federal program designed to cleanup sites that became contaminated with low levels of residual radioactivity during the nation's early atomic energy program over 50 years ago.

The former Guterl Specialty Steel Corporation performed rolling mill operation on uranium and thorium metals during the period from 1948 to 1956 under contracts with the Atomic Energy Commission (AEC). In total, between 25 and 35 million pounds of uranium and approximately 30 to 40 thousand pounds of thorium were rolled from 1948 until operations were discontinued in 1956, at which time the site was decontaminated to the standards in place at that time.

The Corps conducted a Preliminary Assessment/Site Inspection (PA/SI) in 2001. The purpose of the assessment was to review information to determine if the site posed a potential threat to human health or the environment, or if there was a need for further action by the Corps under FUSRAP. The PA/SI concluded that there was no immediate threat to human health or the environment at the Guterl Site; however, because of the potential for the FUSRAP-related contaminants to pose a threat to human health and the environment in the future, it was recommended that the Guterl Site proceed to the Remedial Investigation (RI) phase to further characterize radioactive residuals associated with past activities.

Field sampling data for the RI was obtained between June 2007 and December 2007. Activities performed during the RI field data collection consisted of sampling and analysis of soil, sediment, surface water, groundwater, and building materials. Sampled media were analyzed for radionuclides (uranium, radium, and thorium).

Results from the RI field investigation activities are summarized below:

- There are currently no imminent threats to human health or the environment due to FUSRAP related materials on the Guterl Site.
- The RI confirmed the presence of, and added new information about the nature and extent of thorium and uranium contamination at the Guterl Site.
- Soil and groundwater contamination was documented above RI screening levels (levels established by the US Nuclear Regulatory Commission (NRC) or U.S. Environmental Protection Agency (USEPA) to assist in defining nature and extent of contamination) within the Guterl Site boundary.
- Some degree of FUSRAP-related material was detected above background in the Excised Area including all the buildings, the soil, and the utility surface water/sediments. The most heavily contaminated buildings in the Excised Area are Buildings 6 and 8, primary buildings used for receiving, heating, rolling, packaging, and shipping uranium metal.
- Shallow bedrock groundwater on the Guterl Site is impacted by FUSRAP-related materials.
- Surface water and sediment samples collected from the Erie Canal did not indicate FUSRAP related impacts.

A Human Health Risk Assessment (HHRA) was conducted as part of the RI. This HHRA evaluated potential cancer risks, radiological doses, and systemic effects to both current and potential future human receptors from exposure to FUSRAP-related contamination in building materials within the

Excised Area, surface and subsurface soil, groundwater, and sediment and surface water within utilities, ditches, trenches, etc. and within the Erie Canal. While current receptors include the juvenile trespasser and the onsite worker, potential future receptors include the juvenile trespasser/recreational visitor, the onsite worker, the construction worker, and the hypothetical resident. The constituents of potential concern evaluated in the HHRA were ²²⁶Radium, ²²⁸Radium, ²²⁸Thorium, ²³⁰Thorium, ²³²Thorium, ²³⁴Uranium, ²³⁵Uranium, and ²³⁸Uranium.

The potential routes of exposure include ingestion of all media, inhalation of particulates, and exposure to external gamma radiation. Radiological doses and cancer risks were compared to target threshold risk or dose levels established by the NRC, New York State, and USEPA. Exposure to building materials and contaminated soils beneath Building 8 and a localized area of elevated activity in the railroad right-of-way posed the greatest potential human health risks of any areas on the site. Although the risk assessment estimated that potential lifetime cancer risks and yearly radiological dose rates received by someone trespassing in Building 8 (for 4 hours a week for 6 months of the year for 10 years) could exceed acceptable targets, the actual radiological doses received by the Corps and contractor investigators taking samples in that building were below health and safety monitoring detection limits. Uranium in groundwater below some areas of the site could pose unacceptable risks if the site groundwater were to be used as a source of potable drinking water.

A Screening Level Ecological Risk Assessment (SLERA) was also performed to evaluate potential risks to plants and animals (ecological receptors) from both external and internal exposure to radionuclides and total uranium from soil, sediment, surface water, and food items that may have bio-accumulated site-related contaminants. Some potential risks to ecological receptors at the site were identified based on the SLERA. However, given the localized nature of the exceedances of the screening levels used in the assessment, as well as the current and future use of the site, further assessment and considerations of ecological risks are not necessary. Although some limited patches of habitat exist on abandoned portions of the site, much of the Guterl Site is actively disturbed or occupied by buildings and paved areas. There are no sensitive habitats on site which require protection. The site is not currently managed for ecological purposes and the creation of an ecological preserve on-site in the future is unlikely.

Since FUSRAP-related materials have been identified at the Guterl Site in excess of media-specific HHRA and SLERA screening levels, the appropriate next step is to conduct a Feasibility Study which will use the data gathered during the RI to evaluate actions that may be taken to reduce the risk from exposure to the FUSRAP-related contamination to an acceptable range.

2.2.1.4 Delphi Harrison TCE Site

Delphi Harrison Thermal Systems owns and operates an automotive component manufacturing complex in Lockport, NY. The site is located at Building #8 in the north-central portion of the complex. This building formerly housed degreasing operations that utilized trichloroethylene (TCE). An above ground TCE storage tank was located at the southeast corner of this building from the early 1970's until May 1994, when it was decommissioned.

Prior to the installation of this "new" tank, an "old" tank was located 40 feet to the south. Four fire protection lines exist beneath the former "new" TCE storage tank, one of which ruptured in October 1994. During excavation to repair the rupture, site workers noted a solvent odor. As a result, soils from

an approximate area of 27' by 22' were excavated to a depth of approx. 7.5' and disposed of as hazardous waste. The ROD also included a requirement for Delphi to conduct an evaluation as to whether potential indoor air impacts in Building 6, located adjacent to the groundwater plume, must be considered in the SMP. Delphi completed a vapor intrusion investigation in 2006. The results showed that vapor intrusion was not a concern and in August 2006 DEC issued a letter stating that no further work regarding vapor intrusion within Building 6 is required. Delphi submitted draft versions of a Soils Management Plan and Operation and Maintenance Plan including long term groundwater monitoring to DEC for their review and comment in December 2006.

To further evaluate the extent of TCE contamination, Delphi Thermal completed a soil gas survey, a utility bedding investigation, and installed twelve upper bedrock monitoring wells. These investigations indicate that site soils are not extensively contaminated, and that TCE migration along utility bedding is limited. Groundwater, however, is extensively contaminated with TCE and its breakdown products, with concentrations of TCE ranging up to 1000 ppm in the "new" tank area. A groundwater plume approximately 400 feet wide extends for at least 1300 feet from the former tank area. Site investigations conducted to date, however, do not suggest that contamination is migrating off site.

During 2001 the PRP installed additional monitoring wells to further define the nature and extent of the groundwater contamination plume. The Remedial Investigation and focused Feasibility Study Reports have since been completed by Delphi and reviewed by the DEC. The DEC issued a Record of Decision (ROD) for the site in March 2005. The selected remedy included Monitored Natural Attenuation, development of a Site Management Plan (SMP), imposition of an Environmental Easement and certification of the institutional and engineering controls. As part of the SMP an evaluation of the potential for vapor intrusion in an on-site building near the groundwater plume has been completed. Based upon the sub-slab vapor and indoor air results, it has been determined that no additional investigation or remedial measures are needed at this time to address the soil vapor intrusion exposure pathway. Long term groundwater monitoring began in October 2006 and is conducted annually. The latest round of sampling took place in April 2010. These results indicated that Monitored Natural Attenuation continues to be effective in protecting public health and the environment. Negotiations with the Company are currently on-going for them to enter into a Consent Order with the NYSDEC to implement the long term Operation, Maintenance and Monitoring requirements of the ROD in the forms of a Site Management Plan and an Environmental Easement.

2.2.1.5 Eighteenmile Creek Corridor Site

The Eighteenmile Creek Corridor Site consists of approximately 10.6 acres of land between Clinton and Harwood Streets in the City of Lockport, Niagara County, New York. The site is bounded by Water Street, residential properties and vacant land to the west, Clinton Street to the south, Mill Street to the east and commercial property to the north. Eighteenmile Creek flows through the middle of the site.

Operable Units: The site has been subdivided into six Operable Units (OUs). An operable unit represents a portion of a site that for technical or administrative reasons can be addressed separately to investigate, eliminate or mitigate a release, threat of release or exposure pathway resulting from site contamination. The six operable units are based upon property ownership and are defined as follows: OU1 - Eighteenmile Creek and Millrace: This operable unit consists of approximately 4,000 linear feet of contaminated creek and millrace sediment from the New York State Barge Canal to Harwood Street;

OU2 - Former Flintkote Property: This operable unit consists of the former Flintkote property located at 198 and 300 Mill Street; OU3 - Former United Paperboard Property: This operable unit consists of the former United Paperboard Company property located at 62 and 70 Mill Street; OU4 - Upson Park: This operable unit consists of Upson Park located between Clinton Street, Eighteenmile Creek and the New York State Barge Canal; OU5 - White Transportation Property: This operable unit consists of the former White Transportation property located at 30 through 40 Mill Street at the southwest corner of Clinton and Mill Streets; and OU6 - Water Street Residential Properties: This operable unit consists of residential and vacant property located at 97 through 143 Water Street west of Eighteenmile Creek. The site as listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State (Registry) only consists of OUs 2 and 3; OUs 1, 4, 5 and 6 are considered off-site areas that received wastes generated by the former industrial facilities at OUs 2 and 3 (i.e., OUs 4 and 5), or have been impacted by contaminants migrating from those wastes (i.e., OUs 1 and 6).

Site Features: The topography of the site is relatively flat-lying with steep downward slopes toward Eighteenmile Creek and the millrace. The millrace bisects the 300 Mill Street property and was the original path of Eighteenmile Creek before the Flintkote Company diverted the creek to the west. Dilapidated and unused buildings are found at several of the OUs associated with the site.

Historical Use: The Flintkote Company began operations as a manufacturer of felt and felt products in 1928 when the property was purchased from the Beckman Dawson Roofing Company. In 1935 Flintkote began production of sound-deadening and tufting felt for installation and use in automobiles. Manufacturing of this product line continued until December 1971, when operations ceased and the plant closed. The disposal history of Flintkote is largely unknown, although aerial photographs suggest that disposal on the property was taking place as early as 1938. It has also been reported that ash resulting from the burning of municipal garbage was dumped on the Flintkote property. The fill material at OU2 is consistent with such a source. The former United Paperboard Company property was utilized in the late 1880's and early 1890's by a lumber company, and by a paper company from the late 1890's until at least 1948. The history of the property after that time is unknown. The disposal history of the United Paperboard Company property is also unknown, although ash similar to that at the Former Flintkote Property is observed directly at the surface in many locations. Coal ash from the former power plant located east of Mill Street and operated by the United Paperboard Company may also have been disposed of at OU3.

Remedial History: In 2008, the NYSDEC listed the site in the Registry as a Class 2 site. The remedial history of the Eighteenmile Creek Corridor Site prior to the Remedial Investigation (RI) is described by operable unit as follows:

- OU1 - Eighteenmile Creek and Millrace: In August 1996 the NYSDEC collected six sediment samples from the millrace on the Former Flintkote Property. Concentrations of polychlorinated biphenyls (PCBs) and lead exceeded the NYSDEC sediment criteria. In 2002 the NYSDEC collected four sediment samples from Eighteenmile Creek. Three samples were collected from an area identified as a potential source of PCBs to the creek. Concentrations of PCBs, copper, mercury and zinc exceeded the NYSDEC sediment criteria.
- OU2 - Former Flintkote Property: A portion of this operable unit was formerly listed as Site No. 932072 in the Registry as a Class 3 site. The basis for listing the site was the presence of seven drums

containing sweepings, solid materials and PCB transformer oil stored in the basement of a building. In January 1984 the property owner had these drums removed from the site by a waste oil processor. As a result of this action the Former Flintkote Property was removed from the Registry in 1985. In 1989 the City of Lockport Building Inspector notified the NYSDEC that a number of drums containing chemicals were found in various locations throughout the buildings at the 300 Mill Street property. Subsequent investigation revealed that 28 of these drums contained hazardous wastes. In May 1991 these drums were disposed off-site by a NYSDEC Drum Removal Action. In August 1996 the NYSDEC collected two ash samples from the property. Both samples failed the Toxicity Characteristic Leaching Procedure (TCLP) Regulatory Limit for lead, making the ash a characteristic hazardous waste (D008). In 1999 the NYSDEC conducted an investigation of the entire Flintkote property. This investigation revealed the presence of ash throughout the property, at the surface, and along the embankments of Eighteenmile Creek and the millrace. The thickness of this ash ranged from 0.9 to 24.9 feet, and covered an area of approximately 3.6 acres. Some ash fill on the property was found to be a characteristic hazardous waste for lead (D008). The Flintkote property was also the subject of a United States Environmental Protection Agency (USEPA) removal action in 2002 that focused on the removal of friable asbestos containing materials within the buildings and on-site debris. All asbestos containing debris was disposed off-site at approved facilities. In 2003 Niagara County conducted a Site Investigation of the Flintkote property under the NYSDEC'S Environmental Restoration Program to further define the nature and extent of contamination at the site by filling in data gaps in the NYSDEC's 1999 investigation. The results of the County's investigation were consistent with the results obtained by the NYSDEC. The combined investigations revealed that approximately 46,500 cubic yards of ash fill exist at this operable unit. In March 2006 the NYSDEC issued a Record of Decision for this operable unit. In July 2006 Niagara County made a request to withdraw from the ERP due to its inability to fund the cost of the remediation. This request was granted in February 2008 and the property was subsequently incorporated into the Eighteenmile Creek Corridor Site.

- OU3 - Former United Paperboard Property: Prior to the NYSDEC RI, no subsurface investigations or remedial actions were completed at this operable unit.
- OU4 - Upson Park: Prior to the NYSDEC RI, no subsurface investigations or remedial actions were completed at this operable unit.
- OU5 - White Transportation Property: In 2002 Niagara County hired a consultant to complete a Phase I Environmental Site Assessment (ESA) of this property. This assessment identified a number of potential environmental concerns that were subsequently investigated during the NYSDEC RI and Supplemental RI. OU6 - Water Street Residential Properties: In 2002 the NYSDEC completed two sampling events at this operable unit. Sixteen surface soil samples were collected from nine properties along Water Street. Concentrations of lead in twelve samples, and PCBs in three samples, exceeded the NYSDEC residential soil cleanup objectives.

Remedial Investigation/Supplemental RI/Feasibility Study: In 2005 the NYSDEC completed a Remedial Investigation of OUs 1, 3, 4, 5 and 6 to better define the nature and extent of sediment contamination, and to evaluate potential upland sources of contaminants to the creek. The RI documented elevated concentrations of PCBs and metals (i.e., arsenic, chromium, copper, lead and zinc) in the sediment of Eighteenmile Creek and the millrace (OU1), and in surface and subsurface soils at the Water Street

Residential Properties (OU6). The RI also documented contaminated fill at the Former United Paperboard Property (OU3), Upson Park (OU4) and the White Transportation Property (OU5). The RI did not fully investigate these properties, nor did it quantify the volume of contaminated sediment requiring remediation. A Supplemental RI of OUs 1, 3, 4, 5 and 6 began in the Spring of 2007. This investigation more fully determined the nature and extent of contamination in creek and millrace sediment (OU1), further characterized the contamination at the Former United Paperboard Property (OU3), Upson Park (OU4) and the White Transportation Property (OU5), and identified the area of each operable unit that required remediation. A Feasibility Study evaluating various options for remediating each operable unit was completed in 2009. In March 2010 the NYSDEC issued a Record of Decision for OUs 1, 3, 4, 5, and 6. The ROD finalizes the cleanup plan that will be implemented to address contamination at the Site. Since the originally proposed cleanup measures were not modified during the public comment period, the selected final remedy mirrors the remedy proposed in the January 2010 Proposed Remedial Action Plan (PRAP)

To address the contamination present at the site, the NYSDEC and NYSDOH have approved cleanup measures for Operable Units (OUs) 1, 3, 4, 5 and 6 of the Eighteenmile Creek Corridor Site. Operable Units are portions of a site that for technical reasons are identified as specific areas of concern in order to facilitate a more efficient cleanup. The ROD for OU2 (Former Flintkote Site) was released in March 2006.

The cleanup activities include the following:

- Operable Unit 1: Eighteenmile Creek and Millrace: Sediment and Creek Bank Excavation with Restoration and Long-Term Monitoring;
- Operable Unit 3: Former United Paperboard Property: Hazardous Waste Removal with Bank Stabilization and Long-Term Monitoring;
- Operable Unit 4: Upson Park: Hazardous Waste Removal with Bank Stabilization and Long-Term Monitoring;
- Operable Unit 5: White Transportation Property: Hazardous Waste Removal with Bank Stabilization and Long-Term Monitoring; and
- Operable Unit 6: Water Street Residential Properties: Limited Excavation with Bank Stabilization and Long-Term Monitoring.

As required by State law, DEC is currently in the process of identifying responsible parties (individuals or entities potentially liable for the contamination) and preparing contract specifications for the remedial design work. Progress on the site and demolition of the building structure will depend on the future availability of funding through the State's Superfund program.

2.2.1.6 Old Upper Mountain Road Site

The Old Upper Mountain Road Site is approximately 7 acres in size and consists of seven parcels in a mixed residential/commercial/ industrial neighborhood near the intersection of NY State Routes 31 and 93 in the Town of Lockport, Niagara County, New York. The site is bounded on the west by Old Upper Mountain Road, on the south and east by the Somerset Railroad, and on the north by private property and a ravine and creek known as The Gulf. The site was reportedly operated as a municipal dump by the City of Lockport from 1921 through the 1950's. Garbage and other wastes were apparently dumped at the landfill, burned, and then pushed into the ravine. A narrow stream, Gulf Creek, flows along the bottom of the ravine and eventually discharges into Eighteenmile Creek approximately one mile to the north. The site is located on a relatively flat-lying plateau.

The results of a Site Investigation indicate that ash disposed at this site is a characteristic hazardous waste for lead. Although not all samples failed TCLP, the areal extent (about 7 acres) and thickness (greater than 36 feet in some locations) of the ash indicate that a consequential amount of hazardous waste is present at the site. The large amount of fill in conjunction with the leachability of the waste for lead presents a potential for release to the adjacent stream (The Gulf), which runs adjacent to the site. Fill at the site also contains elevated levels of volatile organic compounds, semivolatile organic compounds, pesticides, polychlorinated biphenyls and metals. Primary constituents of concerns include: tetrachloroethene, trichloroethene, arsenic, cadmium, chromium, copper, lead, and mercury. Many of these contaminants have also been detected in surface water and sediment adjacent to the site at concentrations that exceed the respective standards, criteria and guidance values (SCGs). These data, therefore, suggest that ash fill at the site has adversely impacted creek surface water and sediment adjacent to the site and creates a significant threat to the water body.

The site has been subdivided into two Operable Units (OUs) defined as follows: OU1 - Landfill: This operable unit consists of the former landfill, and consists of two parcels bisected by the Somerset Railroad. This operable unit is approximately 7 acres in size; and OU2 - Gulf Creek Sediment: This operable unit consists of approximately 4,400 linear feet of contaminated creek sediment from the site to Niagara Street. The Old Upper Mountain Road Site was reportedly operated as a municipal landfill by the City of Lockport from 1921 through the 1950's.

Access to the landfill was from a viaduct under the railroad track just north of Old Upper Mountain Road. In later years, a gate was placed at the viaduct to control unauthorized dumping. Incinerator ash from garbage and other wastes was apparently dumped at the landfill and then pushed into the ravine. The location of the incinerator is unknown. It has also been reported that local companies dumped their wastes directly in the landfill. In November 1997 Department staff collected thirteen soil/waste samples from OU1. All thirteen samples contained elevated concentrations of volatile organic compounds, semivolatile organic compounds and metals. In October 1998 the NYSDOH collected five surface soil samples from OU1. These samples contained elevated concentrations of metals. In 2007 the Department conducted a Site Investigation at OU1. Ash was found throughout the site at thicknesses ranging to over 36 feet. Thirteen samples of this material failed the Toxicity Characteristic Leaching Procedure (TCLP) Regulatory Limit for lead, indicating that characteristic hazardous waste (D008) was present at the site. This fill material also contained elevated concentrations of volatile organic compounds, semivolatile organic compounds and metals.

A State Superfund RI/FS began in August 2009. Initial field activities began in November 2009 with the clearing of vegetation, the collection of sediment and surface water samples, and the initial site survey. Six monitoring wells were installed in December 2009 and sampled in February 2010. Test pits and soil borings were completed in May 2010, along with additional sediment samples. Sediment and surface water samples from Gulf Creek were completed as part of the Supplemental RI in August 2010. Submittal of the draft RI report was completed in September 2010 and a draft RI/FS was completed in 2011. A Record of Decision (ROD) is anticipated in March 2012.

2.2.2 Sediment Contamination and Bioavailability Source Characterization

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organizations: Niagara County Soil & Water Conservation District, New York State Department of Environmental Conservation, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers

Background

Sediments accumulate contaminants through the attachment of chemicals from the dissolved phase onto solid particles. The presence of sediments indicates that an area is a deposition zone but not all deposition zones are stable. Runoff velocities associated with storm events can remobilize surficial sediments into the water column. Bottom feeding organisms may ingest contaminants in sediments which may cause toxic effects or contaminants may bio-accumulate to the point of threatening higher food chain consumers. When the sources of toxic discharge are curtailed and sediment stability is high, sedimentation itself will gradually bury toxic substances so they will not be bio-available. Where dredging and other expected disturbances are likely or concentrations are high enough to cause adverse effects, remedial action becomes necessary.

The Eighteenmile Creek Great Lakes Area of Concern (AOC) has five identified use impairments, all of which are linked to sediment contamination. The contaminants of concern associated with these impairments include organic compounds, chlorinated pesticides, polychlorinated biphenyls (PCBs), dioxins/dibenzofurans (PCDD/Fs), and metals such as chromium, copper, lead, manganese, mercury, nickel, zinc and cyanide.

Over the past several years, AOC stakeholders have initiated new investigations in the Eighteenmile Creek system to better understand the nature and extent of sediment contamination and PCB biomagnifications in order to establish a cleanup strategy to remediate in-stream contamination. These studies include sediment sampling for PCBs, metals, and other contaminants upstream from Burt Dam; determination of sediment bed thickness to support sediment volume estimates; and development of a

Trophic Trace model to help better understand biomagnifications of PCBs in the aquatic food web of the creek. These investigations are described in turn below.

Measure

2.2.2.1 Area of Concern Surface Sediment Investigation

To assess the overall toxicological risk of surficial sediment contamination within the AOC that is currently exposed to the aquatic community, the U.S. Army Corps of Engineers (USACE), Buffalo District collected surface sediment samples from 15 locations within lower Eighteenmile Creek in August 2003. These discrete samples were composited to represent five separate reaches within the AOC: moving upstream from approximately upper Olcott Harbor to Burt Dam, these were Reaches EBU1, EBU2, EBU3, EBU4 and EBU5 (See Figure 2-1). The sediment samples were subjected to physical, chemical and bioaccumulation testing. Chemical testing included various heavy metals, and organic contaminants including chlorinated pesticides, PCBs and Polychlorinated p-dibenzo dioxins and polychlorinated p-dibenzo furans (PCDD/Fs). The bioaccumulation experiments entailed a standard 28-day freshwater laboratory test using a surficial sediment deposit feeding aquatic oligochaete, and focused on metals, chlorinated pesticides and PCBs. The specific objectives of this investigation were to:

- Ascertain the concentrations of all of the contaminants tested in surface sediments within the AOC. Evaluate these levels relative to selected freshwater toxicity threshold values, mainly relevant sediment quality criteria, and;
- Assess the bioaccumulation of metals, chlorinated pesticides and PCBs to determine their potential to bio-accumulate in aquatic organisms. Further, quantify and assess the bioavailability of pesticides and PCBs through the calculation and evaluation of biota-sediment accumulation factors (BSAFs).

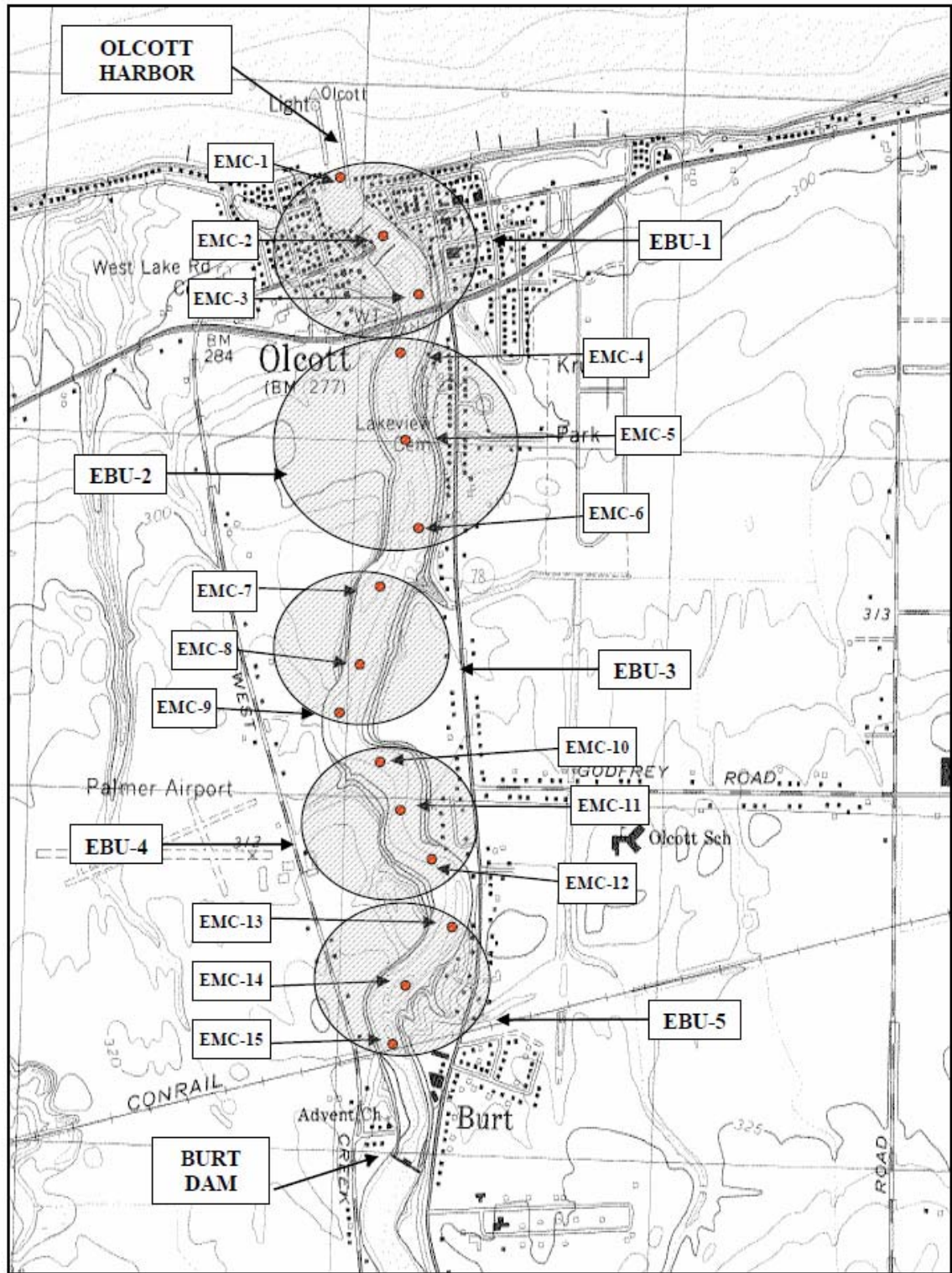
Heavy metals data indicated that concentrations of various metals in surficial sediments, particularly copper, chromium, lead, nickel and zinc, may exert chronic toxicity throughout the AOC. Metal contamination in sediments within reaches EBU3 and EBU5 appear to have the most potential to pose chronic toxicity. Potential for sediment-associated lead and zinc toxicity was consistent throughout the AOC. The bioaccumulation data suggest little bioavailability or bioaccumulation risk associated with heavy metal contamination. (USACE 2004)

Organic contaminant data indicated that levels of the pesticide dichlorodiphenyldichloroethylene (DDE) in surficial sediments within Reaches EBU1 through EBU4 may be chronically toxic. Bioaccumulation data indicated that DDE was bio-available throughout AOC surface sediments (mean BSAF range = 1.21 to 5.41). The high bioavailability of DDE in surficial sediment in Reaches EBU3 (BSAF = 4.60) and EBU5 (BSAF = 5.41) indicate that it is bio-accumulating in benthic invertebrates, and is likely to bio-accumulate in predator fish and higher trophic levels. Both sediment and bioaccumulation data suggest that PCBs in surficial sediments throughout most or all of the AOC are being bio-accumulated to levels that pose a risk to aquatic organisms. PCB concentrations are bio-available in surface sediments throughout the AOC (mean BSAF range = 1.55 to 4.36). The high bioavailability of PCBs in the surficial sediments in Reaches EBU3 (BSAF = 2.95) and EBU5 (BSAF = 4.36) indicate that they are bio-accumulating in benthic invertebrates, and are likely to bio-accumulate in predator fish and higher trophic levels. The site-specific BSAFs determined in this investigation can be applied to conservatively

predict the bioaccumulation of DDE and PCBs by indigenous benthic organisms from AOC sediments. PCDD/F contamination in surficial sediments throughout the AOC indicates a bioaccumulation risk to wildlife. (USACE 2004)

This investigation concluded that surficial sediments throughout the AOC contain levels of contaminants that should be of toxicological concern. When considering both metal and organic compound contamination, surficial sediments within AOC Reaches EBU3 and EBU5 are the most contaminated and appear to present the highest toxicological risk. (USACE 2004)

FIGURE 2-2 2004 AOC SEDIMENT SAMPLING SITES AND REACHES



2.2.2.2 PCB Source Track-down Project

In an effort to supplement the work mentioned previously completed by NYSDEC within the Eighteenmile Creek Corridor Site, A PCB source trackdown project was initiated downstream of the corridor site. In 2006, sediment core sampling in Eighteenmile Creek was conducted from Harwood Street to Stone Road (8,000 ft). Approximately 2,000 feet of creek within this area was not investigated as the gradient of the creek cascading down the Niagara Escarpment is too steep to assure safety to field sampling crews. Also, the amount of sediment in this area available for sampling is minimal due to the swift moving water.

Samples were collected for PCB screening using grab samples at 80 locations throughout the study area. A total of 80 samples and three duplicates were collected. Concentrations ranged from 59 ug/kg to 4300 ug/kg and 29 samples were non-detect. Comparison of PCB screening results to PCB confirmation samples at other sites, indicate the screening results need to be corrected by a factor of 6.5 to be comparable to the confirmation results. A total of 12 cores were collected in areas for PCB confirmation. Three samples were collected at various depths. The concentrations in the core samples range from 12 ug/kg to 69000 ug/kg and only six samples were non-detect.

The PCB results show that PCBs are present in all areas of Eighteenmile Creek. The core sample results show a general decrease in concentration with depth. The results indicate that the sediment is entirely contaminated with PCBs and only the native material in the creek bed is free of PCB contamination. The positive PCB results were corrected for an average total organic carbon (TOC) concentration and compared to NYSDEC criteria. Most of the positive PCB results exceeded PCB screening criteria. The results show a relatively uniform concentration of PCBs except at areas close to the Flintkote property and in the area near the intersection of Old Niagara and Plank Road. The results indicate the potential for an additional source of PCBs in an area north of the waste water plant.

The surface samples from all 12 cores also were analyzed for select metals. The metals results were compared to NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 standards which were designed as guidance for the determination of cleanup levels at Inactive Hazardous Waste Sites. All metal concentrations were near or exceeded TAGM criteria. The highest metals were found in core 2 and core 12, but the concentrations were relatively uniform throughout the study area. The results indicate that metals continue to be a source of concern in the creek and need to be evaluated relative to background concentrations in other areas.

2.2.2.3 Great Lakes Legacy Act Sediment Characterization

In a move that highlights the success of inter-agency partnerships, the U.S. Environmental Protection Agency (EPA), Niagara County Soil & Water Conservation District (NCSWCD) and New York State Department of Environmental Conservation (NYSDEC) have joined together in partnership to address contaminated sediments in Eighteenmile Creek. EPA and NCSWCD signed an agreement to assess the contaminated sediments in the creek, which is an important step toward the eventual de-listing of the creek as an AOC.

The U.S. EPA Great Lakes National Program Office (GLNPO) Great Lakes Legacy Act (GLLA) site characterization project has assessed the nature and extent of sediment contamination upstream from

Burt Dam and the potential for migration of contaminants from upstream source areas, including in-stream sediments. The project builds on the NYSDEC assessment and proposed remediation plan for upstream source areas (Eighteenmile Creek Corridor Site) mentioned previously in this report. The GLLA project includes characterization of three miles of deep sediment in the impoundments behind two dams (Burt Dam and Newfane Dam) and nine miles of shallow creek bed sediment that runs through isolated rural areas downstream of the primary source area in Lockport, New York. Results from over 300 samples were evaluated for PCBs, polycyclic aromatic hydrocarbons (PAHs), and metals contamination. (CH2M HILL 2011) Because this project has completely characterized the extent of contamination present within creek sediments and defines the true reason of why Eighteenmile Creek is an AOC, preliminary results for total PCBs and selected metals are provided in Appendix A of this plan.

The Eighteenmile Creek AOC was divided into five smaller investigation areas/reaches based on the physical characteristics of the creek observed during A Phase I reconnaissance effort (Figure 2-3). The November/December 2009 field sampling effort consisted of collection of 83 sediment samples (main creek channel and tributaries from Reaches 4, 6, and 7), and 21 soil samples from historic channels and wetlands along Reaches 3, 4, 5, 6, and 7. Sampling activities started on November 16, 2009 and were completed on December 2, 2009.

The sample locations by reach are briefly described below.

- Reach 2 consists of the Burt Dam impoundment and the historic stream channel that was flooded after installation of the dam. A total of 15 coring locations were sampled in Reach 2 via vibracore in May 2010. (CH2M HILL 2011)
- Reach 3 is also characterized by the historic stream channel that was flooded after the installation of the dam. Large sediment deposits have formed where the swift moving upstream creek flows into the upper portion of the impoundment area and the flow velocities drop quickly. Surface soil samples were collected from Reach 3 during the initial November/December 2009 hand-coring effort. Sediment samples from a total of 12 coring locations were also collected during the May 2010 vibracoring effort. Additionally, four surface soil sample locations (0 to 6 inches below ground surface [bgs]) were sampled in November 2009 from the surrounding marsh and forested wetland areas. (CH2M HILL 2011)
- Reach 4 is relatively swift moving and includes comparatively fewer sediment depositional areas, with shallower thicknesses. Samples were collected from Reach 4 during the initial November/December 2009 hand-coring effort. Eleven coring locations were sampled in the main creek channel in areas where sediment were deposited due to obstructions or decrease in flow velocities and one in a tributary to the main creek channel. Three surface soil samples (0 to 6 inches bgs) were also collected from a relict creek channel (one sample) and the forested wetland areas and marshes near Ide Road. (CH2M HILL 2011)
- Reach 5 consists of the impoundment area behind Newfane Dam and includes deep water and thick sediment. The investigation for this impoundment area was based on the existence of outfalls that may have contributed contaminants in addition to PCBs as well as the potential for the dam to be removed in the future and included surface and subsurface sediment characterization. Samples were collected from a total of 12 locations during the May 2010 vibracoring effort. Five surface soil

locations were also sampled in November 2009, including one location in a relict creek channel and four in marsh areas and wetlands adjacent to the creek. (CH2M HILL 2011)

- Reach 6 is characterized by limited access, relatively shallow sediment deposition areas, and higher flow velocities. Two historic creek channels and one forested wetland where sediment might have been deposited during historic overbank flooding are found in Reach 6. Samples were collected from Reach 6 during the initial November/December 2009 hand-coring effort. A total of 19 coring locations were sampled in main channel areas where sediment was observed or near obstructions or upstream and downstream of tributaries. Additionally, a total of three surface soil samples (0 to 6 inches bgs) were collected, including two samples from historic creek channels and one sample from a wetland adjacent to this reach. (CH2M HILL 2011)
- Reach 7 is characterized by limited access and large stretches of slowly moving water and high sediment deposition. The 1-mile stretch investigated as part of the PCB trackdown study (E & E 2007a) required less sampling than the other areas of the creek, but included sampling from floodplains and near drainage areas not previously sampled and a “hot spot” sample near Plank Road. Samples collected from Reach 7 included hand-coring at 39 main channel locations including areas of deep sediments near obstructions and outfalls and near the “hot spot” (one in the area where the hot spot was observed and one in the downstream side of Stone Road. Six tributaries were also sampled during this investigation. Additionally, six surface soil samples (0 to 6 inches bgs) were collected from historic creek channels (five samples) and a wetland adjacent to this reach (one sample). (CH2M HILL 2011)

An additional hand-core sampling effort was conducted to address data gaps in Reaches 4, 6, and 7 between June 21 and July 2, 2010. The findings of the November and December 2009 and May 2010 sampling indicated that since depositional zones are present throughout the creek bed in Reaches 6 and 7, targeting specific depositional zones may not yield a representative sample population. The average distance between the 2009 sample points was 556 feet for Reach 4; 1,041 feet for Reach 6; and 505 feet for Reach 7. Sample locations were added in areas with large distances between sample locations (i.e., greater than 500 feet) to provide better coverage. The new locations reduced the variability in the distances between samples and decreased the distance between samples to below 500 feet for these reaches. (CH2M HILL 2011)

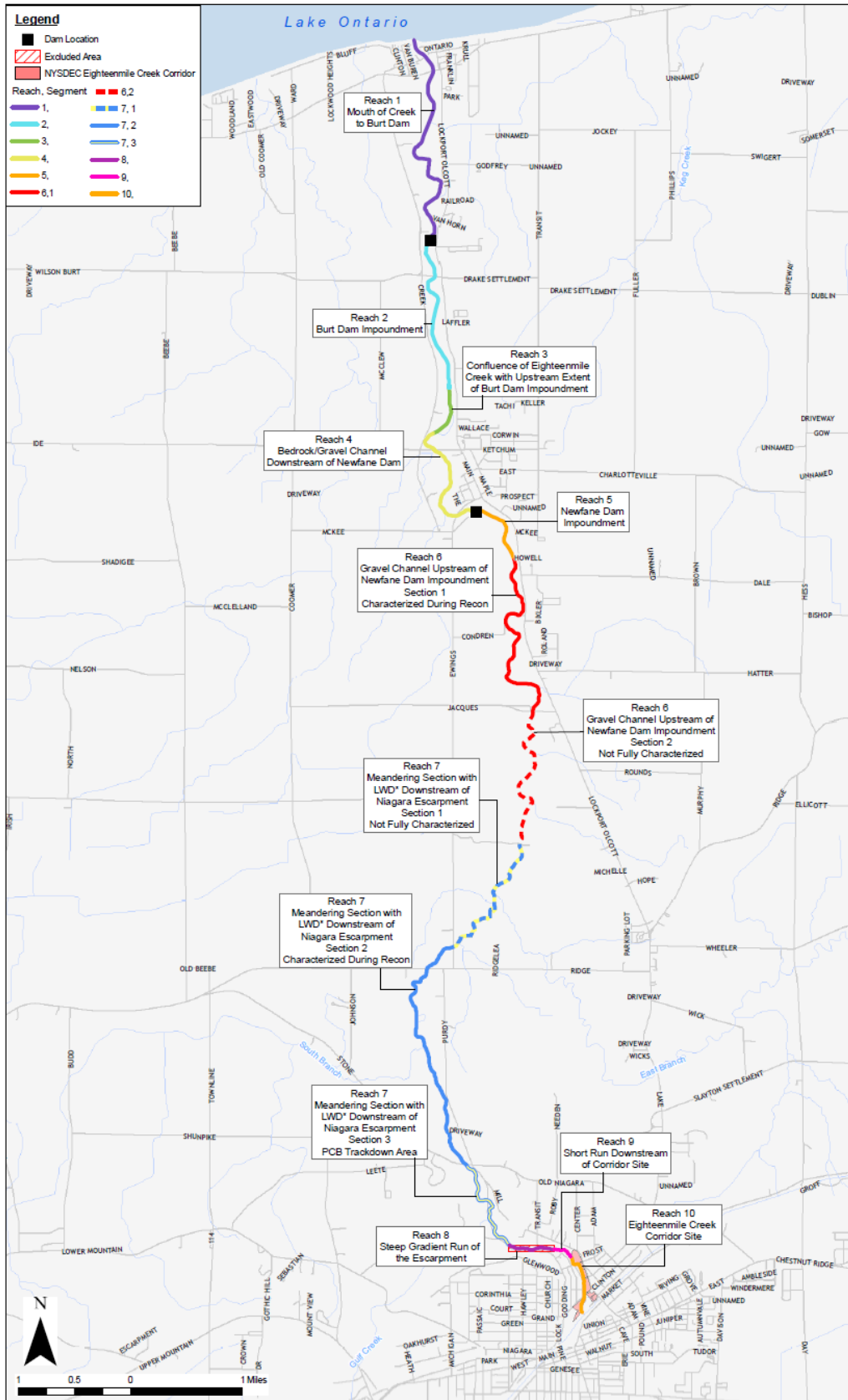
A total of 9 Reach 4, 28 Reach 6, and 34 Reach 7 new locations were sampled to better define the extent of contamination, confirm previously detected high concentrations of PCOCs, and identify additional potential contaminant sources. In addition to sample locations in the main creek channel, sampling locations were added upstream in the East Branch and Gulf Creek to establish background conditions as well as evaluate potential sources.

Sample locations were chosen near previous samples exhibiting higher PAH and metal concentrations as well as near potential sources not related to upstream areas in Lockport (i.e., multi-use industrial facility south of Ide Road in Reach 4). Additionally, wherever possible, new extent sample locations were selected to be downstream of near outfalls or drainage areas. Confirmation samples were selected to be located near samples with significant levels of PCBs and lead. Location selection also took into account difference between concentrations in adjacent samples where elevated concentrations were observed

(i.e., samples near R6-052-C, R6-055-C, R7-73-C, R7-89-C, R7-88-C, and near Stone Road). (CH2M HILL 2011)

The data gap sediment sampling included collection of surface sediment samples (representing the top 0.5 feet of sediment) as well as core composite samples from surface to refusal, to evaluate contamination within the thicker sediment deposits. Specifically, at coring locations where the top sediment layer was clearly distinguished, the surface sample were collected from the top 0.5 foot portion of the core and the remaining core material was composited for the subsurface sample (0.5 feet to refusal). At coring locations where sediment layering was not clearly observed (e.g., in areas where the sediment was too soft to preserve layering within the core), the surface sample was collected using a petite Ponar or AMS Ekman Dredge and the entire core was composited (surface to refusal) for the subsurface sample. At locations where total sediment thickness was less than 1 foot, a single sample was collected from the entire core.

FIGURE 2-3 EIGHTEENMILE CREEK AOC & INVESTIGATION AREAS



2.2.2.4 Sediment Thickness Survey and Bankfull Delineation

In the Legacy Act studies mentioned previously, the chemical data show the extent of sediment contamination by PCBs and other chemicals within Eighteenmile Creek. However, additional physical data was needed to estimate the volume of contaminated sediment. Therefore, beginning in the fall of 2010, sediment thickness was measured and the creek's bank-full width was verified during field surveys conducted as part of the GLLA project. These additional data provided by delineating bankfull width and sediment thickness measurements will be used for the following:

- Verification of the shoreline established using the GIS. The field data will be used as a quality control check of the GIS interpretation of the bankfull width that is based on the 2008 1-foot ground pixel resolution orthophotography.
- Creation of a systematic dataset of sediment thickness. The historic and the Phase 2 data investigations mainly focused on the collecting sediment chemistry data to identify potential sources and define the nature and extent of contamination. A systematic approach to collecting thickness data is needed to estimate the sediment volume that will need to be addressed in a Feasibility Study.
- Determination of a sediment thickness “bottom” layer and “top” layer. The creek boundary and sediment thickness information will be used to model the volume of sediment present. ArcGIS extension “spatial analyst” will be used in GIS to perform a spatial interpolation of thickness points. The method of interpolation will be “Simple Kriging”—a geostatistical method, which will allow the user to define an acceptable confidence interval.

The delineation of the edge of the bankfull and the sediment thickness measurements was conducted concurrently. A total of 136 transects were surveyed in Reaches 4, 6, and 7 and shallow areas of Reaches 3 and 5. A slight variation of “systematic point sampling” was implemented in the field to collect the additional sediment thickness data. Systematic point sampling uses a regular sampling interval and results in an unbiased and proportionally representative dataset of evenly spaced measurements across the study area. The sediment thickness was measured by probing at an average five locations along each transect including the edges of both banks, at the thalweg or midpoint, at two points between the thalweg and left and right banks. (CH2M HILL 2011)

2.2.2.5 Trophic Trace Food Web Model

The U.S. Army Engineer Research and Development Center (ERDC) have developed a Trophic Trace food web model for Eighteenmile Creek (Gustavson et al. 2010). The objective of the project was to evaluate organic contaminant bioaccumulation, trophic transfer, and consequent risks in creek sections above and below Burt Dam. The modeling effort focused on PCBs for a variety of reasons, including: (1) PCBs are the primary risk driver in the Eighteenmile Creek system; (2) PCBs have the most robust and current dataset; (3) chlorinated pesticides and dioxins are not particularly elevated or prevalent in sediment in the Eighteenmile Creek system; and (4) focusing on a single contaminant class will permit a more intensive sampling to support the modeling effort compared to the sampling amount that could be conducted if multiple contaminant classes were modeled.

Based on sampling needs identified in a Data Gaps Memorandum completed by ERDC, sediment and fish tissue sampling was conducted in the Eighteenmile Creek Area of Concern, above and below Burt Dam. The sediment data are used to represent exposure concentrations in the Trophic Trace model and the fish tissue concentrations are used as the empirical basis for model calibration and validation.

Fish sampling took place in the Eighteenmile Creek Area of Concern, above and below Burt Dam, on six days between September 13-30, 2010. Fish were collected by the U.S. Fish and Wildlife Service, Lower Great Lakes Fish and Wildlife Conservation Office in Albany, NY. Boat mounted electrofishing gear or minnow traps were used for collection. Per the Conceptual Site Model (See the Final Conceptual Site Model Memorandum), largemouth bass, brown bullhead, and pumpkinseed were targeted. These fish species represent different trophic levels, have different feeding strategies, and their tissue concentrations can be simulated in the Trophic Trace Model.

Sediment sampling took place on October 26, 2010. Sediment grab samples were collected by the U.S. Army Corps of Engineers Buffalo District at 16 locations in the section below the Burt Dam and were meant to duplicate the efforts completed by USACE Buffalo District in 2003 and are mentioned in Section 2.2.2.1 of this report. Sediment samples were analyzed for PCBs to represent exposure concentrations in the section below Burt Dam. Sediments in the section above Burt Dam were sampled for PCBs in the summer of 2010 by the Great Lakes National Program Office (GLNPO) and are mentioned in Section 2.2.2.3 of this report. The GLNPO data was used to represent sediment contaminant exposure concentrations in this section.

The Trophic Trace model was parameterized, run, and the results compared to the available data without going through an explicit calibration process. The results indicate that it is likely that most receptors (fish, birds and mammals) in the study area, particularly in the section above Burt Dam, experience exposures that exceed no-effect threshold levels. In some cases, effect levels are exceeded as well, indicating a potential for effects. (Gustavson et al. 2010)

Results for Fish in Section 1

The No Observed Adverse Effects Level (NOAEL) based probable range comparisons for fish range from less than one to less than five across all species, suggesting a low to moderate potential that exposures will exceed a no-threshold effect level. However, the Lowest Observable Adverse Effect Level (LOAEL) based comparisons are all less than one, indicating a negligible potential for adverse effects. The upper bound of the possible range exceeds 30, indicating that we have low to moderate confidence in our conclusion of negligible potential for adverse effects, particularly given that there is a low to moderate potential for exposures to exceed a no-threshold effect level.

Results for Fish in Section 2

In Section 2, all NOAEL-based comparisons across all fish species are greater than one but less than ten, indicating a low to moderate potential that exposures will exceed a no-threshold effect level. LOAEL-based comparisons are all less than one, indicating a negligible potential for adverse effects. However, this conclusion is tempered by the observation that the upper bound of the possible range of predicted TQs is greater than 30, and exposures could well exceed a no-effect threshold level. Therefore, the potential for adverse effects cannot be ruled out.

Results for Avian Receptors in Section 1

The NOAEL-based probable range comparison for kingfisher includes and exceeds one, indicating a low potential for kingfisher exposures to exceed a no-effect threshold level. However, the LOAEL-based comparison is less than one. In both cases, the upper bound of the possible range is greater than one but less than ten, indicating moderate to high confidence in the conclusion of negligible potential for adverse effects.

For heron, NOAEL- and LOAEL-based probable range comparisons are all less than one, indicating negligible potential for adverse effects and that exposures will exceed a no-effect threshold level. Confidence in this conclusion is moderately high.

Results for Avian Receptors in Section 2

The NOAEL-based probable range comparison for kingfisher includes and exceeds one, indicating a low potential for kingfisher exposures to exceed a no-effect threshold level. However, the LOAEL-based comparison is less than one. In both cases, the upper bound of the possible range is greater than one but less than ten, indicating moderate to high confidence in the conclusion of negligible potential for adverse effects.

For heron, NOAEL- and LOAEL-based probable range comparisons are all less than one, indicating negligible potential for adverse effects and that exposures will exceed a no-effect threshold level. Confidence in this conclusion is moderately high.

Results for Mink in Section 1

The NOAEL-based probable range comparison for mink includes and exceeds one, indicating a low potential for mink exposures to exceed a no-effect threshold level. However, the LOAEL-based comparison is less than one. For the NOAEL-based comparison, the upper bound of the possible range is greater than ten but less than 100, indicating moderate to high confidence in the conclusion of a low to moderate potential for mink to exceed a no-effects threshold level.

Results for Mink in Section 2

The NOAEL-based probable range comparison for mink includes and exceeds one, indicating a low potential for mink exposures to exceed a no-effect threshold level. However, the LOAEL-based comparison is less than one. For the NOAEL-based comparison, the upper bound of the possible range is greater than ten but less than 100, indicating moderate to high confidence in the conclusion of a low to moderate potential for mink to exceed a no-effects threshold level.

2.2.3 Point Source Discharge Regulation and Monitoring

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organization: New York State Department of Environmental Conservation

Background

Municipal and Industrial discharges are regulated under the State Pollutant Discharge Elimination System (SPDES) system which is administered by the NYSDEC Division of Water. New York State has chosen the “Substance Specific” approach as the primary method of water-quality-based toxic substance management and control for point sources. Water quality standards and guidance values have been adopted for over 200 toxic substances in both fresh and marine water for the protection of human health and aquatic life. These are in addition to the federally mandated technology-based treatment standards, and best professional judgment where such standards are lacking. As a secondary mechanism of toxic control, whole-effluent toxicity testing is an included step, particularly where water-quality-based controls may not assure conformance with water quality standards.

A SPDES permit establishes stringent performance standards and operating conditions that are designed to protect the state’s waters. These permits incorporate current water quality standards, effective implementation of best management practices by permitted facilities, and timely sampling, analysis, and reporting to DEC on the quality of wastewater discharged under the SPDES permit. In addition to issuing permits, DEC staff performs site inspections and continually review facility discharge data to ensure compliance.

Measure

Direct discharge of wastewater to the creek from industrial facilities and municipal wastewater treatment plants is a potential source of contaminants to Eighteenmile Creek (RAP, 1997) NYSDEC regulates these discharges through the SPDES program. SPDES permits specify the allowable volume, contaminant concentrations and physical characteristics (temperature and pH) of the discharge as well as reporting and monitoring requirements.

There are three industrial and two municipal facilities currently permitted to discharge to Eighteenmile Creek. The permitted discharges include wastewater from: Delphi Harrison Thermal Systems; City of Lockport Wastewater Treatment Plant; Gasport Sewer District #1 Wastewater Treatment Plant; ISOCHEM, Inc.; and Redlands Quarries NY, Inc (Table 2-3). These facilities contribute effluents to the creek system that could contain metals, organics, suspended solids, and coliform and could cause fluctuations of biochemical oxygen demand (BOD), temperature, and pH. However, this effluent is

monitored per the requirements of current SPDES permits for these facilities, which list effluent limitations and monitoring requirements that must be adhered to avoid violation of water quality standards.

Other permitted industrial effluent that enters the Eighteenmile Creek drainage basin includes stormwater discharges from these facilities. Stormwater discharges only require a stormwater management plan and are not routinely monitored for physical and chemical parameters. Runoff from a storm event could affect water quality as there may be residual contaminants and other physical conditions such as increased BOD and high turbidity.

The majority of the contaminants of concern relative to confirmed beneficial use impairments are not permitted to be discharged into Eighteenmile Creek. These include PCBs, DDT or its metabolites, Dieldrin, dioxins and dibenzofurans. NYSDEC compliance monitoring of the discharges to the creek do not reveal the presence of any of these contaminants. However, municipal and industrial discharges to the creek do contain metals. The two active dischargers of metals are the City of Lockport Water Wastewater Treatment Plant and Delphi Harrison Thermal Systems. Both of these discharges are in compliance with their SPDES permits. Because of this action, industrial and municipal discharges are not considered a source of metals to the creek. (NYSDEC 1997)

TABLE 2-3 FACILITIES PERMITTED TO DISCHARGE TO EIGHTEENMILE CREEK

FACILITY	SPDES PERMIT #	ORIGINAL PERMIT ISSUED	PERMIT EXPIRATION
Vandemark Chemical Inc.	NY0204323	5/4/1990	03/31/2015
Delphi Harrison Thermal Systems	NY0000558	3/4/1977	02/28/2014
Redland Quarries NY	NY0003077	7/1/1976	05/31/2012
City of Lockport WWTP	NY0027057	12/31/1974	10/31/2011
Gasport SD#1 WWTP	NY0029963	6/30/1975	7/31/2012

2.2.4 Non-Point Source Control Programs

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organization: New York State Department of Environmental Conservation

Background

A nonpoint source (NPS) of pollution is usually considered an area wide source or many small sources of pollution distributed diffusely over an area, which cumulatively make a significant contribution to water quality degradation. Toxics may enter surface waters either dissolved in runoff or attached to sediment or other organic materials and may enter groundwater through soil infiltration. Contaminants transported from the land by runoff following a storm event are usually characterized as nonpoint if they enter the waterbody diffusely rather than at a discrete stormwater discharge point.

Regulation of Petroleum Tanks

In 1983, the State Legislature enacted Article 17, Title 10 of the Environmental Conservation Law, entitled "Control of the Bulk Storage of Petroleum." The Law applies both to Underground Storage Tanks (USTs) and Aboveground Storage Tanks (ASTs), or groupings of such tanks with a combined storage capacity of more than 1,100 gallons. Exempted from this law because they are regulated under other programs are: oil production facilities; facilities licensed under the Navigation Law; and, facilities regulated under the Natural Gas Act. (NYSDEC 1997)

Under the regulations (6NYCRR 612-614) promulgated in 1985, owners are required to register storage facilities with DEC. Facilities must be re-registered every five years. Registration fees vary from \$100 to \$500 per facility, depending on capacity.

New facilities must be registered before being placed into service. DEC must be notified within 30 days prior to substantial modifications. All facilities regulated under Article 17, Title 10 must meet certain handling and storage requirements established by DEC. Existing USTs and ASTs must observe rules for color coding of fill ports, shutoff valves, gauges and check valves. Aboveground tanks must be provided with secondary containment (i.e., berms or other devices to contain spills).

Operators of USTs must keep daily inventory records, reconcile them on a 10 day basis (and maintain them for five years) and notify DEC and the tank owner within 48 hours of unexplained inventory losses. They must also test tanks and pipes every five years or monitor the interstitial space of double-walled equipment.

Operators of ASTs must conduct monthly visual inspections. Every 10 years they must clean out the tanks that are resting on grade, remove the sludge from the bottom, inspect for structural integrity and test for tightness.

Tanks that are temporarily out of service (30 days or more) must be drained of product to the lowest draw off point. Fill lines and gauge openings must be capped or plugged. Inspection and registration must continue. Those tanks that are permanently out of service must be emptied of liquid, sludge and vapors. The tanks that are permanently out of service must then either be removed or if left in place USTs must be filled with solid inert material such as sand or concrete slurry. DEC must be notified 30 days prior to filling or removal.

Part 614 applies to all new and modified facilities. New USTs must either be made of fiberglass reinforced plastic; cathodically protected steel (to protect against the corrosion caused by contact between steel and soil); or steel clad with fiberglass reinforced plastic. Secondary containment such as a double-walled tank, or a vault, must be provided. If tank is double-walled, monitoring of the interstitial space is required, otherwise use of an in-tank monitoring system or one or more observation wells is required.

New ASTs must be constructed of steel. If their bottom rests on the ground, the tank must have cathodic protection. An impermeable barrier must be installed under the tank bottom, with monitoring between the barrier and the bottom.

New underground piping systems must be designed with a 30-year life expectancy. If made of steel, they must be cathodically protected. Pipes may be constructed of fiberglass-reinforced plastic or other equivalent non-corrodible materials.

Regulation of Chemical Tanks

In 1986, the Legislature passed two State laws for protecting public health, safety and the environment. One law, Article 37 of the Environmental Conservation Law requires the Department of Environmental Conservation (DEC) to regulate all substances covered by the Federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), and Federal Toxic Substances Control Act (FTSCA). DEC may also regulate other chemicals known to be hazardous. (NYSDEC 1997)

A second law, which is entitled Article 40, Hazardous Substances Bulk Storage Act, regulates the sale, storage and handling of hazardous substances. These State laws were among the first of their kind in the Nation designed to prevent chemical spills and leaks.

The Department has enacted Chemical Bulk Storage Regulations (6NYCRR Parts 595-599) which set forth rules as follows:

- Over 1,000 substances are listed;
- Requirements for release reporting, response and corrective action are outlined;
- Chemical manufacturers/distributors must supply their buyers with guidance on proper storage and handling of chemicals and to file the guidance with DEC;

- New storage equipment (tanks, pipes, transfer stations and associated equipment) must meet State standards;
 - Tanks and pipes must be tested and inspected for soundness;
- Important past due deadlines are:
- By August 11, 1996, owners were required to develop and keep up-to-date a plan for spill prevention. This is called a spill prevention report or "SPR."
 - By December 22, 1998 underground tanks and piping systems were required to be replaced with double-walled systems.
 - By December 22, 1999 aboveground tanks and transfer stations were required to have secondary containment and be upgraded to meet State standards.
 - By December 22, 1999 non-stationary tanks were required to be stored in dedicated areas with spill containment.

The transfer of hazardous substances is prohibited if the facility is unregistered or where the manufacturer/distributor fails to provide buyers with recommended practices and guidance on proper methods for storage and handling of such substances.

2.2.5 Pretreatment of Industrial Discharges to Eighteenmile Creek

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organization: City of Lockport

Background

In 1972 Congress passed the Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), to restore and maintain the integrity of the nation's waters. The goals of the CWA are to eliminate the introduction of pollutants into the nation's navigable waters and to achieve fishable and swimmable water quality levels. The CWA's National Pollutant Discharge Elimination System (NPDES) Permit Program represents one of the key components established to accomplish the goals of the CWA. The NPDES Permit Program generally requires that point source discharges of pollutants to waters of the United States, i.e., direct dischargers, obtain an NPDES permit.¹ The CWA also established substantial penalty authority for noncompliance with NPDES permits.

In addition to addressing these direct discharges, the CWA also established a regulatory program to address indirect discharges from industries to publicly owned treatment works (POTWs) through the National Pretreatment Program, a component of the NPDES Permit Program. The National Pretreatment Program requires industrial and commercial dischargers, called industrial users (IUs), to obtain permits or other control mechanisms to discharge wastewater to the POTW. Such a permit may specify the

effluent quality that necessitates that an IU pre-treat or otherwise control pollutants in its wastewater before discharging it to a POTW.

Certain industrial discharge practices can interfere with the operation of POTWs, leading to the discharge of untreated or inadequately treated wastewater into rivers, lakes, and other waters of the United States. A discharge that causes interference inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use, or disposal and therefore causes a violation of any requirement of the POTW's NPDES permit. Some pollutants are not amenable to biological wastewater treatment at POTWs and can pass through the treatment plant untreated. This pass through of pollutants affects the receiving water and might cause fish kills or other deleterious effects. Even when a POTW has the capability to remove toxic pollutants from wastewater, the pollutants can end up in the POTW's sewage sludge, which might then be processed into a fertilizer or soil conditioner that is land-applied to food crops, parks, or golf courses or elsewhere.

Measure

An Industrial Pretreatment Program has been developed and is being implemented for the City of Lockport. This program regulates the discharge of toxic substances from industries to the waste water treatment plant. The primary objectives of the pretreatment regulations are to prevent the discharge of toxic pollutants which interfere with the operation of waste water treatment facility and which may either pass through this facility untreated, or severely limit disposal options for large volumes of municipal sludge. (NYSDEC 1997)

The City of Lockport Industrial Pretreatment Program was approved in August 1984 and currently has 16 significant industrial users (SIUs). All SIUs are subject to the Federal General Pretreatment Regulations as well as any local regulations developed by the City of Lockport. SIUs in a particular service area are issued permits for their discharges into the sewer system in a manner analogous to the New York State issued SPDES permits for surface discharges. These permits are pollutant specific and limit the volume, mass and concentration of allowable pollutant discharges into the sewer system.

The City of Lockport implements the program through a system of permits, inspections, sampling and enforcement for cases of non-compliance. The legal authority necessary to implement the compliance and enforcement portions of the program was established during program development Enforcement action in response to SIU non-compliance may include civil actions, civil or criminal penalties and termination of service. (NYSDEC 1997)

2.2.6 Combined Sewer Overflow Assessment and Abatement

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organization: New York State Department of Environmental Conservation, City of Lockport

Background

Combined sewer systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all of their wastewater to a sewage treatment plant, where it is treated and then discharged to a water body. During periods of heavy rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies.

These overflows, called combined sewer overflows (CSOs), contain not only stormwater but also untreated human and industrial waste, toxic materials, and debris. They are a major water pollution concern for the hundreds of cities in the U.S. that have combined sewer systems. The storm water component contributes a significant amount of pollutants to CSO. Each storm is different in the quantity and type of pollutants it contributes. For example, storms that occur in late summer, when it has not rained for a while, have the most pollutants. Pollutants like oil, grease, fecal coliform from pet and wildlife waste, and pesticides get flushed into the sewer system. In cold weather areas, pollutants from cars, people and animals also accumulate on hard surfaces and grass during the winter and then are flushed into the sewer systems during heavy spring rains.

The City of Lockport combined sewer system periodically discharges untreated stormwater overflow into Eighteenmile Creek during periods of significant precipitation. Over the past 15 years, 20 of the City's original 31 combined sewer overflows have been separated by installing new sewer line for either the sanitary or storm flow system. Five of the remaining eleven CSOs have the potential to discharge to Eighteenmile Creek. The remaining six outfalls have the potential to discharge into the Erie Barge Canal. (See Table 2-4) Since Eighteenmile Creek receives constant augmented flow from the Erie Barge Canal, all of the remaining eleven outfalls have the potential to negatively affect the water quality in Eighteenmile Creek.

TABLE 2-4 CITY OF LOCKPORT COMBINED SEWER OUTFALLS

OUTFALL #	OUTFALL LOCATION	LATITUDE	LONGITUDE	STREAM
002	East of Jackson St., North of William St.	43 10' 54'' N	78 41' 27'' W	Eighteenmile Creek
005	Pine St. Service Road	43 10' 15'' N	78 41' 35'' W	Erie Barge Canal
006	Between Niagara St. and Richmond St.	43 10' 12'' N	78 41' 43'' W	Erie Barge Canal
007	Between Cottage St. and Main St.	43 10' 11'' N	78 41' 41'' W	Erie Barge Canal
008	West Main Street	43 10' 08'' N	78 41' 46'' W	Erie Barge Canal
011	Prospect St.	43 09' 51'' N	78 42' 07'' W	Erie Barge Canal
014	State Rd.- 1150 Ft. South of Nichols St.	43 09' 30'' N	78 42' 27'' W	Erie Barge Canal
019	Garden Street	43 10' 32'' N	78 41' 06'' W	Eighteenmile Creek
020	Spring St./Union St.	43 10' 30'' N	78 41' 01'' W	Eighteenmile Creek
023	#208 East Ave.	43 10' 23'' N	78 40' 53'' W	Eighteenmile Creek
034	East Ave./Cave St.	43 10' 22'' N	78 40' 55'' W	Eighteenmile Creek

Measure

2.2.6.1 PCB Sampling in Lockport Sewer System

In 1999, the City of Lockport began a 2 year study of the systems remaining CSOs. The goal of the City of Lockport sewer system PCB trackdown was to determine if there are active sources of PCBs discharging to either Eighteenmile Creek or the Barge Canal through the sewer system.

The City of Lockport sewer system consists of two major interceptors which convey wastewater to the treatment plant. The Gulf Interceptor serves the Northwest section of the City and conveys wastewater to the plant along the Gulf. The remainder of the city is served by the Main Interceptor, which runs along the NY Barge Canal and Eighteenmile Creek. The Main Interceptor receives flow from a number of interceptor trunk sewers, which serve various sections of the city. (NYSDEC 2001a)

A systematic Passive In-Situ Chemical Extraction Sampler (PISCES) sampling approach was undertaken to identify potential source areas of PCBs within the sewer system. Sampling was conducted at the major inflow points to the Main Interceptor plus the Main Interceptor and the Gulf Interceptor. Follow-up confirmatory sampling was undertaken in selected areas of the system utilizing both PISCES and whole water samples.

A PISCES sample collected on Prospect Street at Stevens Street indicated a PCB concentration of 1.5 ug/l. The sample included flow from the Prospect Street sewer and the Stevens Street North sewer which serve residential, commercial and industrial users. This flow discharges into the Main Interceptor at the Prospect Street juncture along with flow from the Stevens Street South sewer and the Southwest Interceptor. The Prospect Street sewer receives residential flow from Prospect Street and side streets and flow from Reid Petroleum, a petroleum distribution facility. The Stevens Street sewer receives

residential flow from Stevens Street and side streets as well as flow from a sewer which services the industrial and commercial area in the Ohio Street area. (NYSDEC 2001a)

PISCES samples collected at Ohio Street were conflicting with Sample A indicating a PCB concentration of 0.0004 ug/l and Sample B indicating 0.064 ug/l. A whole water sample collected in indicated a low level of PCBs at 0.0027 ug/l. An additional PISCES sample indicated a PCB concentration of 0.091 ug/l. The flow from the Ohio Street area is tributary to the Prospect Street juncture with the Main Interceptor. (NYSDEC 2001a)

PISCES sampling in the Main Interceptor above Prospect Street at the Willow-Price Interceptor indicated a PCB concentration of 0.026 ug/l in Sample A and 0.0081 ug/l in Sample B. PISCES sampling in the Main Interceptor below the Prospect Street juncture at W. High Street indicated a PCB concentration of 0.0052 ug/l. (NYSDEC 2001a)

Whole water samples in the Main Interceptor above and below the Prospect Street juncture indicated an increase in PCB concentration from 0.015 ug/l at Minard Street to 0.075 ug/l at West High Street. At the conclusion of the study, it was recommended that the City of Lockport in its ongoing assessment of combined sewer overflows monitor PCB concentrations at its overflow monitoring sites along the Main Interceptor including the Prospect Street overflow and undertake in-system trackdown monitoring for PCBs in the Ohio Street area. (NYSDEC 2001a)

2.2.6.2 Combined Sewer Overflow Abatement

Since 2002, three projects within the City of Lockport sewer system were developed and funded by the New York State Clean Water/Clean Air Bond Act for the reduction of combined sewer overflows. The Ohio-Simonds Sewer Project constructed new storm sewers in the west central portion of the city resulting in separation of stormwater from the combined sewer system. The Wastewater Treatment Plant Improvement Project constructed a new clarifier at the treatment plant to increase the capability to treat wet weather flows from the combined sewer system. The Exchange Street Overflow Elimination Project eliminated combined sewers from discharging into the Eighteenmile Creek culvert. A new drill hole was made into an existing interceptor sewer tunnel constructed at the intersection of Exchange and Market Streets. A total of about 425 feet of 15" and 24" sewer pipe was installed. This sewer pipe will convey sewer flows from an existing diversion chamber to the interceptor sewer tunnel.

To be in compliance with its SPDES permit, the City of Lockport has completed a draft Monitoring Plan for CSOs and CSO Impacts. Preliminary results of the CSO Monitoring Plan revealed 20 direct connections of raw sewage to Eighteenmile Creek. Construction activities to redirect the flow to the sewer system were immediately completed by the City. In addition, the City identified additional direct connections on Stevens Street. When the Ohio-Simonds project was completed, apparently the contractor inadvertently connected four house service laterals directly to the storm sewer which discharges directly to the Barge Canal. Once identified, the sewer laterals were correctly routed to the sanitary sewer. This work was completed in September 2006.

In 2011, two additional CSO's were closed by the City of Lockport. They include CSO #18 which was located on Market Street between houses # 471 & #485 and discharged to the Erie Barge Canal. Also, CSO #24 which was located on Carlton Place and discharged to Eighteenmile Creek was closed.

2.2.7 Stream Water Quality Monitoring

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Measure Status: Ongoing

Lead Organizations: Niagara County SWCD, New York State Department of Environmental Conservation, US EPA

Measure

Lake Ontario Tributary Monitoring

In 2002, the U.S. Environmental Protection Agency (EPA) initiated a program to regularly monitor U.S. tributaries for the critical pollutants. Beginning in April 2002, ambient water samples were collected two to three times annually from stations located in the downstream portions of each of the following tributaries to Lake Ontario: Black River; Salmon River; Oswego River; Genesee River and; Eighteen Mile Creek. The purpose of the investigation was to document loading rates of six critical pollutants identified within the Lake Ontario Lakewide Management Plan (LAMP). The LAMP identified the following critical pollutants because of their toxicity, persistence in the environment, ability to bio-accumulate, and their negative impacts to lakewide beneficial use impairments: PCBs, mercury, DDT, mirex, dieldrin, and dioxins. In the 2002-2004 round of sampling, it was found that PCB levels are significantly higher in Eighteenmile Creek than other major U.S. tributaries to Lake Ontario (Black, Salmon, Oswego and Genesee Rivers). Mercury was also found on all sampling dates. Some Lake Ontario Management Plan priority pollutants of concern (DDT, dieldrin and mirex) were not detected in Eighteenmile Creek in this study.

As has been the case since the initiation of this project in 2002, the highest PCB concentrations are observed in Eighteen Mile Creek. In 2009 – 2010 PCB concentrations in Eighteen Mile Creek were at least one order of magnitude higher than the concentrations observed in any other tributary, usually two to three orders of magnitude. In 2008, PCB concentrations in Eighteen Mile Creek were more than 40 times greater than the concentration observed in any other stream. (USEPA 2010)

Nutrient & Sediment Loss Investigations

In July 2003, the Niagara County Soil & Water Conservation District (NCSWCD), in conjunction with the Department of Environmental Science and Biology at SUNY Brockport, began a monitoring program for Eighteenmile Creek. Eighteenmile Creek was monitored for two annual cycles from August 1, 2003 through July 31, 2005. The NCSWCD began collecting data needed to accurately characterize the water quality in the creek and to quantify the concentration and loading of nutrients and suspended sediments transported from Eighteenmile Creek to Lake Ontario. Identifying the magnitude of soil and

nutrient losses from this watershed will allow the determination of the health of the creek and its impact to Lake Ontario. Monitoring of water quality in the creek was performed via a fixed monitoring station and grab samples. Sampling parameters included total phosphorus, total suspended solids, sodium, nitrate, nitrite, and total kjeldahl nitrogen.

The results of this investigation show that Eighteenmile Creek is moderately to severely impacted with respect to phosphorus loss from its watershed when compared, on an areal basis, with other watersheds in western and central New York State. Within Niagara County, Eighteenmile Creek's areal phosphorus loss is nearly six times that of Twelvemile Creek West and over 12 times that of Twelvemile Creek East (watersheds adjacent to Eighteenmile Creek). The non-event total phosphorus concentration was also very high when compared to other watersheds that have a very heavy agricultural presence or receive discharge from a sewage treatment plant. (Makarewicz et. al. 2006)

It was concluded that the City of Lockport's sewage treatment plant is having an impact on the water quality of Eighteenmile Creek. The treatment plant is contributing a large amount of phosphorus to the creek and creating a biochemical oxygen demand that is lowering the pH and dissolved oxygen in that portion of the watershed. Non-event loadings of total phosphorus, nitrate, total Kjeldahl nitrogen, and sodium are nearly equal to or greater than event loadings, most likely due to the continuous input from the treatment plant. (Makarewicz et. al. 2006)

The mean total suspended solids (TSS) event concentration (26.3 mg/L) was nearly double the mean TSS concentration during non-event conditions (15.0 mg/L) in Eighteenmile Creek. Total suspended solids or soil was lost from the Eighteenmile Creek watershed at a rate of 10,989 kg/day during the two year period encompassing August 1, 2003 to July 31, 2005. On an areal basis, TSS was lost at a rate of 369 g/ha/day during the period August 1, 2003 to July 31, 2004 and a rate of 567 from August 1, 2004 to July 31, 2005. Forty six percent of the TSS loss occurred during the winter seasons followed by spring (29%), summer (16%) and autumn (9%). Of all the parameters measured in Eighteenmile Creek, the loss of total suspended solids was the most affected by hydrometeorological events. Seventy percent of total suspended solids loss occurred when Eighteenmile Creek was in event conditions. This is not surprising as the increased water flowing over land in the watershed erodes soil and picks up solids and carries them to the creek. (Makarewicz et. al. 2006)

As expected the dam at Burt, NY is slowing down the Creek's flow allowing solids to settle out resulting in a significant decrease in total suspended solids concentrations below the dam versus the sampling sites above the dam. (Makarewicz, et al. 2006)

In 2006, NCSWCD began monitoring major creeks within the county, including Eighteenmile Creek for baseline and storm event sediment and nutrient load as well as BOD and temperature. Baseline monitoring was completed on a monthly basis in addition to sampling of four storm events. The results will be used to identify those creeks in need of further study, to provide scientific data to update the Priority Waterbodies List and to identify problems and prioritize local projects. The monitoring of water quality in the creek was performed via grab samples. Sampling parameters included total phosphorus, total suspended solids, sodium, nitrate, nitrite, and total kjeldahl nitrogen. Considering the non-weighted areal loss of phosphorus, Eighteenmile Creek had the greatest overall loss of phosphorus (221.8 kg/P/day) of any watershed evaluated. (Makarewicz et. al. 2008)

Stressed Stream Analysis

In 2009-2010, a Stressed Stream Analysis was completed for the Eighteenmile Creek watershed. The stressed stream analysis is an approach that identifies impacted sub-watersheds and their associated streams. Within a watershed, stressed stream analysis is an approach for determining how and where a stream and its ecological community are adversely affected by a pollution source or other disturbances. It is a technique that identifies the sources, extent, effects, and severity of pollution in the watershed. Previous studies have indicated that Eighteenmile Creek is the highest contributor of phosphorus to Lake Ontario of the Niagara County streams. In comparison to other New York Lake Ontario tributaries, Eighteenmile Creek had relatively high phosphorus concentrations. Some nutrients (e.g., unionized ammonia-nitrogen) can be toxic to benthic life under certain conditions.

Water samples were taken spatially over a one-year period during or just after rainfall periods over the entire Eighteenmile Creek watershed. In total, 28 sites were sampled at least once, and over 540 water samples were analyzed for chemical analysis. Five locations were identified as sources of nutrient and soil loss within the Eighteen mile Creek watershed. (Makarewicz & Lewis 2010)

- 1) **The Lockport Water Treatment Plant:** The City of Lockport's wastewater treatment plant (WWTP) is a major source of nutrients to the "West Branch" of Eighteenmile Creek and. Over the study period, Total Phosphorus (TP) concentrations just downstream the WWTP averaged 165.1 µg P/L, which is significantly above the 20 µg P/L NYS Guideline for Ambient Levels of Phosphorus in Surface Waters. The results from 26 August 2009, a nonevent period, provided clear evidence that the WWTP (West Jackson St.) was impacting downstream areas of Eighteenmile Creek. Compared to sites upstream of the WWTP, all nutrient concentrations increased downstream of the treatment plant.
- 2) **Salt Barn:** The New York State DOT deicing salt storage barn (Lockport Junction Rd.) is a source of sodium to Eighteenmile Creek. On several occasions, sodium concentrations exceeding 100 mg/L were observed just downstream of the salt barn. This suggests that the origin of the salt is the de-icing salt barn.
- 3) **Agricultural Land:** The large fields near McKee Rd. and West Creek Rd. were the source of organic nitrogen observed. On 29 May 2009, high TKN concentrations were observed at Site 3 (894 µg N/L) and Site 4 (839 µg N/L). Elevated TP concentrations were also observed at these locations (>120 µg P/L) on this date. There was a strong smell in this area. Inspection of some of the adjacent fields revealed that manure had been recently applied to the fields.
- 4) **Agricultural Land:** Located in the general area of Campbell Boulevard and Old Saunders Settlement Road, this area drains agricultural land through a series of ditches. Elevated levels of TP were observed in the area. The elevated TP concentrations were always associated with elevated levels of total suspended solids indicating that soil erosion, either stream bank or surface field erosion, was occurring in this headwater area. Similarly, high organic nitrogen levels (1909 µg N/L) were observed.
- 5) **Agricultural Land:** The East Branch of Eighteenmile Creek drains a series of agricultural operations with animals and corn silage stored on site. At least three, perhaps 4 Combined Animal Feeding Operations (CAFO) exist in the watershed of this branch of the stream. Throughout the study

period, the entire East Branch of Eighteenmile Creek had elevated levels of phosphorus, organic nitrogen, and nitrate. In fact, much effort went into locating sources within this branch of the creek. The source of much of the nutrient pollution of the East Branch was located above the Niagara Escarpment in the southwestern portion of the watershed. For example, TP concentrations on Mackey Road (Site reached 2,679.8 µg P/L in a small stream ditch that runs into the main branch. This represents a 100-fold increase over the NYS Guidelines for ambient levels of phosphorus (20 µg P/L). (Makarewicz & Lewis 2010)

Other Programs

A host of surface water quality studies of Eighteenmile Creek have been completed over the years and include the following surveys and sampling by NYSDEC:

- Stream surveys for water quality parameters such as BOD, pH, temperature, nutrient levels, and coliform bacteria counts.
- Dioxin and furan sampling (1990), which included a single sample taken from Eighteenmile Creek that tested for total dioxins and total furans. This study was conducted to determine if there were any exposure risks to 2,3,7,8-TCDD (dioxin) from exposure to the water. Dioxins were not detected in this study.
- Lake Ontario tributary sampling in 1994, which included Passive In-Site Chemical Extraction Sampler (PISCES) and pressure filtration samples taken from various locations along Eighteenmile Creek and the NYS Barge Canal that were tested for dissolved phase PCBs, pesticides in the water column, and contaminant levels associated with the suspended solids in the water column.
- PCB sampling in 1995 as part of the Lake Ontario tributary sampling program tested specifically for PCBs from the discharge of the NYS Barge Canal into Eighteenmile Creek downstream to North Transit Road.
- Phenols and chlorinated benzene sampling and analysis in 1995 did not detect any of these compounds.
- PCB trackdown project (1998-2000) of the City of Lockport Sewer System, included PICES (within sewers) and whole water (collection from wastewater flow) sampling to identify potential source areas of PCBs within the sewer system (NYSDEC 2001).
- Rotating intensive basin surveys (RIBS), which included sampling for a wide range of contaminants such as metals and organic compounds as well as physical water quality parameters.
- In 2002, NYSDEC, with NYS Department of Health and the Niagara County Health Department, conducted three separate sampling events to obtain information sufficient to determine if the properties along Water Street are being impacted by the former Flintkote site and/or Eighteenmile Creek.

- Long term monitoring of the City of Lockport's CSO discharges and downstream ambient water quality began in 1999 and will continue per the City's wastewater treatment plant SPDES permit.
- Niagara County (2005) conducted a Site Investigation/Remedial Alternatives Report (SI/RAR) of the former Flintkote site involved sampling of on-site and off-site (outfall sediments in Eighteenmile Creek) environmental media and determined that while the Flintkote site may have been a source of contaminants to Eighteenmile Creek, there are likely other sources of contaminants in the upper watershed.

2.2.8 Agricultural Planning and Best Management Practice Construction

Use Impairments Addressed:

#3 Degradation of Fish and Wildlife Populations

#6 Degradation of Benthos

Measure Status: Ongoing

Lead Organizations: New York State Department of Agriculture and Markets, Niagara County SWCD

Measure

In 2005, NCSWCD began implementing the Agricultural Environmental Program (AEM) within the Eighteenmile Creek watershed. AEM is a voluntary, incentive-based program that helps farm operators make common-sense, cost effective and science-based decisions that help meet business objectives while protecting and conserving the State's natural resources. (NYS Ag & Markets, 2006)

In response to various environmental concerns statewide, the AEM Program has been developed by farmers, every level of government, and farm conservation professionals. It uses existing environmental planning processes and tested approaches to solve and prevent numerous environmental problems. In short, AEM establishes a coordinated framework for protecting and improving the environment off and on the farm, while maintaining the viability of farming as a commercial enterprise.

Since 2005, NCSWCD has been conducting farm assessments and evaluating water quality on scores of farms within the watershed. Since then, various resource concerns have been identified and ranked for the watershed. (Table 2-5) To address these resource concerns, NCSWCD applied for and received funds from the New York State Agricultural & Non-Point Source Abatement Program to implement Best Management Practices (BMPs) on high priority farms.

**TABLE 2-5 EIGHTEENMILE CREEK AGRICULTURAL ENVIRONMENTAL
MANAGEMENT RESOURCE CONCERNS**

RANK	CONCERN	SOURCE
1	Water Quality	PWL, Water Quality Strategy
2	Contaminated Sediment	PWL
3	Urban Runoff	PWL, SUNY Brockport
4	Agricultural Runoff	Water Quality Strategy
5	Combined Sewer Overflows	PWL
6	Land disposal	PWL
7	Impaired fish consumption and fishing	PWL

In 2008, an agricultural BMP Implementation Project was initiated for three farms present in the Eighteenmile Creek watershed. A Barnyard Water Management System was constructed to contain the 25-year, 24-hour rainfall from an existing barnyard. The storm water run-off from an existing barnyard was not contained at the farm. During rainfall events the runoff was uncontrolled and ran into an adjacent catch basin which drains into an onsite drainage ditch and ultimately into Eighteenmile Creek. A concrete containment area with curbs was constructed to collect the storm water runoff from the barnyard. The collection area contains a pump to transfer the liquid from the barnyard into an existing slurry storage unit on the farm, thereby eliminating all contaminated runoff from the barnyard. This BMP has reduced nutrient loading from the farm, and thereby benefits the water quality of the creek.

A Milk Center Waste Water Treatment System was constructed to treat the process wash water from a milk house before it reached Eighteenmile Creek. An existing system was constructed to service the milk center at the farm a number of years ago but is has since failed. The existing leveling boards and stone trench were replaced and the plumbing was repaired to allow the system to function properly. In addition, the filter was short circuited because the leveling boards were rotted allowing concentrated flow across the filter. To allow the system to function properly, the filter area was re-graded and reseeded to allow for uniform flow across the wastewater treatment strip. The repair and construction of the milk center waste water treatment system has eliminated 200,000 gallons of untreated waste water from entering the on-site drainage course each year and draining into Eighteen Mile Creek.

A Silage Leachate Management System was also completed for one farm. The concentrated leachate and storm water runoff from two existing bunk silos was not controlled or treated. The project consisted of installing swales and ditches to direct runoff to a low flow collection pad where the concentrated leachate is collected and transferred into an existing on site slurry storage. The high flows (diluted runoff) during rain events are now routed through a wastewater treatment strip to treat the runoff prior to discharging it into the clean water ditch. The system has improved water quality by removing the 50,000 gallons of concentrated leachate from the drainage ditch and storing it until it can be diluted with manure waste and spread onto cropland and by treating the 640,000 gallons of rainfall run-off from the bunk silo through a wastewater treatment strip.

In 2010-2011, a second agricultural BMP Implementation Project was initiated for three additional farms present in the Eighteenmile Creek watershed. A Milk Center Waste Water Treatment System was constructed on a farm to store the waste water from a milking parlor. The project consisted of adding a steel ring to an existing manure slurry storage tank located at the farm. The wastewater is now handled

by transferring it into a manure storage facility and spreading the wastewater on cropland in accordance with a Comprehensive Nutrient Management Plan. The additional ring to the existing manure storage tank has provided for 225,000 gallons of additional storage capacity. The milk center wastewater storage system has virtually eliminated 225,000 gallons of untreated waste water from entering the on-site drainage course each year and draining into Eighteenmile Creek.

A silage leachate management system and a barnyard water management system were completed for a beef farm located in the watershed. Uncontrolled runoff from a silage storage area used to drain into a drainage ditch which discharges into a tributary to Eighteenmile Creek. The farm stores sweet corn silage which has a high moisture content and a large amount of concentrated runoff. The project consisted of moving the silage storage area to a higher location, and providing a paved area to allow for the removal of spilled silage and the collection of concentrated leachate as well as the collection and routing of storm water runoff through a vegetated filter strip. The system improved water quality by eliminating the discharge of concentrated leachate into the adjacent stream, and treating 240,000 gallons of rainfall run-off from the bunk silo through a wastewater treatment strip. The barnyard runoff management system consisted of relocating the barnyard away from the tributary to Eighteenmile Creek, constructing a paved barnyard with concrete curbing to contain manure on the barnyard and the installation of a roof covering system to prevent rain water from contacting the manure. The barnyard runoff management system eliminated approximately 850,000 gallons of contaminated runoff from the area each year.

A compost facility was completed for a third farm located in the watershed. The farm is currently using a rotational grazing system for cattle. During the winter months the animals are kept in the barn to prevent damage to the pasture. The manure from the barn is scraped and stored outside in manure piles adjacent to the barn. The area around the manure piles becomes muddy from scraping operations during wet conditions and there was no control of the runoff from the piles and the contaminated runoff drained into an onsite drainage channel which discharges into a tributary to Eighteen Mile Creek. To improve water quality a compost facility was constructed which consisted of a paved area where manure from the farm can be composted. The hard surface will allow for the turning of the compost piles throughout the year without creating muddy conditions during times when the soil is wet from rainfall and snow melt events. The compost pad is properly graded to allow for the collection of rainfall runoff from the area, which is directed and treated through a wastewater treatment strip. The project eliminated approximately 100,000 gallons of contaminated runoff from the disturbed area each year.

The completed BMP's have tremendously reduce nutrient and sediment loading from the farms by preventing contamination from reaching the creek. The improvements have allowed for complete containment of manure and manure laden storm water on the existing concrete barnyard; the treatment of milk center process waste water; and now collect and store the concentrated leachate from the bunk silos and treat the storm water flows from the bunk silos through a waste water treatment strip.

2.2.9 Erosion & Sediment Control

Use Impairments Addressed:

- #3 Degradation of Fish and Wildlife Populations
- #6 Degradation of Benthos

Measure Status: Ongoing

Lead Organization: Niagara County SWCD

Measure

SWAT Model

In 2005, Buffalo State College in conjunction with U.S. Army Corps of Engineers, Buffalo District, implemented the Soil Water Assessment Tool (SWAT) for the Eighteenmile Creek watershed. Under Section 516(e), Water Resources Development Act of 1996, as amended, USACE is directed to apply sediment transport models to tributaries of the Great Lakes that discharge to Federal navigation channels or Areas of Concern (AOCs). These models are being developed to assist state and local resource agencies evaluate alternatives for soil conservation and non-point source pollution prevention in the tributary watersheds. The ultimate goal is to support state and local measures that will reduce the loading of sediments and pollutants to navigation channels and AOCs, and thereby reduce the costs for navigation maintenance and sediment remediation. (Inamdar, 2005)

The SWAT model was implemented for the Eighteenmile Creek watershed to determine annual sediment yields and critical source areas of erosion in the watershed. A stochastic approach was used to calibrate the hydrologic component of the model since the watershed did not have any real time U.S. Geological Survey gage stations. Model simulated monthly runoff ratios for Eighteenmile were compared against measured runoff ratios for two adjacent watersheds – the Tonawanda and Cayuga Creek watersheds. Sediment calibrations were performed by comparing model simulated daily sediment concentrations against measured suspended sediment concentrations for two sites in the watershed. Sediment monitoring was performed by continuously-recording YSI sondes and grab sampling for suspended sediment. Sediment data was collected for the period August 2004 – November 2005.

There was considerable spatial variation in sediment generation within the Eighteenmile Creek watershed with a range of 0.22-5.52 tons ha⁻¹yr⁻¹. A group of agricultural sub-basins on the southwestern end of the watershed generated the highest sediment yields and should be targeted for implementation of best management practices. (Inamdar, 2005)

Streambank Stabilization & Habitat Restoration Project

A 2003 project was designed to be the first critical step in creating sustainable fisheries in, and improving access to, Eighteenmile Creek. The goal of the project was to: improve the habitat for coldwater fish species immediately below the Burt Dam; to improve bank stability and provide for non-point source pollution and sedimentation control through the application of innovative stabilization and bioengineering techniques; to improve public access and safety by widening the eroding trail and stream

bank; and to improve adjacent riparian and aquatic habitat by establishing bank side vegetation, a canopy of native tree species, and various aquatic habitat features. Goal and function-based design techniques utilized for this restoration project include: buried keys; patio stones for fishermen's access; a hand-placed stone ledge; a stone-step staircase; a stepped-stone wall with a pinned base level for bank protection; an uneven bank-line; exclusionary vegetation; protection of natural "leaner" trees; bent willow pole method; soil-choked rip-rap; locked limbs; locked logs; dense root mass replication; traditional wooden and cantilverted stone lunkers; tree stump habitat; hydraulic cover stones; bed diversity stones; duck resting rocks; locked branches; free branches; and an erosion control seeding. The project also included the invention of the "pushed" tree technique and spurred the inception of the term "extreme instant shade."

Phase II

In 2006, Niagara County SWCD secured funds to initiate Phase II of the restoration of Eighteenmile Creek below Burt Dam. The project consisted of the placement of large rip-rap stones along the east and west banks to re-define and narrow the channel to its former configuration, and to create a wetland area along the east shoreline. The project also placed additional hydraulic cover stones in the creek.

Approximately 560 lineal feet (375 tons) of large rip-rap stone was placed along the east bank of Eighteenmile Creek to narrow the channel to its former configuration and to create a low flow deflector/fishing access wall. Three hundred and forty (340) lineal feet (63 tons) of hydraulic cover stones were placed along the west bank of Eighteenmile Creek to better define the channels shape and protect the wetland marsh present along said bank. Fifty (50) hydraulic covers stones (88 tons) were also placed in the main channel of Eighteenmile Creek.

The purpose of the project is to continue the restoration of the physical, biological, and chemical integrity of the Eighteenmile Creek ecosystem and improve existing access to the popular fishing area along Eighteenmile Creek. The project addresses several priorities of the Great Lakes Restoration Program including:

- Restoration, protection, and enhancement of stream corridors for protecting and improving water quality, protecting and enhancing fish and wildlife habitats, eliminating or minimizing streambank erosion and reducing sediment loads to streams and lakes;
- Protection and restoration of watershed functions for maintaining base flow and water quality necessary to sustain fish and wildlife within streams, and associated wetlands; and
- Restoration, protection, and enhancement of riparian habitats, including in-stream and freshwater habitats.

The stabilization of the creek banks was necessary to prevent future erosion and to maintain safe access to the creek for fishing below Burt Dam. The overall project will involve using both "hard" (i.e., rock riprap wall) and "soft" (i.e., vegetative plantings) methods. Due to the extensive use of the area by anglers and water level fluctuations, bioengineering alone would not provide a sound long-term solution to prevent future bank erosion and wetland degradation.

CHAPTER 3

Possible Alternative/Additional Remedial Measures

CHAPTER 3: Possible Alternative/Additional Remedial Measures

Introduction

As defined in 4(a)(iii) of Annex 2 of the Great Lakes Water Quality Agreement, as amended in 1987, Stage 2 RAPs are to be submitted to the International Joint Commission for review and comment and are to contain an evaluation of alternative additional measures to restore beneficial uses.

This chapter describes proposed new remedial measures and actions for use impairments in the Eighteenmile Creek Area of Concern. Many of the proposed remedial measures will directly address more than one BUI, and may indirectly impact others.

3.1 USGS Gage Station

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Potential Lead Organization: U.S. Geological Survey (USGS)

Estimated Cost: \$30,000

Measure

Currently, contaminant loadings from Eighteenmile Creek to Lake Ontario are estimated based on the closest gauge station located on Tonawanda Creek. This results in inaccuracies in data and a lack of a clear understanding as to the contributions that this tributary may be making to Lake Ontario water quality and ecosystem degradation. The western shoreline of Lake Ontario is listed on the 2010 New York State Section 303(d) List of Impaired/Total Maximum Daily Load (TMDL) Waters as impaired due to phosphorus. This impairment spans the shoreline from Niagara County east through Orleans County. Eighteenmile Creek serves as sources of nutrients, pesticides, and other contaminants to the lake.

The primary function of many stream gauges is to measure the water surface elevation and/or volumetric discharge. Discharge is the volume of flow passing a specific point in a given time interval and is measured in cubic feet per second (cfs). This value also reflects any sediment or solids in the water. The USGS maintains gauges throughout the U.S., including New York. In addition to hydrologic parameters, USGS gauges can also include water quality parameters, such as nutrients, suspended sediment, and turbidity, among others. The information collected at the various gauges is either transmitted via satellite back to the USGS or another managing entity, or manually retrieved and downloaded/observed in person.

Installation of a gauge station for Eighteenmile Creek would not only collect hydrologic parameters, but would include measurements of the following water quality parameters: total phosphorus levels; Chlorophyll-a; water clarity and; concentrations of critical pollutants. As remediation progress in the future, the station could be utilized as a long term monitoring tool to assess the potential reduction of contaminant loadings to Lake Ontario and the reduced impact to the section of creek where BUIs currently exist.

3.2 Inactive Hazardous Waste Site Remediation: Eighteenmile Creek Corridor (Site #932121) and Former Flintkote Plant (Site # B-00161-9)

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Potential Lead Organizations: NYS Department of Environmental Conservation, Environmental Protection Agency

Estimated Cost: \$21,792,000

Background

The Eighteenmile Creek Corridor Site consists of approximately 10.6 acres between Clinton and Harwood Streets in the City of Lockport, New York. The Site is contaminated primarily with lead and polychlorinated biphenyls (PCBs). While the exact sources of all the contaminants are unknown, industrial operations at the former Flintkote plant are suspected to be partly responsible. Utilizing the New York State Inactive Hazardous Waste Disposal Site Remedial Program (also known as the State Superfund Program), NYSDEC has extensively investigated and characterized the contamination present within the site over the past 10 years. In addition, a proposed Remedial Action Plan (PRAP) was completed in January 2010 which summarizes the decision that led to the recommended remedial action by discussing each alternative and the reasons for choosing or rejecting it. A Record of Decision (ROD) was completed in March 2010 which presents the remedial action plan for the site and documents the information and rationale used to arrive at the decision. The ROD is the culmination of extensive investigations and a remedy selection that identifies a solution to remove significant threats to the public health and the environment. The ROD presents the selected remedy for Operable Units 1,3,4,5 and 6, as described below. Operable Unit #2, also known as the former Flintkote plant site, is addressed in a separate ROD which was issued in 2006.

The Former Flintkote Plant Site is an abandoned industrial property that occupies approximately six acres at 198 and 300 Mill Street in the City of Lockport, New York. It is referred to above as Operable Unit #2. Niagara County currently owns the 300 Mill Street portion of the site, while a private individual owns the 198 Mill Street portion. The majority of the site is situated along the eastern bank of Eighteenmile Creek, and is bordered by commercial property to the north, vacant land to the south, Mill Street to the east, and Eighteenmile Creek to the west. A small portion of the site, however, is located along the western bank of Eighteenmile Creek, and is bounded to the south by residential properties along Water Street. This portion of the site is referred to as the Water Street Section (WSS).

The basis for listing the site in the Registry was the presence of seven drums containing sweepings, solid materials and polychlorinated biphenyl (PCB) transformer oil stored in the basement of one of the buildings on the site. During an inspection of the site on May 12, 1983 as part of a Phase I Investigation, the drums were observed to be stored in accordance with federal regulations. Analyses of the waste oil

(March 1983) indicated that none of the oil contained more than 2 parts per million (ppm) of PCBs. In January 1984 the Thomas E. Carter Trucking Company, at the time the owner of the property, had these drums removed from the site by a waste oil processor. As a result of this action the site was removed from the Registry in 1985.

In 1989, the City of Lockport Building Inspection Department reported to the NYSDEC that a number of drums containing chemicals were found in various locations throughout the buildings at 300 Mill Street. Subsequent investigation revealed that 28 of these drums contained hazardous wastes. These drums were disposed off site in May, 1991 by a NYSDEC Drum Removal Action.

Sediment and ash samples were collected by the NYSDEC Division of Environmental Remediation (DER) in August 1996. These analyses confirmed the presence of PCBs in the millrace sediment; the two ash samples collected from the island failed the Toxicity Characteristic Leaching Procedure (TCLP) Regulatory Limit for lead. The findings and conclusions of the April 1996 study and the results of the August 1996 sampling event indicated the need for additional investigation at the site.

The site was also the subject of a United States Environmental Protection Agency (USEPA) removal action in 2002, which focused on the removal of friable asbestos containing materials within the site's buildings and on-site debris. A total of 170 cubic yards of asbestos containing debris and 180 cubic yards of debris that did not contain asbestos were disposed offsite at an approved facility.

A proposed Remedial Action Plan (PRAP) was completed in February 2006 which summarizes the decision that led to the recommended remedial action by discussing each alternative and the reasons for choosing or rejecting it. A Record of Decision (ROD) was completed in March 2006 which presents the remedial action plan for the site and documents the information and rationale used to arrive at the decision.

Measure

Eighteenmile Creek Corridor (Site #932121)

Based on the results of the Remedial Investigation/Feasibility Study (RI/FS) for the Eighteenmile Creek Corridor Site and the criteria identified for evaluation of alternatives, the Department has selected sediment and creek bank excavation with restoration and long-term monitoring for Operable Unit 1, hazardous waste removal with bank stabilization and long-term monitoring for Operable Units 3, 4 and 5, and limited excavation with bank stabilization and long-term monitoring for Operable Unit (OU) 6. The components of the remedy are as follows:

OU 1: Eighteenmile Creek and Millrace - Sediment and Creek Bank Excavation with Restoration and Long-Term Monitoring

- A remedial design program consisting of a floodplain and hydraulic study to determine if reconstruction of the creek banks would impact the floodplain and floodway, to determine the types and locations of the grade control structures, and to determine the best method for diverting the creek during construction;

- Excavation of contaminated sediment from Eighteenmile Creek and the millrace followed by on-site dewatering and subsequent transport to approved off-site disposal facilities;
- Removal of the Clinton and William Street dams following sediment removal. Both dams are dilapidated and unpermitted;
- Excavation of contaminated creek bank soils between the creek and bankfull width followed by creek bank restoration utilizing natural stream restoration principles including, but not limited to, the placement of topsoil, bio-degradable erosion control fabric and live plantings along the length of the creek and millrace;
- Construction of a series of rock riffles to control flow within the creek, reduce the potential for erosion and scour of the banks, and reduce the potential for downstream flooding; and
- Long-term monitoring to assess the effectiveness of the remediation. As part of this monitoring, biota will be monitored and sediment accumulation will be evaluated behind the control structures with samples collected periodically to assess the recontamination potential from upstream sources. The creek bank stabilization measures will be repaired when required.

OU 3: Former United Paperboard Property; OU 4: Upson Park; and OU 5: White Transportation Property - Hazardous Waste Removal with Bank Stabilization and Long-Term Monitoring

- A remedial design program to (1) further delineate the extent of contaminated soil and fill requiring removal, (2) further delineate the extent of contaminated soil and fill along the embankment to determine the extent of the soil cover, and (3) determine the layout of the gravel access roads;
- Construction of gravel access roads along Eighteenmile Creek to be utilized in the remediation of creek sediment. The access roads will remain in place following sediment remediation and form part of the bank stabilization cover system;
- Excavation of soil and fill from OU 3 and 4 that is considered hazardous with the excavated materials transported to approved off-site disposal facilities;
- Backfilling of all excavations to grade with clean soil, with the top 6 inches consisting of topsoil that will be planted with native grasses, shrubs, and/or trees; and
- Construction of a 2-foot thick clean soil cover with demarcation layer between the access roads and the top of the embankment adjacent to the creek. This cover will extend approximately ten feet beyond the top of the embankment, and also extend over contaminated soil and fill that exceeds the commercial soil cleanup objectives. The top 6 inches of the soil cover will consist of topsoil that will be planted with native grasses, shrubs and/or trees.

OU6: Water Street Residential Properties - Limited Excavation with Bank Stabilization and Long-Term Monitoring

- A remedial design program to further delineate the extent of contaminated soil and fill requiring removal and to determine the layout of the gravel access roads;
- Construction of gravel access roads along Eighteenmile Creek to be utilized in the remediation of creek sediment. The access roads will be removed following sediment remediation;
- Excavation of soil and fill that exceeds the residential soil cleanup objectives, with the excavated materials transported to approved off-site disposal facilities; and
- Backfilling of all excavations to grade with clean soil, with the top 6 inches consisting of topsoil that will be planted with native grasses, shrubs, and/or trees.

In addition to the above, the following elements are applicable to Operable Units 3, 4 and 5:

- Imposition of an institutional control in the form of an environmental easement that will require (a) limiting the use and development of the property to commercial use, which will also permit industrial use; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and (d) the property owner to complete and submit to the Department a periodic certification of institutional and engineering controls;
- Development of a site management plan that will include the following institutional and engineering controls: (a) management of the final bank stabilization measures to restrict excavation below the demarcation layers. Excavated soil will be tested, properly handled to protect the health and safety of workers and the nearby community, and will be properly managed in a manner acceptable to the Department; (b) identification of any use restrictions at each operable unit; and (c) provisions for the continued maintenance of the components of the remedy;
- The property owners will provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owners in writing that this certification is no longer needed. This submittal will: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that will impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department; and
- Since the remedies result in contaminated soil and fill remaining at the site, a long-term monitoring program will be instituted. This monitoring program will consist of periodic, visual inspections of the soil covers with repairs made as necessary.

Former Flintkote Plant (Site # B-00161-9)

Based on the results of the Site Investigation/Remedial Alternatives Report (SI/RAR) for the Former Flintkote Plant site and the criteria identified for evaluation of alternatives, the NYSDEC has selected Excavation and Containment. The components of the remedy for OU #2 are as follows:

- Construction of a minimum 2 foot thick, clean soil cover with demarcation layer over the non-hazardous fill materials on the 300 Parcel of the site;
- Excavation of hazardous fill materials to native soils or bedrock (where native soils are absent) on the 198 Parcel, Island and Water Street Section (WSS) of the site. These materials would be disposed off-site in an approved facility;
- Removal of sediments from the Building C sump and trench drain, and evaluate options to address sediments in the Building D deep basement;
- Removal of sediment from a portion of an outfall pipe to Eighteenmile Creek and closure of the pipe in place;

- Abatement of asbestos containing materials (ACMs). These materials would be disposed off-site in an approved facility;
- Demolition of all buildings to four feet below grade. Removal of C&D debris from exterior portions of the site. These materials would be disposed off-site in an approved facility;
- Installation of a minimum 2 foot thick, clean soil cover with demarcation layer over the demolished building footprint;
- A remedial design program to provide the details necessary to implement the remedial program;
- Development of a site management plan to address residual contamination, use restrictions, and maintenance of the soil cover;
- Imposition of an environmental easement; and
- Periodic certification of the institutional and engineering controls.

NOTE: On June 30, 2011, NYSDEC submitted a formal request to US EPA requesting that the Eighteenmile Creek project sites be nominated to the National Priorities List (NPL). The NPL is also known as the federal Superfund Program. US EPA published a rule proposing to add the site to the NPL in the September 16, 2011 edition of the Federal Register. A 60 day comment period followed where the public was given the opportunity to comment on EPA's proposed addition to the NPL. It is anticipated that Eighteenmile Creek will be added to the NPL in March 2012. At that time, all site work planned to be completed utilizing the NYS Superfund Program will cease. All future activities are anticipated to be completed under the umbrella of the Federal Superfund Program.

3.3 Inactive Hazardous Waste Site Remediation: Upper Mountain Road (Site #932112).

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Potential Lead Organization: New York State Department of Environmental Conservation

Estimated Cost: \$25,000,000 - \$35,000,000

Background

The Old Upper Mountain Road Site is approximately 7 acres in size and consists of seven parcels in a mixed residential/commercial/ industrial neighborhood near the intersection of NY State Routes 31 and 93 in the Town of Lockport, Niagara County, New York. The site is bounded on the west by Old Upper Mountain Road, on the south and east by the Somerset Railroad, and on the north by private property and a ravine and creek known as The Gulf. The Gulf Creek flows in a northerly direction from the site and eventually discharges into Eighteenmile Creek approximately one mile to the north.

The site was reportedly operated as a municipal dump by the City of Lockport from 1921 through the 1950's. Garbage and other wastes were apparently dumped at the landfill, burned, and then pushed into the ravine.

Previous investigations at the site have found that site soils, fill material, and surface and ground water are contaminated with volatile and semi-volatile organic compounds and metals, particularly lead. A Remedial Investigation (RI) conducted by NYSDEC under the State Superfund program. The specific objectives of the RI were to:

- Further define the nature and extent of contamination in fill material at the site;
- Further define the nature and extent of contamination in surface water and sediment of Gulf Creek adjacent to the site;
- Evaluate groundwater flow patterns across the site and assess bedrock groundwater quality;
- Quantify the volume of fill material throughout the site;
- Investigate the storm sewer that discharges into Gulf Creek near Old Upper Mountain Road to determine the origin of this sewer and the possible upstream source of surface water contamination;
- Identify potential pathways for human exposure as part of a qualitative exposure assessment; and
- Complete a NYSDEC Fish and Wildlife Impact Analysis

The RI confirmed that the Old Upper Mountain Road Site is a source of lead and Semi Volatile Organic Compounds (SVOCs) contamination to Eighteenmile Creek sediments. NYSDEC is currently finalizing a Feasibility Study (FS) for the site which will recommend the appropriate remedial actions to be taken to address the contaminated sediments and continuing releases from the site. A Record of Decision (ROD) is expected in the Spring of 2012.

Measure

Once the FS and ROD are completed, a plan to address the contamination present at the Old Upper Mountain Road Site can be finalized. Remedial Alternatives chosen for the site should commence to effectively remediate the Site and prevent any further negative impacts to Eighteenmile Creek and the AOC.

3.4 Sediment Remediation Feasibility Study (FS) and Remedial Design (RD)

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Potential Lead Organization: U.S. Environmental Protection Agency

Estimated Cost: \$3,700,000

Background

Utilizing the Great Lakes Legacy Act, a Site Characterization project was completed during 2008-2011 for Eighteenmile Creek beginning just downstream of the Eighteenmile Creek Corridor Site and Former Flintkote Plant Site. The purpose of the site characterization was to evaluate the nature and extent of contamination in the sediments throughout the AOC, focusing on the unevaluated area between the city of Lockport and the Burt Dam. This area of the creek is outside of the boundary of the Eighteenmile Creek Corridor Superfund Site and was therefore, not applicable for characterization under the NYS Superfund Program.

The objectives of this site characterization were to collect data to:

- Evaluate the horizontal and vertical extent of sediment contamination of selected PCOCs (PCBs and metals) within and adjacent to the creek.
- Determine total organic carbon (TOC) of sediment to correlate PCB concentrations to percent organic carbon.
- Evaluate concentrations of PCOCs in upstream locations in major tributaries to the creek to identify other potential sources and establish background conditions.
- Evaluate ecologically significant chemicals (e.g., PCB congeners and acid volatile sulfides/simultaneously extracted metals [AVS/SEM]) in the surface sediment to determine the bioavailability of PCOCs.
- Evaluate the potential for historic contamination to have been transported to wetlands or historic (e.g., relict) creek channels during past flooding events.
- Evaluate the potential sources of additional chemicals previously detected in the sediment (e.g., pesticides and poly-nuclear aromatic hydrocarbons [PAHs]) and establish the correlation of these other chemicals with the PCOCs.
- Evaluate the geotechnical characteristics of the sediment materials.

Review of the initial site characterization creek core samples indicated that additional data were needed to achieve the project objectives and support project decisions. The field program was modified to include collection of additional data to:

- Evaluate the extent of PCBs and metals in the sediment depositional areas in shallow water reaches of the creek and establish whether the contamination can be attributable to upstream sources in Lockport.
- Evaluate concentrations of PCBs and metals in upstream tributaries to the creek (especially East Branch tributary and Gulf Creek tributary) to identify other potential sources and establish background conditions.
- Evaluate the potential sources of PAHs and establish the extent of contamination.
- Evaluate AVS/SEM in areas where elevated metals concentrations exist to determine the bioavailability of metals.
- Evaluate whether large volumes of highly impacted sediment exist that would require special management during remediation.

As expected, significant sediment contamination is present throughout the entire stretch of creek. To effectively restore Beneficial Use Impairments and eventually de-list Eighteenmile Creek as an AOC, these sediments need to be addressed. Prior to sediment remediation, feasibility of remediating the sediments needs to be investigated. In addition, a remedial design needs to be completed. The remedial design details the size, scope and character of a site's remediation - the planned action that will, at a minimum, protect public health and the environment. It translates information from the Remedial Investigation/Feasibility Study phase into clear, precise facts and numbers.

Measure

Feasibility Study

A Feasibility Study (FS) for the main branch of Eighteenmile Creek will be completed by collecting and using all information available and necessary to evaluate the remedial alternatives that are applicable and appropriate for remediating contaminated sediment. Specific objectives of the FS are described as follows:

- Establish remedial action objectives specifying constituents and media of concern, potential exposure pathways and remediation goals;
- Identify and preliminarily evaluate remedial alternatives and potentially suitable technologies that if implemented would reduce the identified threat to public health and the environment;
- Screen the remedial alternatives identified in the preliminary evaluation of alternatives;
- Develop and perform treatability studies, if required, to assist in the detailed analysis of the remedial alternatives; and
- Complete a detailed analysis on a limited number of alternatives that represent viable approaches to remedial action.

Remedial alternatives to be analyzed include, but are not limited to:

- No Action
- Institutional Controls
- Natural Attenuation with Ongoing Monitoring
- Dredge and Offsite Disposal
- Dredge and Place in a Confined Disposal Facility
- Dredge and High Temperature Thermal Desorption (HTTD) or other treatment
- Powdered Activated Carbon (PAC) Treatment
- Cover through Elimination of Navigational Dredging
- In-situ Capping

Remedial Design

Conduct remedial design work for remedial alternatives chosen via the Feasibility Study phase. This work will also include the design of activities necessary to restore aquatic habitat which is modified and/or degraded during remediation.

Remedial Design activities should include the following planning components: quality control; assurances and; contingency plans.

Construction Quality Control (CQC) - A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC, usually carried out by the contractor, is necessary to achieve quality in the constructed system.

Construction Quality Assurance (CQA) - A planned system of activities to provide assurance to the owner and the permitting agency that all aspects of remedial construction meet design requirements. CQA includes inspections, verifications, audits, tests and evaluations of materials and workmanship to determine and document the quality of the remedial construction.

Contingency Plan (CP) - The contingency plan protects the local community in the instance of an accident or emergency caused by remedial activities. Contingency plans may include:

- Name of person responsible for responding in an emergency;
- Schedule for meeting with local, state and federal agencies, the community, local emergency agencies and hospitals;
- First aid and medical information;
- Air monitoring plan if a human health risk exists through inhalation of specified pollutants;
- Spill control and countermeasures plan to prevent contamination of soil, water, air, structures, equipment or material from the discharge of wastes due to spills. Also, to contain the spill and remove and properly dispose of media contaminated from the spill.

NOTE: On June 30, 2011, NYSDEC submitted a formal request to US EPA requesting that the Eighteenmile Creek project sites be nominated to the National Priorities List (NPL). The NPL is also known as the federal Superfund Program. US EPA published a rule proposing to add the site to the NPL in the September 16, 2011 edition of the Federal Register. A 60 day comment period followed where the public

was given the opportunity to comment on EPA's proposed addition to the NPL. It is anticipated that Eighteenmile Creek will be added to the NPL in March 2012. All work planned to be completed utilizing the Great Lakes Legacy Act will cease. All future activities are anticipated to be completed under the umbrella of the Federal Superfund Program.

3.5 Remediation of In-Stream Contaminated Sediments

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Potential Lead Organization: U.S. Environmental Protection Agency

Estimated Cost: \$28.8 to \$40.3 million

Background

Contaminated sediments present in Eighteenmile Creek are linked to all 5 Beneficial Use Impairments (BUIs) currently identified for the AOC. Over the past several years, a number of new investigations have been initiated in the Eighteenmile Creek system to better understand the nature and extent of sediment contamination and PCB bio-magnification. These studies include sediment sampling for PCBs, metals, and other contaminants upstream from Burt Dam; determination of sediment bed thickness to support sediment volume estimates; and development of a Trophic Trace model to help better understand bio-magnifications of PCBs in the aquatic food web of the creek.

The EPA Great Lakes National Program Office (GLNPO) Great Lakes Legacy Act (GLLA) site characterization project recently assessed the nature and extent of sediment contamination upstream from Burt Dam and the potential for migration of contaminants from upstream source areas, including in-stream sediments. The project builds on the NYSDEC assessment and proposed remediation plan for upstream source areas (Eighteenmile Creek Corridor Site & Former Flintkote Plant Site). The GLLA project includes characterization of three miles of deep sediment in the impoundments behind two dams (Burt Dam and Newfane Dam) and nine miles of shallow creek bed sediment that runs through isolated rural areas downstream of the primary source area in Lockport, New York. Results from over 300 samples have been evaluated for PCBs, polycyclic aromatic hydrocarbons (PAHs), and metals contamination.

Measure

Remediation of in-stream contaminated sediments is the key to delisting the Eighteenmile Creek AOC. Previously suggested projects related to this large hurdle include: contaminant source remediation (Eighteenmile Creek Corridor Site, Former Flintkote Plant Site, Old Upper Mountain Road Site); feasibility of remediating in-stream contaminated sediments and identification of remedial alternatives and; design of chosen remedial alternatives. Remediation of in-stream contaminated sediments should commence once remedial alternatives have been chosen and designed.

It is expected that remediation of in-stream sediment will begin within the reach of Eighteenmile Creek closest to the Corridor Site and move progressively downstream, culminating with sediment remediation in the navigational channel of Olcott Harbor.

Alternatives for remediating in-stream sediments that exceed sediment criteria guidelines include but are not limited to:

- No Action
- Institutional Controls
- Natural Attenuation with Ongoing Monitoring
- Dredge and Offsite Disposal
- Dredge and Place in a Confined Disposal Facility
- Dredge and High Temperature Thermal Desorption (HTTD) or other treatment
- Powdered Activated Carbon (PAC) Treatment
- Cover through Elimination of Navigational Dredging
- In-situ Capping

NOTE: On June 30, 2011, NYSDEC submitted a formal request to US EPA requesting that the Eighteenmile Creek be nominated to the National Priorities List (NPL). The NPL is also known as the federal Superfund Program. US EPA published a rule proposing to add the site to the NPL in the September 16, 2011 edition of the Federal Register. A 60 day comment period followed where the public was given the opportunity to comment on EPA's proposed addition to the NPL. It is anticipated that Eighteenmile Creek will be added to the NPL in March 2012. All work planned to be completed utilizing the Great Lakes Legacy Act will cease. All future activities are anticipated to be completed under the umbrella of the Federal Superfund Program.

3.6 Use of the Trophic Trace Model to Establish Site-specific Sediment Remedial Goals for PCBs

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Potential Lead Organization: U.S. Army Corps of Engineers, Niagara County SWCD

Estimated Cost: \$500,000

Background

The US Army Engineer Research and Development Center conducted a bioaccumulation modeling effort for the AOC in response to a request from the US Army Corps of Engineers Buffalo District. The modeling approach focused on two areas: the lower reach of Eighteenmile Creek from Lake Ontario to Burt Dam and an upper reach from Burt Dam to the Newfane Dam. The definition of the two areas

assumes that the dams act as physical barriers and that fish populations will not interact and only be exposed to conditions in those areas. The *Trophic Trace* food web bioaccumulation model was applied at the sites to evaluate contaminant bioaccumulation across various trophic levels.

Based on sampling needs identified via a data exercise, sediment and fish tissue sampling was conducted in the Eighteenmile Creek AOC, above and below Burt Dam (the area below Burt Dam is designated as Area 1; above Burt Dam as Area 2). The sediment data are used to represent exposure concentrations in the *Trophic Trace* model and the fish tissue concentrations are used as the empirical basis for model calibration and validation.

Fish sampling took place in the Eighteenmile Creek Area of Concern, above and below Burt Dam, on six days between September 13-30, 2010. Sediment sampling took place on October 26, 2010. Sediment grab samples were collected by the U.S. Army Corps of Engineers Buffalo District at 16 locations throughout Section 1. Sediment samples were analyzed for PCBs to represent exposure concentrations in Section 1, below Burt Dam. Sediments in Section 2, in the Burt Dam reservoir, were sampled for PCBs in the summer of 2010 by the Great Lakes National Program Office (GLNPO). The GLNPO data was used to represent sediment contaminant exposure concentrations in Section 2.

The project concluded that there are not substantive differences in the foodweb bioaccumulation dynamics between Sections 1 and 2. This suggests that the environmental conditions that varied between sections, (contaminant and Total Organic Compound concentrations) accounted for the differences seen in fish tissue concentrations.

Measure

A sediment remedial goal for PCBs in Eighteenmile Creek is needed to define areas based on realistic, site-specific exposure scenarios, exposure parameters, and areas of the creek channel in need of remediation. Risk assessment methods bioaccumulation factors result in the most reliable remedial goals. The *Trophic Trace* model can be used to develop sediment concentrations that serve as remedial goals for a site; it is commonly employed at Superfund sites for this purpose. Remedial goals would be established on the basis of risk to receptors. Another primary function of *Trophic Trace* and other food-web bioaccumulation models is to evaluate various "what if" scenarios regarding remediation. For example, if actions are taken to reduce the sediment PCB concentration to a particular level, what will be the impact to fish tissue concentrations and risk to receptors?

This can be completed via the completion of two primary tasks:

- 1) Refine model and impacts to receptors by investigating exposure pathways.
 - Collect and assess stomach contents of largemouth bass and bullheads during spring and summer timeframe
 - Sampling of crayfish contaminant levels
 - Water sampling to define dissolved fraction of PCBs
 - Duplicate sediment and fish tissue sampling events used in initial model development
- 2) Use of model to develop remedial goals
 - Evaluate PCB congener vs Aroclor relationship in sediment and biota to define appropriate metric for risk-based remedial goals

- Use Feb 2011 model to develop risk-based remedial goals
- Update 2011 model and remedial goals based on Task 1 data
- High resolution cores, chemistry, and geochronology markers (to indicate expected time to reach remedial goals)

3.7 Pilot Study on Treatment of Contaminated Sediments with Powdered Activated Carbon to Reduce PCB Bioavailability

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Potential Lead Organization: Niagara County SWCD

Estimated Cost: \$70,820

Background

Poor water quality and sediment contamination in Eighteenmile Creek are largely the result of historical industrial and municipal waste discharges, pesticides from agricultural runoff, and other factors. Sediment and surface water contamination in Eighteenmile Creek have contributed to restrictions on fish and wildlife consumption, degradation of benthos, and restrictions on dredging activities in the Eighteenmile Creek AOC. Additionally, sediment contamination in the creek may be adversely affecting populations of some fish and wildlife species and increasing the prevalence of deformities or reproductive problems in piscivorous mammals (E & E 2009). Contaminants that have been identified in Eighteenmile Creek sediments include PCBs, mercury, dioxins/furans, dieldrin, mirex, lead, copper, and dichlorodiphenyltrichloroethane (DDT). Of these, PCBs appear to be the greatest problem based on recent investigations which indicated that concentrations of PCBs in brown bullheads are ten times greater than background and exceed critical PCB tissue concentrations (E & E 2009) and current fish consumption advisories (NYSDOH 2010). Recent bioaccumulation studies performed in the AOC by the U.S. Army Corps of Engineers (USACE) under a grant from the U.S. Environmental Protection Agency indicate that PCB levels in surficial sediments are highly bio-available and present a bioaccumulation risk.

Contaminated sediments pose challenging cleanup and management problems. The standard approaches to addressing contaminated sediments are dredging and disposal or capping, which are expensive. In situ treatment of sediment contaminated with hydrophobic organic contaminants such as PCBs has the potential to greatly reduce remedial costs (Luthy et al. 2009).

Measure

This project would include a laboratory bench-top pilot study using sediment from three reaches of Eighteenmile Creek: below Burt Dam, between Burt Dam and Newfane Dam, and upstream from Newfane Dam. Samples spanning a range of PCB concentrations of an order-of-magnitude or more will

be included in the study. Sediment sampling locations will be selected based on data from the recent GLLA sediment investigation above Burt Dam (Ross et al. 2011) and recent sediment sampling below Burt Dam for the Trophic Trace modeling work (Gustavson et al. 2010). Each of the three sediment samples collected for this study will be subjected to four treatments: high PAC treatment, medium PAC treatment, low PAC treatment, and no PAC treatment. High, medium, and low PAC treatments will be defined based on Luthy et al. (2009) and similar studies.

Sediments in each treatment will be analyzed for individual chemical compounds in the PCB category to determine how much of the PCBs remain following treatment. In addition, the effectiveness of the treatment in decreasing the PCB bioavailability will be determined using a bioaccumulation test on worms (*Lumbriculus variegatus*). This test will follow USEPA (2000) Test Method 100.3 (28-day *Lumbriculus variegatus* Bioaccumulation Test for Sediments). The worms will be tested and after 28 days will be analyzed for the presence of PCBs in their tissue. Bio-accumulation will be evaluated by comparing PCB levels in the worms among treatments and by calculating and comparing biota-sediment accumulation factors (BSAFs) across treatments. A BSAF is a parameter which describes bioaccumulation of sediment-associated compounds into the tissues of an ecological receptor, like a worm. Thus, by comparing the BSAFs across the four treatment types, a determination can be made as to which treatment is most effective in decreasing the bioavailability of the PCBs in the test sediment.

If the pilot study proves to be successful, then application of this in situ technique has the potential to contribute to delisting of the five BUIs for the Eighteenmile Creek AOC. The results of this study will be incorporated into the Eighteenmile Creek Feasibility Study (FS) and Remedial Design (RD) and used in developing cost-effective remedial alternatives for the site.

3.8 Mink Survey and Exposure Assessment for Eighteenmile Creek AOC and Watershed

Use Impairments Addressed:

- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems

Potential Lead Organization: Niagara County SWCD

Estimated Cost: \$83,400

Background

In 2007, the status of bird and mammal deformities and reproductive impairments was assessed for the Eighteenmile Creek AOC. Two lines of evidence were examined to evaluate this BUI: (1) the risk of reproductive impairment for fish-eating birds and mammals, and (2) the prevalence of bird and mammal deformities. It was determined that potential reproductive impairment may exist at Eighteenmile Creek for fish-eating mammals, but not fish-eating birds, due to high levels of PCBs in fish. The available survey data for mammals did not suggest impairment for this BUI at Eighteenmile Creek; however, given that the available survey data are limited, they are not conclusive proof. Nonetheless, it should be noted that over the course of the surveys (over 50 hours of survey time over the course of three seasons within each creek corridor), no dead or deformed birds or mammals were observed. In addition, discussions with NYSDEC biologists who have spent a substantial amount of time in and near the

Eighteenmile Creek AOC indicated that they have never seen any diseased, deformed, or dead birds or mammals.

Relative to Diversity and abundance of mammals, a lower number of mammal species were observed at Eighteenmile Creek (9) compared with Oak Orchard Creek reference sites (13), but this may be in part an artifact of sampling. Overall, far fewer observations were made for mammals compared with birds due to the more secretive habits of many mammal species. The available data, although limited and qualitative, do not suggest impairment at Eighteenmile Creek.

Relative to Diversity and abundance of amphibians, a similar number of amphibian species was observed at Eighteenmile Creek (9 species) and Oak Orchard Creek (8 species). The relative abundances of these species were similar between creeks. This would suggest that no impairment exists at Eighteenmile Creek.

Relative to risk of reproductive impairment for fish-eating mammals from PCBs and dioxins/furans in fish, the estimated exposure of a representative fish-eating mammal (mink) to total PCBs and dioxins/furans at Eighteenmile Creek was greater than at Oak Orchard Creek. For PCBs, the estimated exposure exceeded the lowest observed adverse effect level for effects on mammal reproduction at Eighteenmile Creek. Impaired reproduction could affect population size. This can be interpreted to confirm a possible impairment from PCBs at Eighteenmile Creek.

In total, the evaluation found that PCB levels in fish from Eighteenmile Creek may be great enough to adversely affect reproduction of fish-eating mammals. Fish-eating birds do not appear to be at risk due largely to their lower sensitivity to PCBs compared with mammals. However, the investigation was not designed to detect the types of deformities (e.g., jaw lesions in mink) that may result from PCB exposure. Additional work is recommended to determine if mink in the Eighteenmile Creek AOC and watershed are being affected by PCBs.

Measure

This project would involve completing a survey along the Western Lake Ontario (WLO) shoreline, a reference tributary and in Eighteenmile Creek for bio-accumulative chemicals in wildlife prey and tissues and for wildlife deformities. The primary objective of the project would be to determine the extent to which bio-accumulative chemicals in wildlife prey and wildlife deformities are WLO-wide issues. This project will complete a survey of the following:

Task 1. Assess Levels of bio-accumulative chemicals in aquatic prey of mink, including fish, crayfish, and/or frogs.

Mink prey on fish, crayfish, and frogs. Fish and crayfish will be collected from sites along the Lake Ontario shoreline, a reference tributary and Eighteenmile Creek and analyzed for PCBs, dioxins/furans, and chlorinated pesticides. Sampling would occur during the spring, when these organisms are active. Five medium sized fish and five crayfish would be harvested from each sampling location. Five frogs per location would be harvested during creek-side or shoreline surveys if adequate numbers of fish and crayfish are not available. All collected specimens would be frozen and sent to an analytical laboratory to determine whole-body levels of bio-accumulative chemicals.

Task 2. Assess levels of bio-accumulative chemicals in mink tissues and mink jaw lesions

The mink is a sentinel species commonly found along water edges and in wetlands. Since it is a predator atop the aquatic food chain, it is highly susceptible to bio-accumulative pollutants in prey (Haynes et al. 2007). Symptoms of bio-accumulative chemicals in mink include lesions on the liver and along the jaw line. Individuals captured and pelted by trappers will be used for this study. The livers of five mink would be removed and stored for chemical analysis of PCBs, dioxins/furans, and chlorinated pesticides. The jaws of five individuals would be removed and stored for examination as per Haynes et al. (2007).

Task 3. Video surveillance of mink for reproductive evidence

Weather-proof video surveillance equipment would be used to examine trends in mink relative abundance and population structure within the Eighteenmile Creek AOC and reference sites. Differences among areas (if any) will be evaluated in light of the prey chemical data from these areas to determine if differences in mink abundance and population structure may be the result of differences in chemical exposure.

Video surveillance stations would be set up May 15, and would continue monitoring until November 15, which covers the post-breeding period, a time when mink families would likely travel together. All video surveillance stations would be visited once per week. The video data would be analyzed for mink presence; with special attention paid to the number of mink observed at a given time, as multiple individuals recorded during the post-breeding season are indicative of family units and mink reproduction.

3.9 Baseline Sampling and Long-term, Post-remediation Monitoring of Fish from Different Trophic Levels

Use Impairments Addressed:

- #1 Restrictions on Fish and Wildlife Consumption
- #3 Degradation of Fish and Wildlife Populations
- #5 Bird/Animal Deformities/Reproduction Problems
- #6 Degradation of Benthos
- #7 Restrictions on Dredging Activities

Potential Lead Organization: Niagara County SWCD

Estimated Cost: \$65,950 (baseline), \$59,950 (long-term)

Background

In August 2007, eight brown bullheads were collected from both Eighteenmile and Oak Orchard (control site) creeks and analyzed for PCBs. Two bullheads from each creek also were analyzed for dioxins/furans. The data was collected to: (1) determine whether levels of PCBs and dioxins/furans in bullheads from Eighteenmile Creek are elevated compared with the levels in bullheads from Oak Orchard Creek; (2) determine whether these chemicals pose a potential risk to bullheads in these creeks; and (3) determine whether these chemicals pose a potential risk to fish eating birds and mammals at these creeks. These three topics are discussed in turn below.

Whole-body concentrations of Aroclors 1248, 1254, and 1260 and total PCBs were an order of magnitude greater in brown bullheads from Eighteenmile Creek compared with the levels in brown bullheads from Oak Orchard Creek. The less-chlorinated PCB Aroclors (1016, 1221, 1232, and 1242) were not detected in bullheads from either creek. Whole-body concentrations of dioxins/furans (expressed as the TCDD toxic equivalent [TEQ]) in bullheads from Eighteenmile Creek were approximately five times greater than in bullheads from Oak Orchard Creek.

Elevated levels of PCBs and dioxins/furans in bullheads from Eighteenmile Creek probably are the result of historic industrial activities in the upstream reaches of the creek near Lockport, New York (NYSDEC 2006; EEEPC 2007a). These historic activities have resulted in elevated sediment concentrations of PCBs and dioxins in the lower reaches of Eighteenmile Creek, and these contaminants have been shown to be bio-available in laboratory bioaccumulation studies (USACE 2004). Bullhead data collected for this study also indicated that sediment contaminants in the lower reaches of Eighteenmile Creek are bio-available.

Potential risks to bullheads from PCBs and dioxins/furans were assessed by comparing the measured whole-body concentrations of these chemicals with critical tissue concentrations from the literature. The following critical tissue concentrations were used:

- PCBs (all Aroclors): 440 micrograms per kilogram ($\mu\text{g/kg}$) wet weight (Dyer et al. 2000); and
- 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD): 72 nanograms per kilogram (ng/kg) wet weight (Windward 2004).

Whole-body concentrations of Aroclors 1248 and 1254 and total PCBs in bullheads from Eighteenmile Creek often exceeded the PCB critical tissue concentration. No sample from Oak Orchard Creek exceeded the PCB critical tissue concentration. In both Eighteenmile Creek and Oak Orchard Creek, whole-body concentrations of dioxins/furans in bullheads were well below the critical tissue concentration. Overall, these results suggest that bullheads from Eighteenmile Creek may be at risk from elevated tissue residues of PCBs but not from dioxins/furans. These chemicals pose no risks to fish in Oak Orchard Creek.

Given that this study only assessed the bullhead population, baseline sampling of fish from different trophic levels should be implemented before the onset of sediment remedial work. Long-term monitoring of fish and should be implemented every five years after baseline sampling.

Measure

To address data requirements needed to assess BUI #1, #3, #5, #6 and #7, NCSWCD proposes to conduct baseline sampling of contaminant levels in fish from various Trophic levels. Sampling would entail collecting five forage fish composite samples and five game fish samples from each of three reaches of Eighteenmile Creek—below Burt Dam; between Newfane and Burt Dams; and upstream from Newfane Dam—for a total of 30 fish samples. The fish samples will be analyzed for PCBs, lipids, and percent moisture.

Prior to sampling, a sampling and quality assurance plan will be completed. The New York State Department of Health (NYSDOH) and NYSDEC will both be consulted during this process to assure that the data collected will be usable by both parties during the re-evaluation of existing fish and wildlife consumption advisories.

This analysis will provide a current baseline condition of the contaminant levels in fish from various Trophic levels prior to any significant remediation efforts. These results will also be used during the delisting process of BUI # 1– Restrictions on Fish and Wildlife Consumption, #3 – Degradation of Fish and Wildlife Populations, #5 - Bird or Animal Deformities or Reproductive Problems, #6 - Degradation of Benthos and #7 - Restrictions on Dredging. Also, fish tissue analysis is a good indicator of PCB contamination in aquatic systems and therefore this fish monitoring action will provide a measure of the effectiveness of future remedial actions in reducing PCB levels in Eighteenmile Creek sediments.

3.10 Baseline Sampling and Long-term, Post-remediation Monitoring of the AOC Benthic Community

Use Impairments Addressed: #6 Degradation of Benthos

Potential Lead Organization: Niagara County SWCD

Estimated Cost: \$41,570 (baseline), \$33,320 (long-term)

Background

Bottom-dwelling organisms serve as both a food source for higher organisms such as fish, and as an indicator of pollution stress. A 1994 Olcott Harbor Sediment Study contained three data sets to evaluate the health of benthos in Eighteenmile Creek. These are: sediment contaminant concentrations; toxicity testing of Eighteenmile Creek sediments and; species makeup of sampling for benthic organisms. An evaluation of this and other data indicates that the benthos in Eighteenmile Creek is slightly to moderately impaired.

Available benthic community data from the NYSDEC Rotating Integrated Basin Study (RIBS) program are insufficient to determine with confidence the true and current status of BUI #6 (Degradation of Benthos) for the Eighteenmile Creek AOC. Nonetheless, impairment is suspected based on the ubiquitous nature of sediment contamination in the Eighteenmile Creek watershed. Also, a recent investigation by Makarewicz and Lewis (2010) identified significant ongoing sources of nutrients and total suspended solids (TSS) to the Eighteenmile Creek watershed. Some nutrients (e.g., unionized ammonia-nitrogen) can be toxic to benthic life under certain conditions. High TSS can adversely affect benthic organisms by smothering their habitat. There are three delisting criteria for this BUI. Two of the criteria are based on benthic community composition and one criterion is based on sediment toxicity.

Measure

This action would examine benthic macro-invertebrate community composition, sediment toxicity, and sediment chemistry at three locations in the AOC. The sampling would entail collecting sediment and benthic macro-invertebrate samples at each of the three sites. Sediment samples would be analyzed for

PCBs, selected metals, toxicity, and ancillary parameters (total organic carbon, grain size, etc.). Benthic macro-invertebrate samples would be evaluated for taxonomic diversity and abundance as well.

Not only will this analysis provide a current baseline condition of the AOC benthic community prior to any significant remediation efforts envisioned for the future, it will define the level of existing impairment or lack thereof. These results will also be used during the delisting process of BUI #6 Degradation of Benthos.

CHAPTER 4

Selected Remedial Measures

CHAPTER 4: Selected Remedial Measures

Introduction

As defined in 4(a)(iii) of Annex 2 of the Great Lakes Water Quality Agreement, as amended in 1987, Stage 2 RAPs are to be submitted to the International Joint Commission for review and comment and are to contain selected remedial measures to restore beneficial uses.

This chapter describes remedial measures and actions chosen to delist use impairments for the Eighteenmile Creek Area of Concern.

For each of the five impaired beneficial uses at the Eighteenmile Creek AOC (see Table 1-1), the cause(s) of the impairment and recommended actions to correct the situation are described. If an action is recommended for more than one BUI, the same action is described in each table for each BUI it addresses. In addition, rough cost estimates for recommended actions are provided (see Table 4-1). The discussion below is organized by BUI, typically with a subheading for each delisting criterion for that BUI.

TABLE 4-1 SUMMARY OF COST ESTIMATES FOR RECOMMENDED ACTIONS IN THE EIGHTEENMILE CREEK AOC AND WATERSHED

Action	Approximate Cost Estimate ¹	Remarks
Inactive HWS remediation: Eighteenmile Creek Corridor (Site 932121) and Former Flintkote Plant (Site B-00161-9).	\$16,178,000 (Corridor Site) \$5,614,000 (Flintkote). \$21,792,000 (total)	See Section 4.1 and Appendix B.1 for basis of cost estimate.
Sediment remediation FS/RD for in-stream sediment in Eighteenmile Creek.	\$2.2 million (FS) \$1.5 million (RD) \$3.7 million (total)	See Section 4.1 for basis of cost estimate.
Remediation of in-stream contaminated sediments (excluding the portion of the creek channel within the corridor site).	\$28.8 to 40.3 million	See Section 4.1 and Appendix B.2 for basis of cost estimate.
Baseline sampling and long-term, post-remediation monitoring of fish from different trophic levels.	\$65,950 (baseline) \$59,950 (long-term)	See Section 4.1 and Appendix B.3 for monitoring program details and basis of cost estimate. Long term monitoring cost estimate is for one round (i.e., each time the sampling is done).
Pilot study on treatment of contaminated sediments with powdered activated carbon to reduce PCB bioavailability.	\$70,820	See Section 4.1 and Appendix B.4 for description of study and basis of cost estimate.
Mink survey and exposure assessment for Eighteenmile Creek AOC and watershed.	\$83,400	See Section 4.2.1 and Appendix B.6 for project description and basis of cost estimate.
Continued annual fish stocking and pen rearing.	\$298,930	See Section 4.2.1 and Appendix B.7 for basis of cost estimate.
Inactive HWS remediation: Upper Mountain Road (Site 932112).	\$681,000 to \$8,818,000	See Section 4.2.1 for basis of cost estimate.
Baseline sampling and long-term, post-remediation monitoring of the AOC benthic community.	\$41,570 (baseline) \$33,320 (long-term)	See Section 4.4 and Appendix B.8 for monitoring program details and basis of cost estimate. Long term monitoring cost estimate is for one round (i.e., each time the sampling is done).
Continued NYSDEC RIBS Assessments with Modifications to Include AOC	\$30,000	See Section 4.4 for basis of cost estimate
Continued SPDES Discharge Permit Monitoring and Renewal	N/A	This activity is a regulatory responsibility which NYSDEC is required to conduct

Note: 1 = 2011 dollars.

Key:

AOC = Area of Concern.

BUI = Beneficial Use Impairment.

FS = Feasibility Study.

HWS = Hazardous Waste Site.

NYSDEC = New York State Department of Environmental Conservation.

PCB = Polychlorinated biphenyls.

RD = Remedial Design.

RIBS = Rotating Integrated Basin Studies.

4.1 BUI #1 - Restrictions on Fish and Wildlife Consumption

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 2009b) and current fish consumption advisories (NYSDOH 2010). Elevated levels of PCBs in fish in Eighteenmile Creek appear to be the result of bioaccumulation from sediment (USACE 2004a, b; Gustavson et al. 2010). The situation above Burt Dam is worse than in the AOC; that is, sediment PCB levels are greater and fish advisories more stringent above the dam. Recent sediment sampling shows that surface sediment PCB levels are greater in the portion of the creek near the source areas in Lockport than in downstream reaches (see Appendix A). Source areas along the creek in Lockport were characterized by NYSDEC (2006a) and E & E (2009a). Remediation of these upstream areas is critical for addressing both delisting criteria for this BUI—*No AOC-specific Advisories* and *No Upstream Causes of AOC Impairment* (see Table 1-3)

Recommended Actions

1. Inactive Hazardous Waste Site Remediation: Eighteenmile Creek Corridor (Site 932121) and Former Flintkote Plant (Site B-00161-9)

Total cost estimate: \$21,792,000 (\$16,178,000 + \$5,614,000, respectively). NYSDEC (2010b) estimated an overall cost of \$16.2 million for remediation of Operable Units (OUs) 1, 3, 4, 5, and 6 within the Corridor Site. The estimated costs of the preferred alternative for each OU are: OU 1—Eighteenmile Creek and Millrace, \$8,818,000; OU 3—Former United Paperboard Property, \$1,985,000; OU 4—Upson Park, \$3,438,000; OU 5—White Transportation Property, \$681,000; and OU 6—Water Street Residential Properties, \$1,256,000. For the Former Flintkote Plant Site (OU2), NYSDEC (2006b) estimated remedial costs to be \$5.6 million. See Appendix B.1 for additional information regarding these cost estimates.

It is anticipated that this project will be funded and completed under a future USEPA Superfund Site project, pending a National Priorities List (NPL) designation due in the spring of 2012.

2. Sediment Remediation Feasibility Study (FS) and Remedial Design (RD) for Eighteenmile Creek In-Stream Contaminated Sediments.

Total cost estimates: \$2.2 million for FS and \$1.5 million for RD. These estimates are based on the current understanding of data gaps that must be filled before an FS can be completed. It is estimated that 30 to 40% of the FS cost estimate may be needed to address data gaps.

It is anticipated that this project will be funded and completed under a future USEPA Superfund Site project, pending a National Priorities List (NPL) designation due in the spring of 2012.

3. Remediation of In-Stream Contaminated Sediments (excluding the portion of the creek channel within the Eighteenmile Creek Corridor Site)

Total cost estimate: \$28.8 to 40.3 million. To arrive at a rough cost estimate for this action, remedial costs for other large contaminated sediment sites on the Great Lakes were examined (see Appendix B.2).

Actual or estimated remedial costs for over 90 sediment projects are available (www.epa.gov/glla/remed/GreatLakesSedimentManagementPlan.pdf). The costs for completed sediment remediation projects range from \$2,000,000 to \$97,000,000 for remediation of 5,000 to 784,000 cubic yards of contaminated sediments. For these sites, there is a correlation between sediment volume remediated and cost ($r\text{-squared} = 0.9227$; $n = 12$; $\text{cost} = 114.97[\text{volume}] + 5,814,229$). If one assumes that the volume of sediment requiring remediation at Eighteenmile Creek is between 200,000 and 300,000 cubic yards, then remedial costs are predicted to range from \$28.8 to 40.3 million based on the above relationship. Regarding implementation of sediment remediation at Eighteenmile Creek, it is recommended that this action not begin until after Corridor Site remediation is complete. It is also recommended that remediation of in-stream sediment begin with the reach of Eighteenmile Creek closest to the Corridor site and move progressively downstream, culminating with remediation of contaminated sediment in the navigation channel of Olcott Harbor. Sediment remediation of the navigational channel will have the added benefit of addressing BUI #7 (Restrictions on Dredging Activities).

It is anticipated that this project will be funded and completed under a future USEPA Superfund Site project, pending a National Priorities List (NPL) designation due in the spring of 2012.

4. Baseline Sampling and Long-term, Post-remediation Monitoring of Fish from Different Trophic Levels

Total cost estimate: \$65,950 (baseline) and \$59,950 (post-remedial). The costs of baseline sampling and one round of post-remedial sampling are estimated to be \$65,950 and \$59,950, respectively. The estimate for post remedial sampling is less than the estimate for baseline sampling because the Sampling and Analysis Plan (SAP) prepared for baseline sampling is assumed to be useful for post-remedial sampling with little or no modification. This cost estimate is based on collection and analysis of five forage fish composite samples and five game fish samples from each of three reaches of Eighteenmile Creek: (1) below Burt Dam; (2) between Newfane and Burt Dams; and (3) upstream from Newfane Dam. The fish samples will be analyzed for PCBs, lipids, and percent moisture. Support for this cost estimate is provided in Appendix B.3.

5. Pilot Study on Treatment of Contaminated Sediments with Powdered Activated Carbon to Reduce PCB Bioavailability

Total cost estimate: \$70,820. This *in situ* technique binds toxic organic chemicals in sediments and reduces uptake into the aquatic food web and toxic impacts to the benthic community. The method involves use of a high pressure water jet to inject PAC at varying depths into contaminated sediments. Up to 90% reduction in PCB bioavailability has been observed at sites where this method has been used (<http://www.clu-in.org/contaminantfocus/default.focus/sec/Sediments/cat/Overview/>). A laboratory bench-top study should be undertaken to evaluate the potential effectiveness of this method for reducing PCB bioavailability in Eighteenmile Creek sediment. If implemented, the study results could be incorporated into the Eighteenmile Creek FS and used to help develop additional remedial alternatives. This treatment method may be useful at Eighteenmile Creek as a polishing step in areas where sediment dredging is implemented and/or as the principal means of sediment remediation in areas that are difficult or impossible to access for dredging. Appendix B.4 provides additional information about the proposed study and support for the cost estimate.

4.2 BUI #3 - Degradation of Fish and Wildlife Populations

4.2.1 Criterion 1: Wildlife Diversity, Abundance, and Condition in the AOC are Similar to Non-AOC Control Sites

In 2007, a fish and wildlife survey was conducted in the Eighteenmile Creek AOC and a suitable reference creek, Oak Orchard Creek. This investigation found that diversity and abundance of fish, amphibians, and birds at the Eighteenmile Creek AOC and Oak Orchard Creek were similar, suggesting no impairment for these wildlife groups at Eighteenmile Creek (E & E 2009b). Unfortunately, the mammal survey data were limited and qualitative and therefore inadequate for drawing conclusions with certainty. Further evaluation of mammal diversity and abundance is recommended. It is recommended that follow-up work be focused on the American mink (*Neovison vison*) because PCB levels in fish from Eighteenmile Creek may be great enough to result in reproductive impairment of mink (E & E 2009b). A project to evaluate the relative abundance of mink in the Eighteenmile Creek system and their dietary exposure to PCBs is described below.

Recommended Actions

1. Mink Survey and Exposure Assessment for Eighteenmile Creek AOC and Watershed

Total cost estimate: \$83,400. Wellman and Haynes (2006) studied mink, a sentinel species, in the Rochester AOC to address two BUIs: *Degradation of Fish and Wildlife Populations* and *Bird or Animal Deformities or Reproductive Problems*. That study used weather-proof video surveillance equipment to examine mink relative abundance and reproduction (as indicated by the presence of young mink) in and out of the AOC. Implementation of a similar video surveillance study is recommended for Eighteenmile Creek to determine if mink are present and reproducing along the creek above and below Burt Dam. The video surveillance data for Eighteenmile Creek can be compared with similar data collected by Wellman and Haynes (2006) at Iroquois National Wildlife Refuge and Bergen Swamp to qualitatively evaluate if mink relative abundance in the Eighteenmile Creek system differs from these reference areas. In addition, to better define mink exposure to PCBs in the Eighteenmile Creek AOC and watershed, it is recommended that the mink exposure assessment presented in E & E (2009b) be reevaluated in light of the new fish PCB data collected in 2010 to support the Eighteenmile Creek TT model (Gustavson et al. 2010).

An additional action is recommended under this delisting criterion to bolster fish abundance in the AOC.

2. Continued Annual Fish Stocking and Pen Rearing

Total cost estimate: \$298,930 annually to stock at 2009 levels. Fish stocking helps to address this delisting criterion by contributing to game fish abundance in the Eighteenmile Creek AOC. Currently, fish stocking in Eighteenmile Creek is done by NYSDEC; however, it is possible that NYSDEC may stop fish stocking in the future for budgetary reasons. Hence, this recommended action is contingent upon future NYSDEC capacity.

4.2.2 Criterion 2: PCBs in Bottom-Dwelling Fish Do Not Exceed Critical Tissue Concentrations for Effects on Fish

This delisting criterion is not being met based on the high levels of total PCBs found in bullheads collected recently from the AOC (E & E 2009b). The problem in the AOC is largely due to upstream sources, primarily the large inventory of PCBs in sediment above Burt Dam and in the Corridor Site in Lockport, New York. Remediation of these sources is critical to satisfying this delisting criterion. Therefore, the projects recommended and described under BUI #1 (Restrictions on Fish and Wildlife Consumption; see Section 4.1) also are recommended here.

Recommended Actions

- 1. Inactive Hazardous Waste Site Remediation: Eighteenmile Creek Corridor (Site 932121) and Former Flintkote Plant (Site B-00161-9).*
- 2. Sediment Remediation Feasibility Study (FS) and Remedial Design (RD) for Eighteenmile Creek.*
- 3. Remediation of In-stream Contaminated Sediments.*
- 4. Baseline Sampling and Long-term, Post-remediation Monitoring of Fish from Different Trophic Levels.*
- 5. Pilot Study on Treatment of Contaminated Sediments with Powdered Activated Carbon to Reduce PCB Bioavailability.*

4.3 BUI #5 -- Bird or Animal Deformities or Reproductive Problems

4.3.1 Criterion 1: No Reports of Deformities or Reproductive Problems above Expected Background Levels

No bird or mammal deformities were observed during a 2007 investigation (2009b). However, that investigation was not designed to detect the types of deformities (e.g., jaw lesions in mink) that may result from PCB exposure. Furthermore, the E & E (2009b) investigation suggested that mink reproduction may be impacted by elevated PCB concentrations in AOC-resident fish. Additional work is recommended to determine if mink in the Eighteenmile Creek AOC and watershed are being affected by PCBs. The *Mink Survey and Exposure Assessment for Eighteenmile Creek AOC and Watershed* project described in Section 4.2.1 also is recommended here because it will provide data relevant to understanding possible mink reproduction problems in the Eighteenmile Creek system.

Recommended Action

1. *Mink Survey and Exposure Assessment for Eighteenmile Creek AOC and Watershed*

4.3.2 Criterion 2: Bio-accumulative Chemicals in Bottom-Dwelling Fish Do Not Exceed Levels Established to Protect Fish-Eating Wildlife

PCB levels in bullheads collected from the Eighteenmile Creek AOC were found to be great enough to adversely affect reproduction of piscivorous mammals (i.e., mink; E & E 2009b). In addition, all fish analyzed from Eighteenmile Creek since 1987 exceed the NYSDEC fish flesh criterion for total PCBs for protection of fish-eating wildlife (0.11 milligrams per kilogram [mg/kg]) by an order of magnitude or more (see Table 1-2). As noted in Section 4.1, elevated PCB levels in fish in Eighteenmile Creek are the result of elevated PCB levels in sediment, especially the large inventory of PCBs in sediment above Burt Dam and within the Corridor Site in Lockport, New York. Remediation of these sources is critical to satisfying this delisting criterion. Therefore, the six projects recommended to address BUI #1 (Restrictions on Fish and Wildlife Consumption; see Section 4.1) also are recommended here.

Recommended Actions

1. *Inactive Hazardous Waste Site Remediation: Eighteenmile Creek Corridor (Site 932121) and Former Flintkote Plant (Site B-00161-9).*

2. *Sediment Remediation Feasibility Study (FS) and Remedial Design (RD) for Eighteenmile Creek.*

3. *Remediation of In-stream Contaminated Sediments.*

4. *Baseline Sampling and Long-term, Post-remediation Monitoring of Fish from Different Trophic Levels.*

5. *Pilot Study on Treatment of Contaminated Sediments with Powdered Activated Carbon to Reduce PCB Bioavailability.*

4.3.3

Criterion 3: Bio-accumulative Chemicals in Sediment Do Not Exceed NYSDEC Criteria for Adverse Effects on Wildlife

PCB levels in surface sediment from Eighteenmile Creek greatly exceed the NYSDEC (1999) PCB sediment bioaccumulation criterion for wildlife protection (0.014 mg/kg for 1% organic carbon). The exceedance of the criterion is generally greatest in the portion of the creek immediately downstream from the Corridor Site in Lockport, New York, where the average surface sediment total PCB concentration is 9.7 mg/kg (see Appendix A). However, surface sediment in all other reaches of the creek also exceeded the criterion (see Appendix A). Remediation of upstream PCB source areas and of sediment throughout the creek is critical to satisfying this delisting criterion. Therefore, the projects recommended to address BUI #1 (Restrictions on Fish and Wildlife Consumption; see Section 4.1) also are recommended here.

Recommended Actions

1. *Inactive Hazardous Waste Site Remediation: Eighteenmile Creek Corridor (Site 932121) and Former Flintkote Plant (Site B-00161-9).*
2. *Sediment Remediation Feasibility Study (FS) and Remedial Design (RD) for Eighteenmile Creek.*
3. *Remediation of In-Stream Contaminated Sediments.*
4. *Baseline Sampling and Long-term, Post-remediation Monitoring of Fish from Different Trophic Levels.*
5. *Pilot Study on Treatment of Contaminated Sediments with Powdered Activated Carbon to Reduce PCB Bioavailability.*

Two additional projects identified in this document are included under this delisting criterion because they will help reduce inputs of bio-accumulative chemicals and other substances to Eighteenmile Creek. These projects are:

1. **Continued Discharge Permit Monitoring and Renewal (State Pollution Discharge Elimination System [SPDES])**

Cost estimate: Not provided.

NYSDEC runs the SPDES program in New York State currently and is expected to continue doing so.

2. **Inactive Hazardous Waste Site Remediation: Upper Mountain Road—Site #932112.**

Cost estimate: \$681,000 to \$8,818,000. Data collected by NYSDEC (2007a) during the site investigation suggests that the Old Upper Mountain Road Site is a contaminant contributor to Eighteenmile Creek. A wide range of contaminants including volatiles, PAHs and other semi-volatiles, metals, pesticides, and PCBs are present in site soils at levels in excess of NYSDEC cleanup standards. It is probable that the cost to remediate the Upper Mountain Road site will be similar to the cost of

remediation of one to two OUs at the Eighteenmile Creek Corridor site. Estimated remedial costs for the Corridor Site range from \$681,000 for OU 5 (White Transportation Property) to \$8,818,000 for OU 1 (Eighteenmile Creek and Millrace). (See Section 4.1)

4.4

BUI #6 -- Degradation of Benthos

Available benthic community data from the NYSDEC Rotating Integrated Basin Study (RIBS) program are insufficient to determine with confidence the true status of this BUI in the Eighteenmile Creek AOC (NYSDEC 2007b). Nonetheless, impairment is suspected based on the ubiquitous nature of sediment contamination in the Eighteenmile Creek watershed. Also, a recent investigation by Makarewicz and Lewis (2010) identified significant ongoing sources of nutrients and total suspended solids (TSS) to the Eighteenmile Creek watershed. Some nutrients (e.g., unionized ammonia-nitrogen) can be toxic to benthic life under certain conditions. High TSS can adversely affect benthic organisms by smothering their habitat. There are three delisting criteria for this BUI. Two of the criteria are based on benthic community composition and one criterion is based on sediment toxicity. Only one of the three criteria needs to be satisfied to delist this BUI; however, a single well-designed project could provide the data needed to evaluate all three criteria. Two such projects are described below.

Recommended Actions

1. **Baseline Sampling and Long-term, Post-remediation Monitoring of the AOC Benthic Community**

Cost estimates: \$41,570 (baseline) and \$33,320 (post-remedial). The costs of baseline sampling and one round of long-term, post-remedial sampling are estimated to be \$41,570 and \$33,320, respectively. The estimate for post-remedial sampling is less than the estimate for baseline sampling because the SAP prepared for baseline sampling will be useful for post-remedial sampling with little or no modification. This action will examine benthic macroinvertebrate community composition, sediment toxicity, and sediment chemistry at three locations in the AOC. Additional details and support for this cost estimate are provided in Appendix B.8.

2. **Continued RIBS Assessments in the AOC with Modification as Appropriate to Collect Data Required to Advance Delisting**

Cost Estimate: \$1,800. The NYSDEC RIBS sampling program does not evaluate benthic community composition or sediment toxicity in the Eighteenmile Creek AOC (NYSDEC 2007b). However, it is understood that NYSDEC is open to suggestions regarding improving the program to better meet the needs of the public and AOC program.

In addition, because sediment quality in the AOC is impaired as a result of the widespread sediment contamination in areas upstream from the AOC, the six projects described in Section 4.1 also are relevant to the eventual delisting of this BUI. These projects are:

1. *Inactive Hazardous Waste Site Remediation: Eighteenmile Creek Corridor (Site 932121) and Former Flintkote Plant (Site B-00161-9).*
2. *Sediment Remediation Feasibility Study (FS) and Remedial Design (RD) for Eighteenmile Creek.*
3. *Remediation of In-stream Contaminated Sediments.*

4. Baseline Sampling and Long-term, Post-remediation Monitoring of Fish from Different Trophic Levels.

5. Pilot Study on Treatment of Contaminated Sediments with Powdered Activated Carbon to Reduce PCB Bioavailability.

Also relevant to the eventual delisting of this BUI are the last two projects listed in Section 4.3.3; these projects are:

1. Continued Discharge Permit Monitoring and Renewal (SPDES).

2. Inactive Hazardous Waste Site Remediation: Upper Mountain Road—Site #932112.

4.5 BUI #7 -- Restrictions on Dredging Activities

Dredge spoils from the AOC are not suitable for open-lake disposal or beneficial uses because of elevated levels of PCBs and metals. Elevated concentrations of these contaminants in AOC sediments are the result of upstream sources, primarily the large inventory of PCBs and metals in sediment above Burt Dam and in the Lockport Corridor Site, contributions from inactive hazardous waste sites, and potential contributions from ongoing, regulated discharges. Remediation and continued control of these sources are critical to the eventual delisting of this BUI.

Therefore, the following projects identified and described in Section 4.1 also are recommended to address this beneficial use impairment.

Recommended Actions

1. *Inactive Hazardous Waste Site Remediation: Eighteenmile Creek Corridor (Site 932121) and Former Flintkote Plant (Site B-00161-9).*
2. *Sediment Remediation Feasibility Study (FS) and Remedial Design (RD) for Eighteenmile Creek.*
3. *Remediation of In-stream Contaminated Sediments.* As mentioned in Section 4.1, it is expected that remediation of in-stream sediment will begin within the reach of Eighteenmile Creek closest to the Corridor Site and move progressively downstream, culminating with sediment remediation in the navigational channel of Olcott Harbor. Remediation of the navigational channel will directly address this BUI. Also, it is expected that remediation of this final portion of the creek will be a multiagency effort involving USACE, which has authority for navigational dredging, EPA, which has authority for sediment remediation under the GLLA, and other agencies.
4. *Baseline Sampling and Long-term, Post-remediation Monitoring of Fish from Different Trophic Levels.*
5. *Pilot Study on Treatment of Contaminated Sediments with Powdered Activated Carbon to Reduce PCB Bioavailability.*

CHAPTER 5

Summary of Proposed Actions and Overall Delisting Strategy

CHAPTER 5: Summary of Proposed Actions and Overall Delisting Strategy

Table 5-1 lists the actions identified in Section 4 and shows their relationships to the delisting criteria for each BUI. The actions can be divided into three categories: (1) remediation; (2) monitoring and assessment; and (3) other. A score was assigned to each action. The score equals the tally of the “X”s in the delisting criteria columns in Table 5-1. The maximum score is 11, which corresponds to the number of delisting criteria for the five Eighteenmile Creek BUIs. The remediation projects all received high scores, 8 or 9, because these actions address the cause of most of the BUIs (i.e., PCB-contaminated sediments). The assessment and monitoring actions received comparatively low scores, except for the fish monitoring action. Fish tissue analysis is a good indicator of PCB contamination in aquatic systems and therefore the fish monitoring action will provide a measure of the effectiveness of remedial actions in reducing PCB levels in Eighteenmile Creek sediments. The two actions in the other category also received comparatively low scores. A low score indicates that a project addresses only a few, but not all, of the delisting criteria. All of the projects identified in this Chapter are important for BUI delisting and, eventually, delisting of the AOC as a whole.

Table 5-2 presents an approximate schedule for implementing the actions identified above. In essence, Table 5-2 represents the overall strategy for delisting the individual BUIs and, eventually, the Eighteenmile Creek AOC as a whole. The following actions are recommended:

- It is proposed that remediation of the Eighteenmile Creek Corridor Site and Former Flintkote Plant Site be undertaken before remediation of in-stream contaminated sediments. Because acceptable remedial alternative plans for these sites have been proposed (NYSDEC 2010b, 2006b), it is anticipated that the actual remediation of these sites can be conducted within the next approximately six years (2012-2017).
- It is proposed that the FS and RD for the Upper Mountain Road site be completed within the next approximately three years (2012-2014) and site remedial work be completed within three years thereafter (2015-2018)
- It is proposed that an FS and RD for contaminated sediment in Eighteenmile Creek, excluding the Corridor Site, be developed during the next approximately six years (2012-2017). concurrent with remediation of the Eighteenmile Creek Corridor Site, Former Flintkote Plant Site, and Upper Mountain Road Site.
- It is proposed that a pilot study on treatment of sediment with PAC to reduce PCB bioavailability can be implemented within the next two years (2012-2013). This action will provide data useful for developing remedial alternatives for the FS/RD for in-stream contaminated sediments in Eighteenmile Creek. It should be noted that funding has already been secured for this project and it is anticipated to begin in the field season of 2012.
- Remediation of in-stream contaminated sediment is assumed to begin as soon as possible after the FS/RD for in-stream contaminated sediment is developed and HWS remediation in Lockport, New York, is completed.

- It is expected that the mink survey and exposure assessment project can be completed in 2012. This project is designed to be completed over the course of a calendar year. It should be noted that funding has already been secured for this project and it is anticipated to begin in the field season of 2012.
- Baseline sampling of fish from different trophic levels and baseline benthic community sampling should be implemented before the onset for remedial work at HWSs in Lockport, New York. Long-term monitoring of fish and benthos should be implemented every three years after baseline sampling.
- Three ongoing NYSDEC programs—continued RIBS assessments, annual fish stocking, and SPDES discharge permit monitoring and renewal—are assumed to continue indefinitely to provide ongoing stewardship for the Eighteenmile Creek system. Currently, it is unknown if the RIBS program can be modified by NYSDEC to include a sample location in the Eighteenmile Creek AOC. If not, then all future benthic community data for the AOC will come from the *Baseline Sampling and Long-term Monitoring of the AOC Benthic Community* project (see Section 4.4 and Appendix B.8).
- Lastly, after baseline monitoring and each round of long-term monitoring of fish and benthos, the RAC should re-evaluate the status of each BUI based on new data and recommend delisting BUIs, if appropriate. Revision of delisting criteria, if appropriate and desirable, may be considered at these points in the overall process. It should be noted that funding has already been secured for this project and it is anticipated to begin in the field season of 2012.

TABLE 5-1 SUMMARY OF RELATIONSHIPS BETWEEN PROPOSED ACTIONS AND BUIS FOR EIGHTEENMILE CREEK

Action	BUI 1: Restrictions on Fish and Wildlife Consumption		BUI 3: Degradation of Fish and Wildlife Populations		BUI 5: Bird or Animal Deformities or Reproductive Problems			BUI 6: Degradation of Benthos			BUI 7: Restrictions on Dredging	
	Criterion 1	Criterion 2	Criterion 1	Criterion 2	Criterion 3	Criterion 1	Criterion 2	Criterion 3				
Score*	No AOC-specific advisories	No upstream causes of impairment	Wildlife diversity & abundance in AOC similar to reference area	PCB levels in Bottom dwelling fish less than 440 µg/kg	No reports of deformities	Chemical residues in fish < NYSDEC fish flesh criteria	Chemical levels in sediment < NYSDEC fish & wildlife bioaccumulation sediment criteria	Non-impacted or slightly impacted benthic community	Acceptable species richness, EPT richness, and other metrics	No toxicity compared with controls	No restrictions on dredging or disposal of dredged sediment	
Remediation												
FS and RD for Remediation of In-stream Contaminated Sediments	9	X	X	X		X	X	X	X	X	X	
Inactive HWS Remediation: Upper Mountain Road (Site 932112)	8	X	X	X			X	X	X	X	X	
Inactive HWS Remediation: Corridor Site (Site 932121) and Flintkote (B-00161-9)	9	X	X	X		X	X	X	X	X	X	
Pilot Study on Treatment of Contaminated Sediments with PAC to Reduce PCB Bioavailability	9	X	X	X		X	X	X	X	X	X	
Remediation of In-stream Contaminated Sediments	9	X	X	X		X	X	X	X	X	X	
Monitoring and Assessment												
Mink Survey and Exposure Assessment for Eighteenmile Creek AOC and Watershed	2			X		X						
Baseline Sampling and Long term Monitoring of Fish from Different Trophic Levels	9	X	X			X	X	X	X	X	X	
Baseline Sampling and Long term Monitoring of the AOC Benthic Community	3							X	X	X		
Continued NYSDEC RIBS Assessments with Modifications to Include AOC	3							X	X	X		
Other												
Continued Annual Fish Stocking and Rearing	1			X								
Continued SPDES Discharge Permit Monitoring and Renewal	4						X	X	X	X		

Note:

* Score is based on a tally of the Xs in the delisting criteria columns; maximum value is 11.

Key:

AOC = Area of Concern.

BUI = Beneficial Use Impairment.

EPT = Ephemeroptera, Plecoptera, Trichoptera

FS = Feasibility Study.

HWS = Hazardous Waste Site.

< = less than.

NYSDEC = New York State Department of Environmental Conservation.

PAC = powdered activated carbon.

PCBs = polychlorinated biphenyls.

RD = Remedial Design.

RIBS = Rotating Integrated Basin Studies.

SPDES = State Pollutant Discharge Elimination System.

TTM = TrophicTrace model.

µg/kg = micrograms per kilogram.

TABLE 5-2 ACTION IMPLEMENTATION STRATEGY FOR THE EIGHTEENMILE CREEK AOC

Action		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Remarks
Remediation																			
FS and RD for Remediation of In-stream Contaminated Sediments																			Occurs during HWS remediation in Lockport; may require < 5 years
Inactive HWS Remediation: Eighteenmile Creek Corridor (Site 932121) and Flintkote (B-00161-9)																			Recommended that remedial work be implemented in the next 6 years
Inactive HWS Remediation: Upper Mountain Road (Site 932112)																			FS/RD preparation from 2011 to 2013 with remediation from 2014 to 2016 recommended.
Pilot Study on Treatment of Contaminated Sediments with PAC to Reduce PCB Bioavailability																			To be implemented in 2012.
Remediation of In-stream Contaminated Sediments Implementation assumed to require 5 years.																			Implementation assumed to require 5 years.
Monitoring and Assessment																			
Mink Survey and Exposure Assessment for Eighteenmile Creek AOC and Watershed																			To be implemented in 2012.
Baseline Sampling and Long-term Monitoring of Fish from Different Trophic Levels																			Baseline sampling to occur before HWS remediation, with monitoring every 3 years thereafter.
Baseline Sampling and Long-term Monitoring of the AOC Benthic Community																			Baseline sampling to occur before HWS remediation; with monitoring every 5 years thereafter.
Continued NYSDEC RIBS Assessments with Modifications to Include AOC Sampling**																			Ongoing NYSDEC program assumed to continue, with sampling every 5 years.
Other																			
Continued Annual Fish Stocking and Rearing																			Ongoing NYSDEC program assumed to continue.
Continued SPDES Discharge Permit Monitoring and Renewal																			Ongoing NYSDEC program assumed to continue.
BUI Status Check																			
Evaluate Attainment of Delisting Criteria and Delist BUIs as Appropriate																			Do after each round of sampling.

Notes:

 Indicates that project is implemented or ongoing during that calendar year.

* Survey for Levels of Bioaccumulative Chemicals in Wildlife Prey and Tissues and Wildlife Deformities within Western Lake Ontario and its Tributaries.

** At this time, it is unknown if NYSDEC will be able to modify the RIBS sampling for Eighteenmile Creek to include a site in the AOC.

Key:

AOC = Area of Concern.

BUI = Beneficial Use Impairment.

FS = Feasibility Study.

NYSDEC = New York State Department of Environmental Conservation.

PAC = powdered activated carbon.

PCBs = polychlorinated biphenyls.

RD = Remedial Design.

RIBS = Rotating Integrated Basin Studies.

SPDES = State Pollutant Discharge Elimination System.

TTM = TrophicTrace model.

WLO = Western Lake Ontario

CHAPTER 6

REFERENCES

Chapter 6: References

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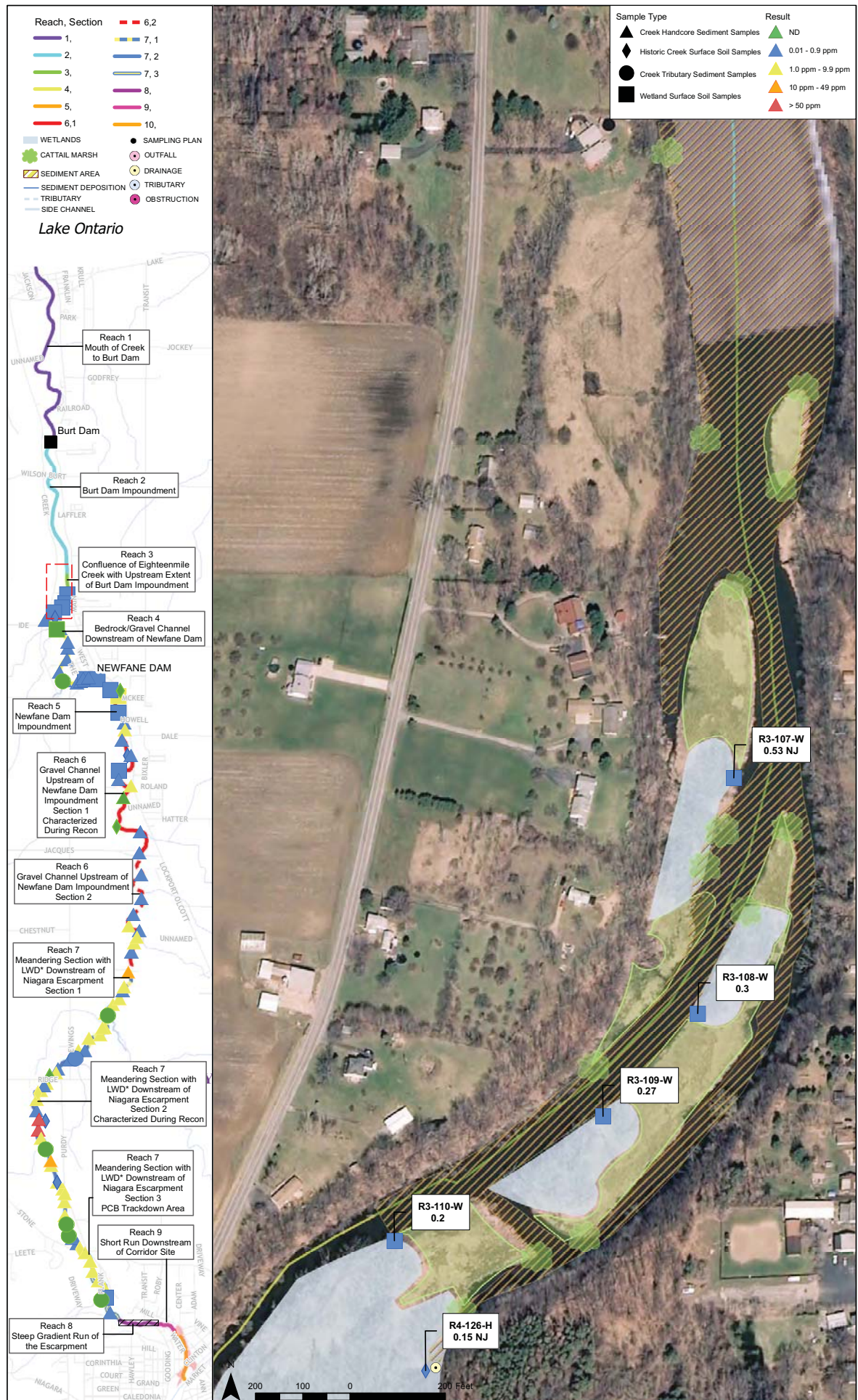
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APPENDIX A

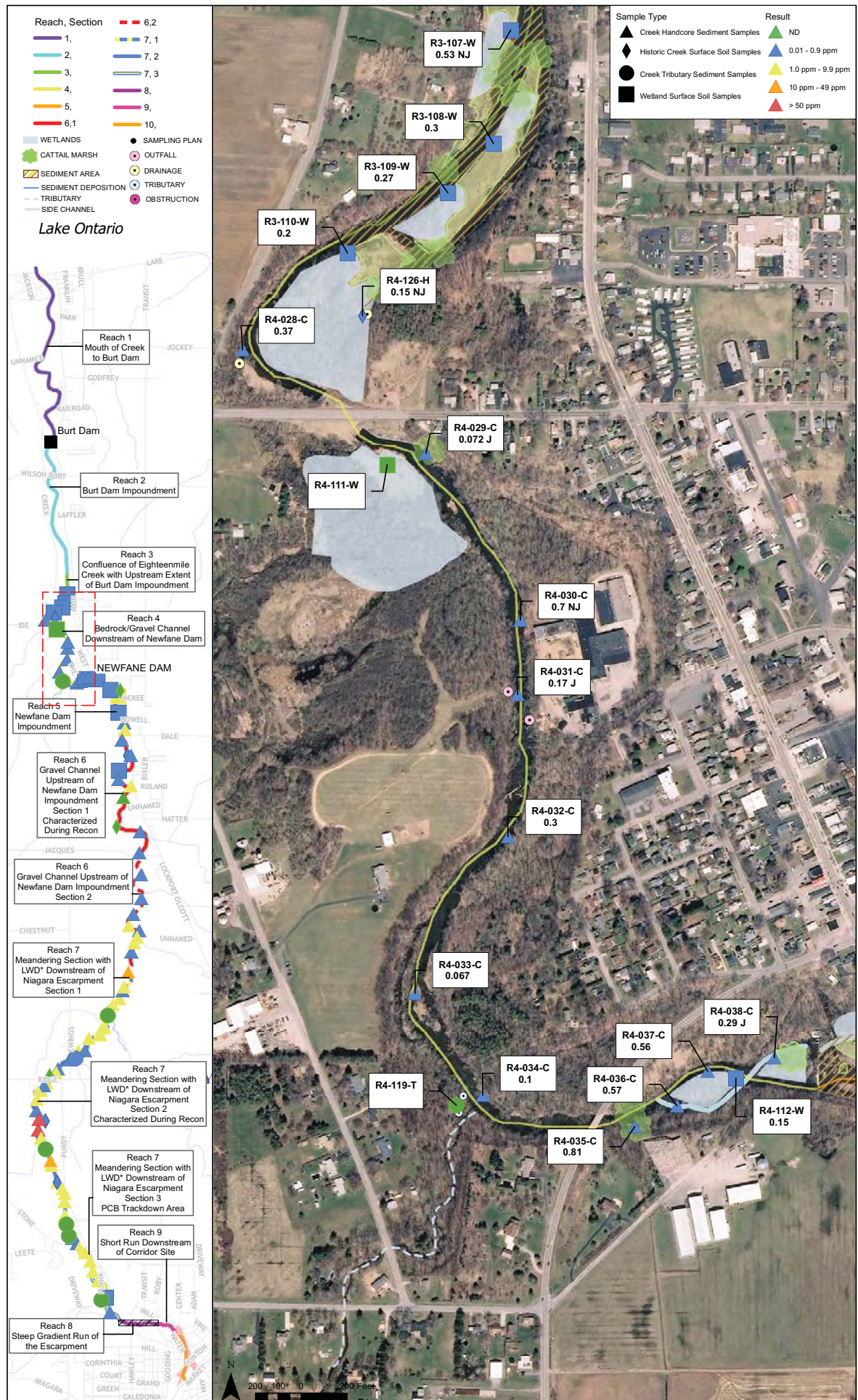
Data Summaries from the Great Lakes Legacy Act Sediment Characterization Study at Eighteenmile Creek

Appendix A: Sediment Data from Recent Investigations

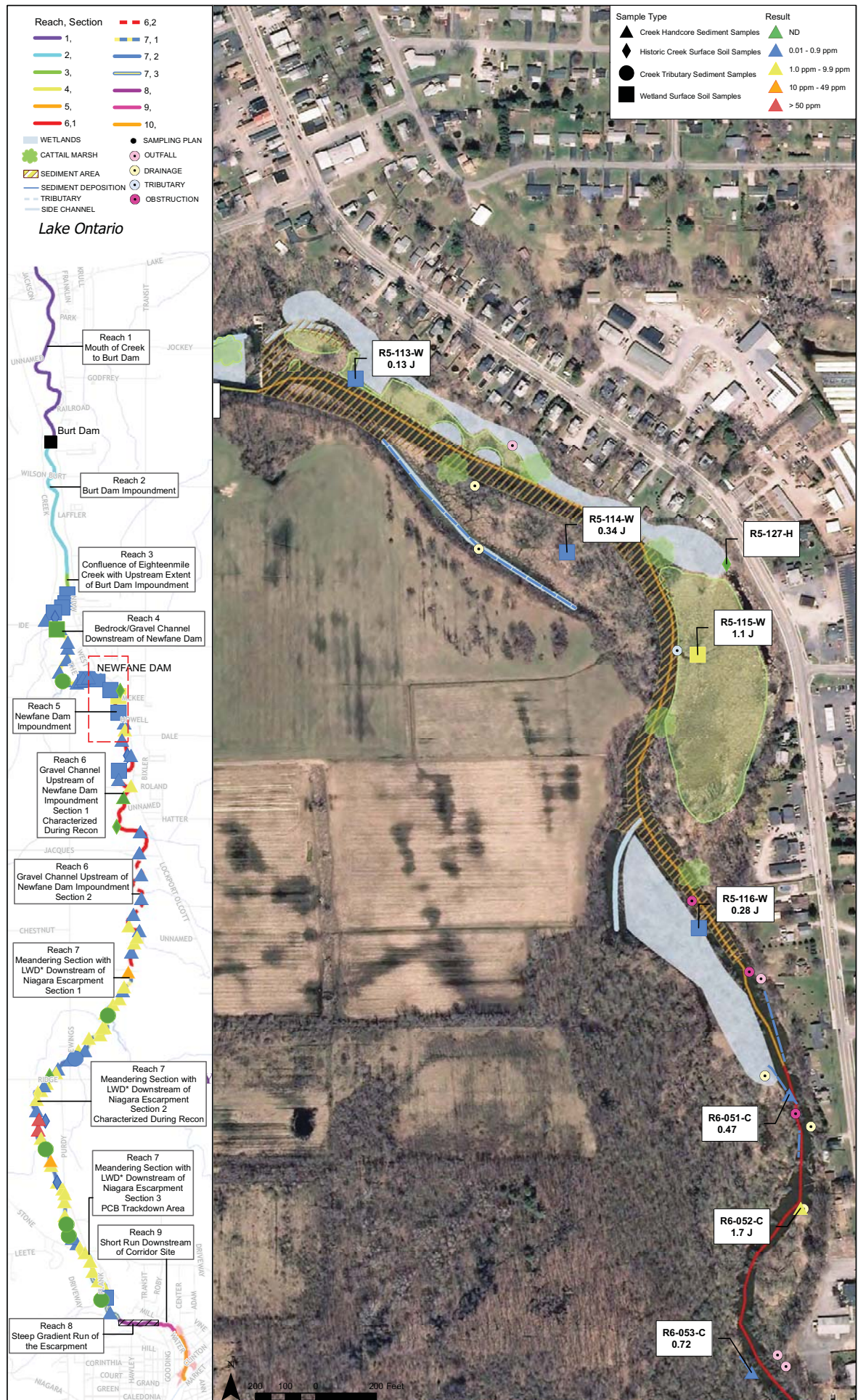
This appendix presents preliminary sediment data for polychlorinated biphenyls (PCBs) and selected metals collected recently (2009 and 2010) from Eighteenmile Creek above Burt Dam. It includes a series of figures showing total PCB levels in surface sediment.



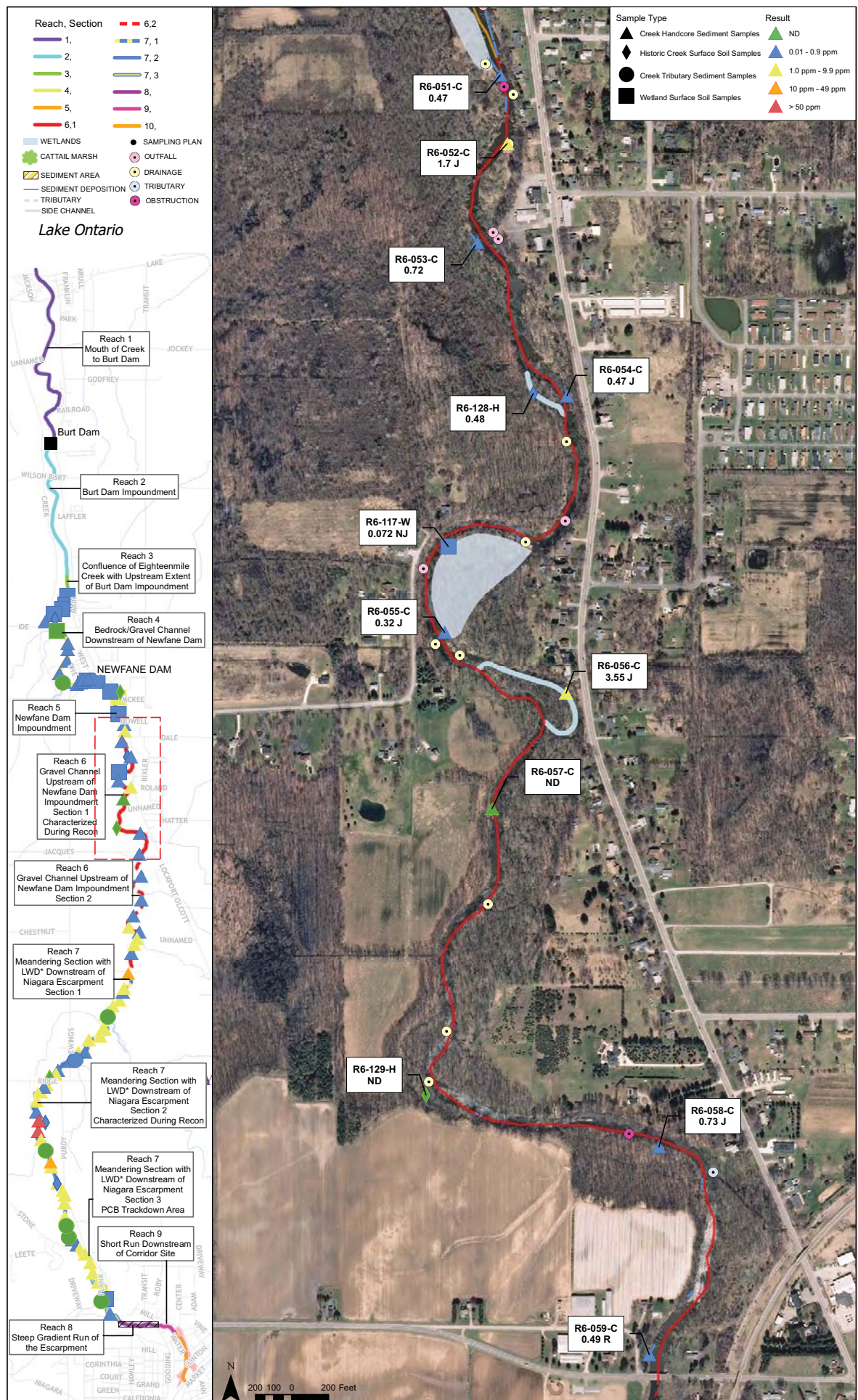
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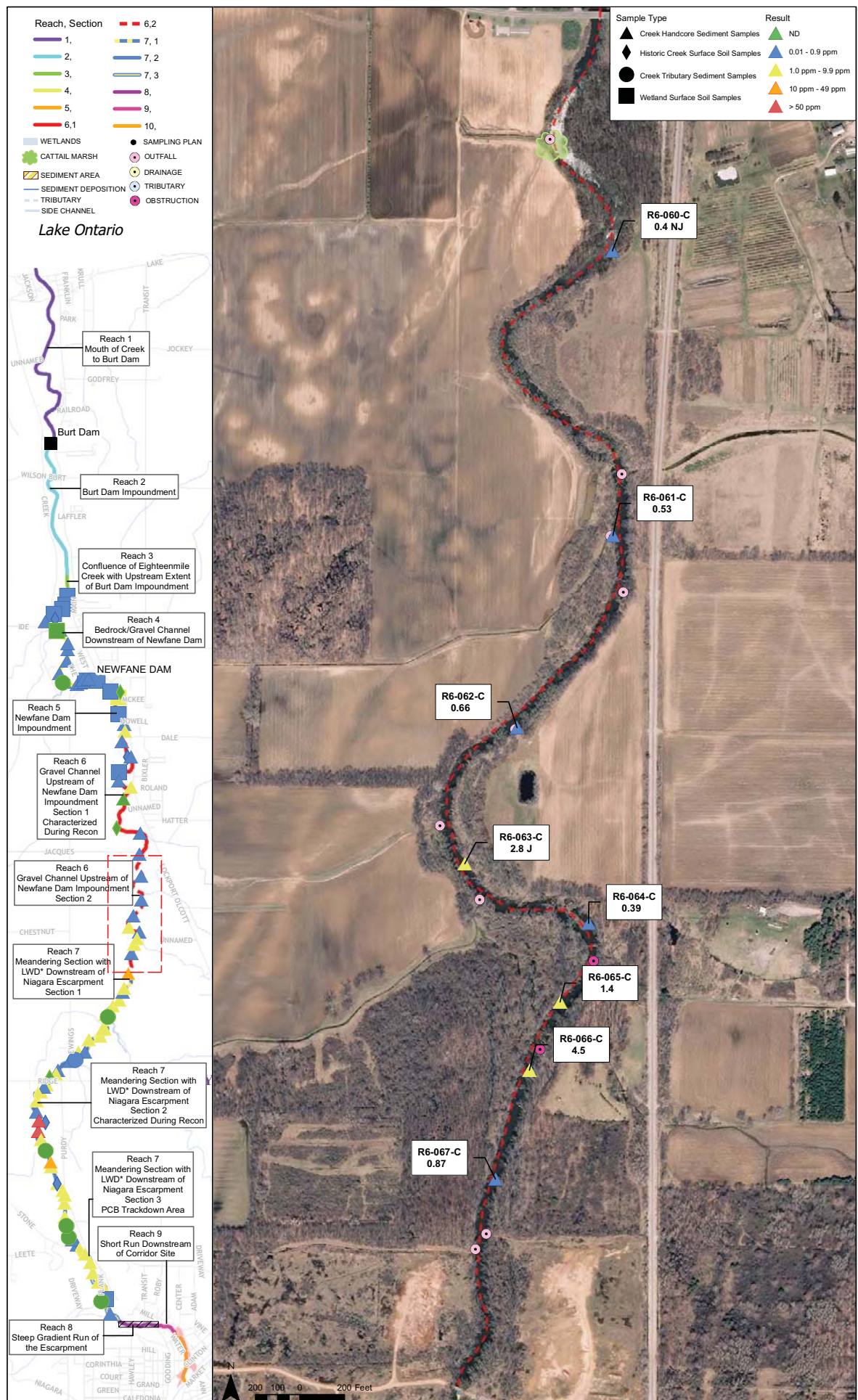
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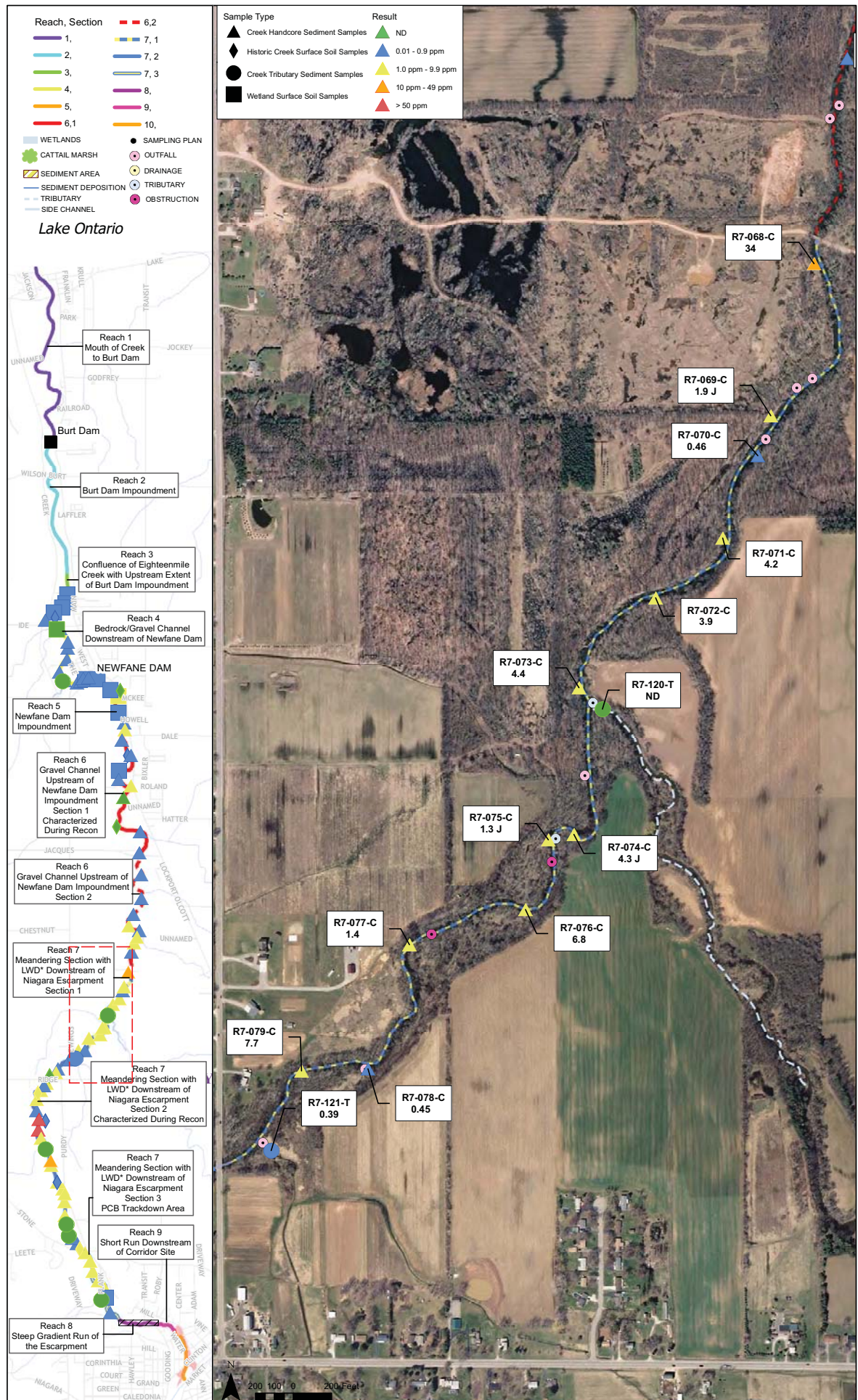
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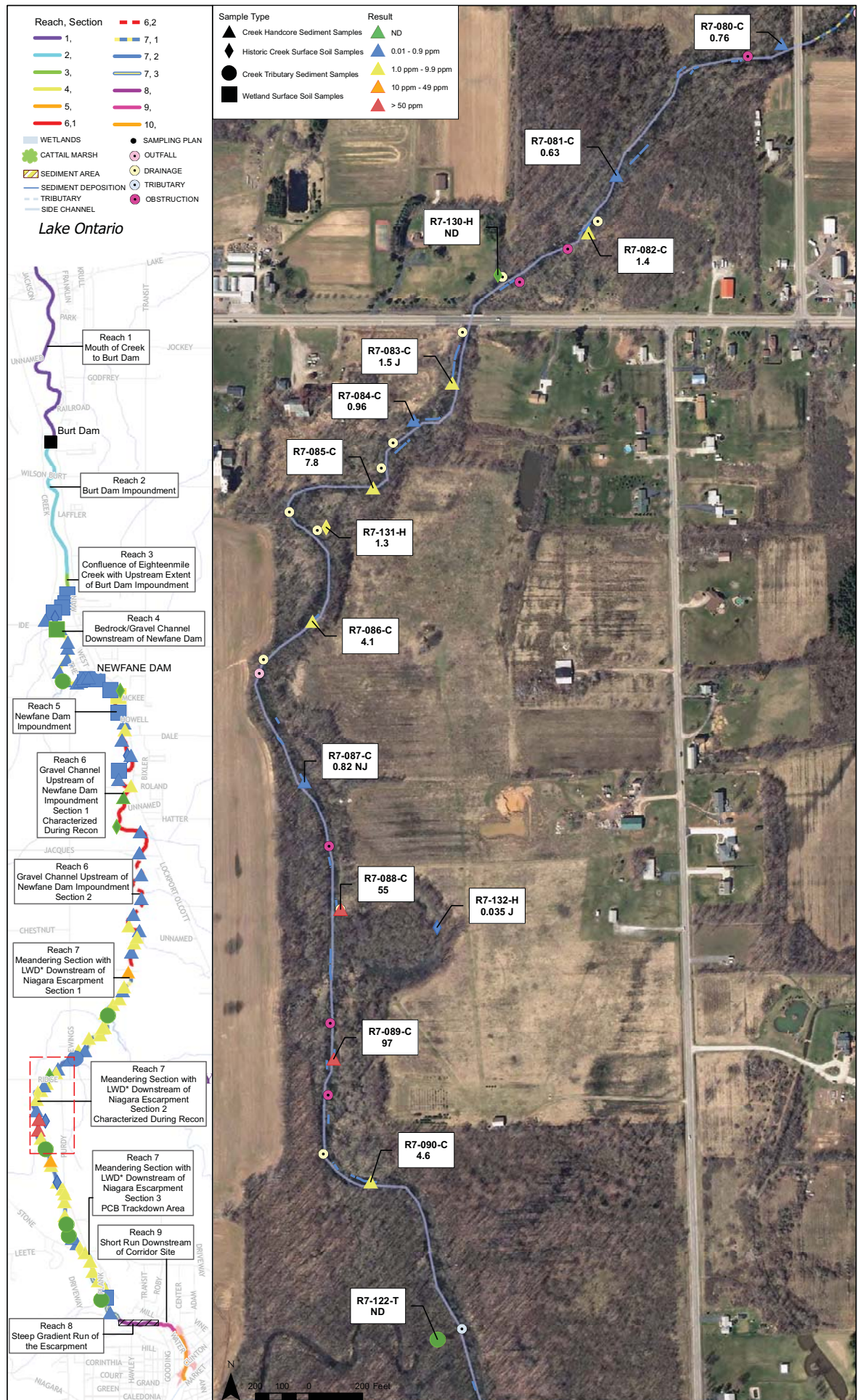
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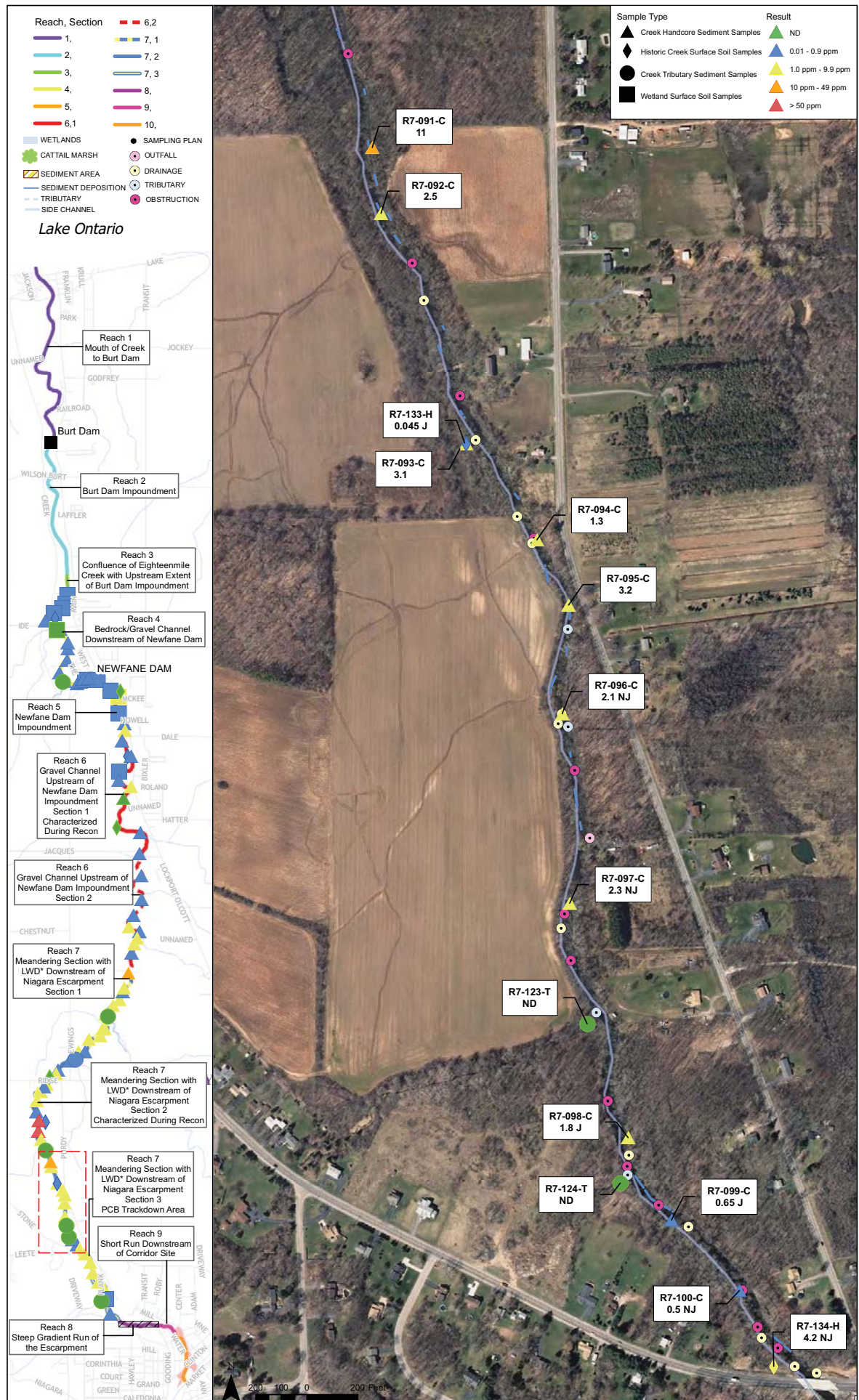
Reach 6 Section 2 2009 Site Characterization PCB Results



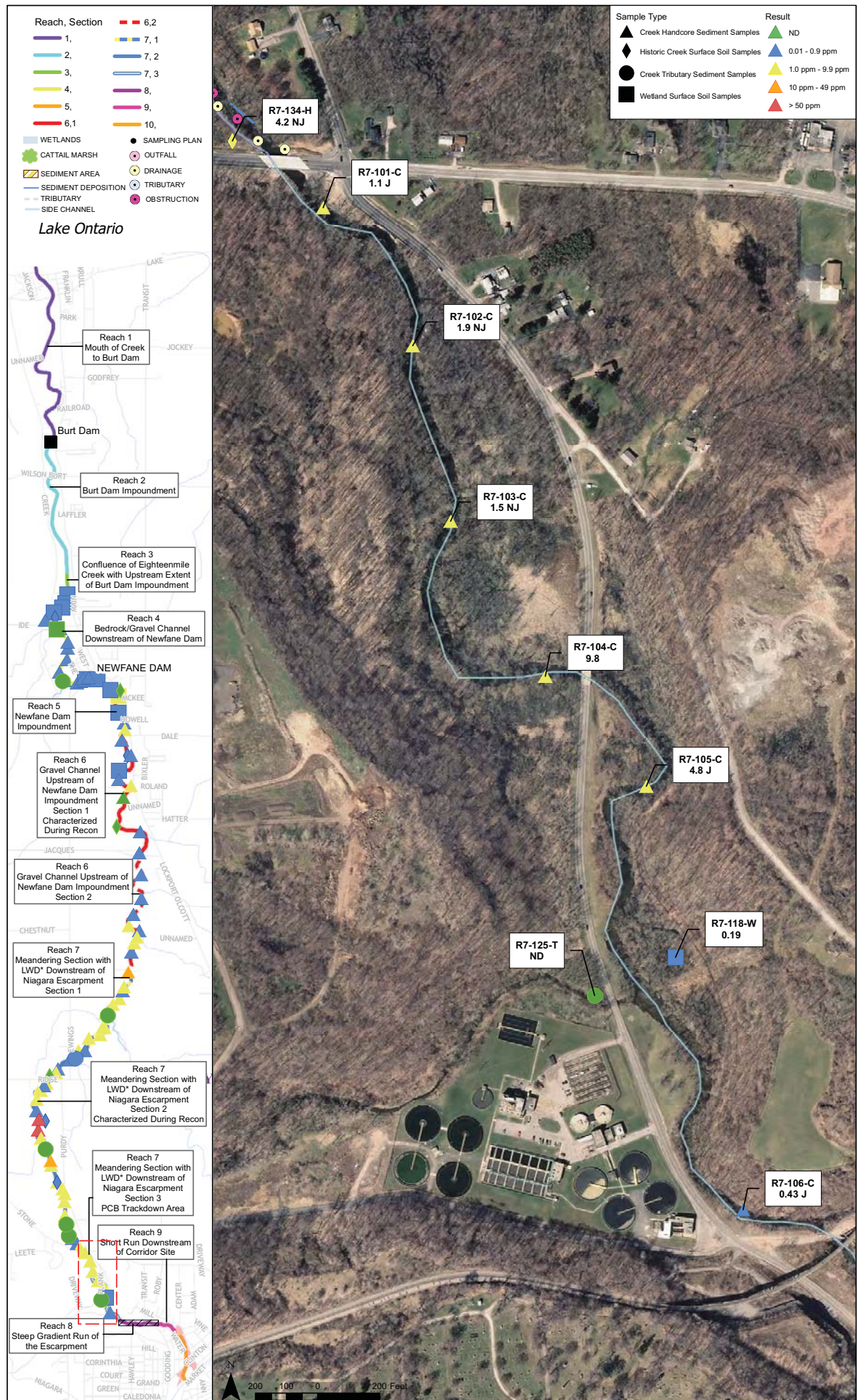
Reach 7 Section 1 2009 Site Characterization PCB Results



Reach 7 Section 2 Part 1 2009 Site Characterization PCB Results



Reach 7 Section 2 Part 2 2009 Site Characterization PCB Results



Reach 7 Section 3 2009 Site Characterization PCB Results

APPENDIX B

Cost Estimates

Appendix B

Rough Cost Estimates and Descriptions of Recommended Actions

This appendix presents rough cost estimates and descriptions of recommended actions to advance delisting of beneficial use impairments at Eighteenmile Creek, Niagara County, New York. This appendix includes seven subsections:

- Appendix B.1 -- Remedial Costs for the Eighteenmile Creek Corridor Site and Former Flintkote Plant Site, Lockport, New York.
- Appendix B.2 -- Range of Sediment Remedial Costs for Great Lakes Sediment Sites.
- Appendix B.3 -- Rough Cost Estimate for Baseline Sampling and Long-Term, Post-Remedial Monitoring of Fish from Different Trophic Levels in the Eighteenmile Creek System.
- Appendix B.4 -- Pilot Study on Use of Powdered Activated Carbon to Reduce Bioavailability of Polychlorinated Biphenyls (PCBs) in Eighteenmile Creek Sediment.
- Appendix B.5 -- Rough Cost Estimate for Use of TrophicTrace Model to Establish Site-specific Sediment Remedial Goals for PCBs in Eighteenmile Creek.
- Appendix B.6 -- Mink Survey and Exposure Assessment within the Eighteenmile Creek Area of Concern (AOC) and Watershed: Project Description and Cost Estimate.
- Appendix B.7 -- Cost Estimate for Stocking Eighteenmile Creek with Salmonid Species.
- Appendix B.8 -- Rough Cost Estimate for Baseline Sampling and Long-Term, Post-Remedial Monitoring of the Benthic Community in the Eighteenmile Creek System.

Appendix B.1.1

Remedial Costs for the Eighteenmile Creek Corridor Site (Site No. 932121), Lockport, New York

Introduction

The New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), is proposed remedies for Operable Units (OU) 1, 3, 4, 5 and 6 of the Eighteenmile Creek Corridor Site. These remedies are described in the Proposed Remedial Action Plan (RAP) for the site (NYSDEC 2010). Included below is a summary of the remedial goals and proposed remedial alternatives and their costs identified in the RAP. The site location map and OU map are included in Figures 1 and 2 (from NYSDEC 2010), respectively.

Summary of Remedial Goals

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- Exposures of residents, anglers and workers at or around the site to semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and inorganic compounds in surface soil/fill, subsurface soil/fill, and sediment;
- Environmental exposures of flora or fauna to SVOCs, PCBs, and inorganic compounds in surface soil/fill, subsurface soil/fill and sediment;
- The release of contaminants from subsurface soil/fill into groundwater that may create exceedances of groundwater quality standards; and
- The release of contaminants from surface soil/fill and subsurface soil/fill into Eighteenmile Creek and the millrace through erosion and the discharge of contaminated storm water runoff.

Further, the remediation goals for the site include attaining to the extent practicable of:

- 6 NYCRR Part 375 soil cleanup objectives;
- TAGM 4046 soil cleanup objectives when Part 375 soil cleanup objectives are not available; and
- Sediment Screening Concentration Guidelines (SCGs) derived from the Department's Technical Guidance for Screening Contaminated Sediments.

Summary of Proposed Remedial Alternatives

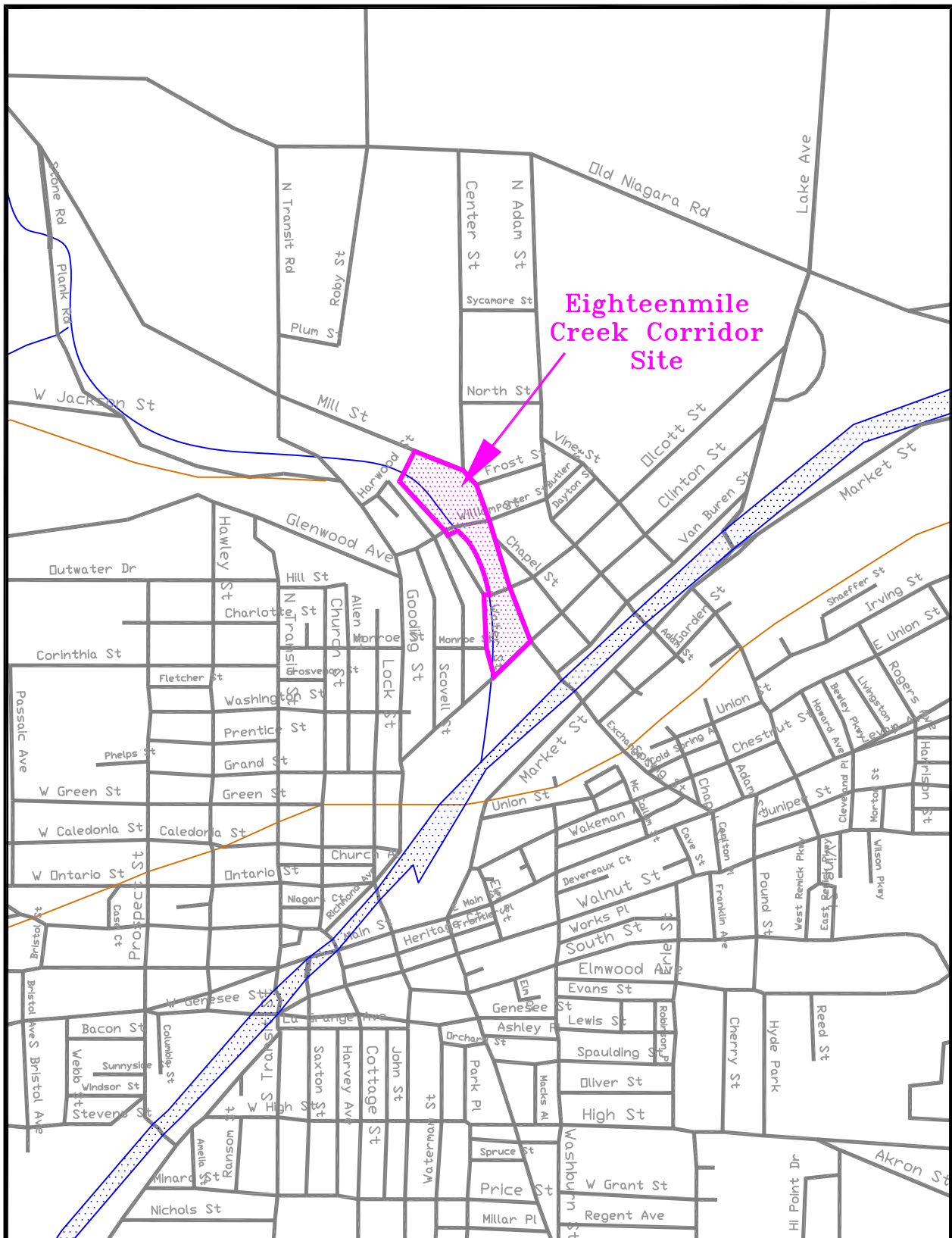
Table B.1-1, below, provides a summary of the costs for the proposed remedial alternatives identified for each OU. Costs of other alternatives that were evaluated and not selected are excluded from the table.

Reference

New York State Department of Environmental Conservation (NYSDEC). 2010. *Proposed Remedial Action Plan, Eighteenmile Creek Corridor Site, Operable Unit No. 1, 3, 4, 5 and 6, Lockport, Niagara County, New York, Site No. 932121*. Prepared by NYSDEC Division of Environmental Remediation. Available from <http://www.dec.ny.gov/chemical/49445.html> (accessed 12-5-10).

Table B.1-1 – Summary of Proposed Remedial Alternative Costs for the Eighteenmile Creek Corridor Site.				
Operable Unit	Remedial Alternative(\$)	Capital Costs(\$)	Annual Costs (\$)	Total Present Worth (\$)
1	Alt 7 - Sediment and Creek Bank Excavation with Restoration and Long-Term Monitoring: Dam and Pump Around	8,566,000	8,300 (annual) 18,200 (periodic)	8,818,000
3	Alt 3 - Hazardous Waste Removal with Bank Stabilization and Long-Term Monitoring	1,706,000	8,300 (annual) 24,700 (periodic)	1,985,000
4	Alt 3 - Hazardous Waste Removal with Bank Stabilization and Long-Term Monitoring	3,166,000	8,300 (annual) 22,900 (periodic)	3,438,000
5	Alt 3 - Hazardous Waste Removal with Bank Stabilization and Long-Term Monitoring	447,000	8,300 (annual) 14,000 (periodic)	681,000
6	Alt 4 - Limited Excavation with Bank Stabilization and Long-Term Monitoring	1,256,000	0	1,256,000
<i>Total Costs</i>		<i>15,141,000</i>	<i>33,200 (annual) 79,800 (periodic)</i>	<i>16,178,000</i>

Source: NYSDEC (2010)



Lockport Quadrangle

Scale Depends on Final Plotted Size

SITE LOCATION MAP

DIVISION OF ENVIRONMENTAL REMEDIATION

DATE: 02/20/03

DRAWING: Location Map.dwg

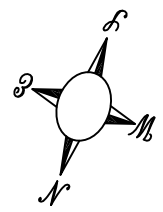
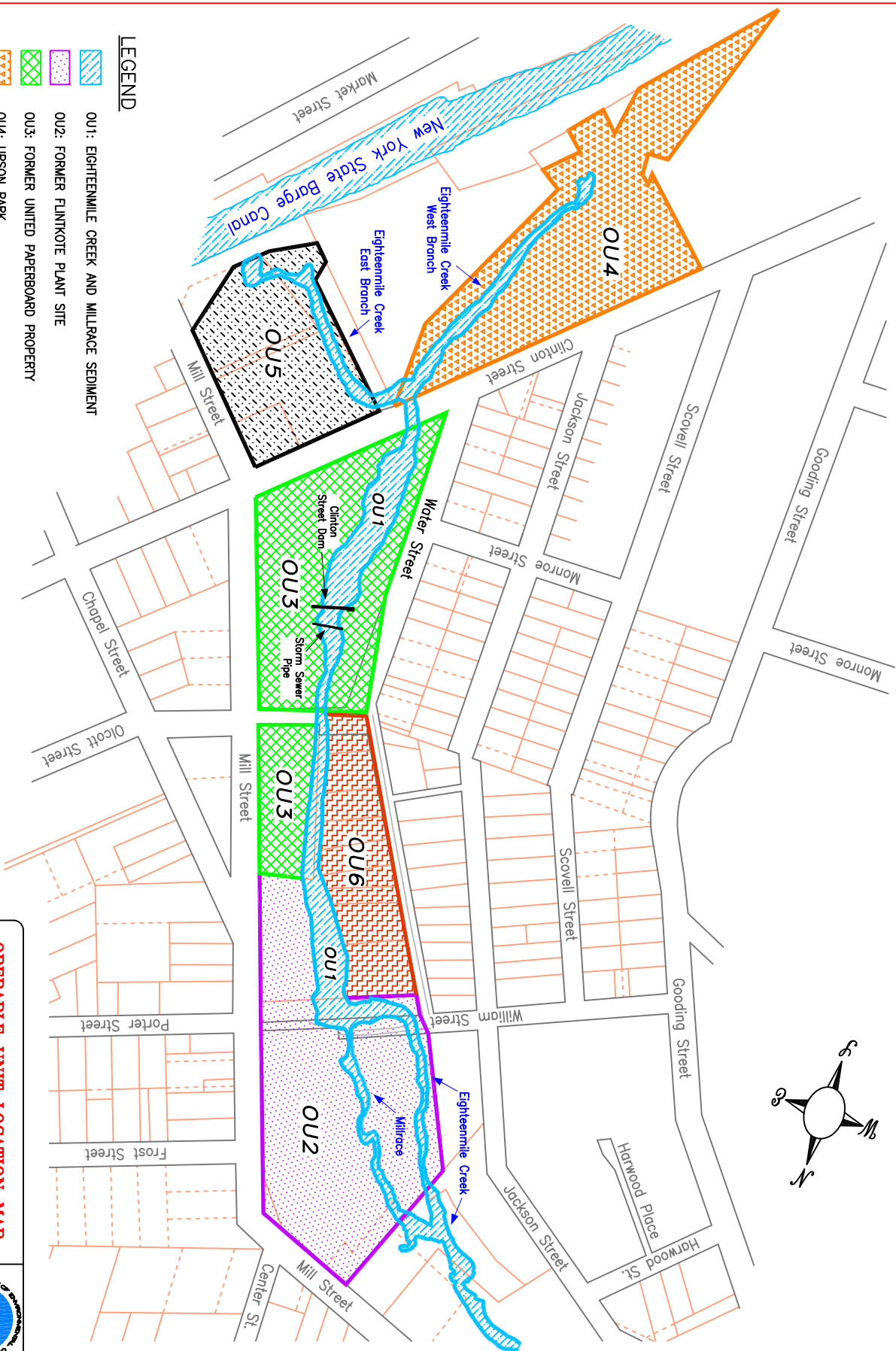
SITE:

EIGHTEENMILE CREEK CORRIDOR



FIGURE 1

- LEGEND**
-  OU1: EIGHTEENMILE CREEK AND MILLRACE SEDIMENT
 -  OU2: FORMER FLINTKOTE PLANT SITE
 -  OU3: FORMER UNITED PAPERBOARD PROPERTY
 -  OU4: UPSON PARK
 -  OU5: WHITE TRANSPORTATION PROPERTY
 -  OU6: WATER STREET RESIDENTIAL PROPERTIES



OPERABLE UNIT LOCATION MAP

DIVISION OF ENVIRONMENTAL REMEDIATION

DATE: 08/12/09 DRAWING: Site Wide Map.dwg

SITE NAME: EIGHTEENMILE CREEK CORRIDOR

FIGURE 2



Appendix B.1.2

Estimates Remedial Costs for Former Flintkote Plant Site, Lockport, New York

Introduction

The New York State Department of Environmental Conservation (NYSDEC or Department) has selected a remedial action for the Former Flintkote Plant Site (B-00161-9) in its Record of Decision (ROD) published in 2006. Included below is a summary of the remedial goals and a description and cost for the selected remedial alternative. A site location map, site features map, and hazardous fill area map are provided as Figures 1, 2, and 7, respectively. The figures were taken directly from NYSDEC (2006) without modification.

Summary of Remedial Goals

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- Exposures of persons at or around the site to semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and metals in surface soil/fill, subsurface ash/fill, creek and millrace sediment, unfiltered groundwater, sediments in buildings, waste in buildings, and standing water in buildings;
- Environmental exposures of flora or fauna to SVOCs, PCBs, and metals in surface soil/fill, subsurface ash fill, and creek and millrace sediment;
- The release of contaminants from subsurface ash fill into groundwater that may create exceedances of groundwater quality standards; and
- The release of contaminants from surface soil/fill, subsurface ash fill, unfiltered groundwater, sediments in buildings, waste in buildings, and standing water in buildings into Eighteenmile Creek and the millrace through the discharge of contaminated stormwater runoff, discharge of contaminated sediments, waste and standing water in buildings, and erosion of contaminated surface soil/fill and subsurface ash fill.

Further, the remediation goals for the site include attaining to the extent practicable:

- Ambient water quality standards;
- Technical Administrative Guidance Memorandum (TAGM) 4046 soil cleanup objectives; and
- Sediment screening concentration guidelines (SCGs).

Summary of Proposed Remedial Alternative

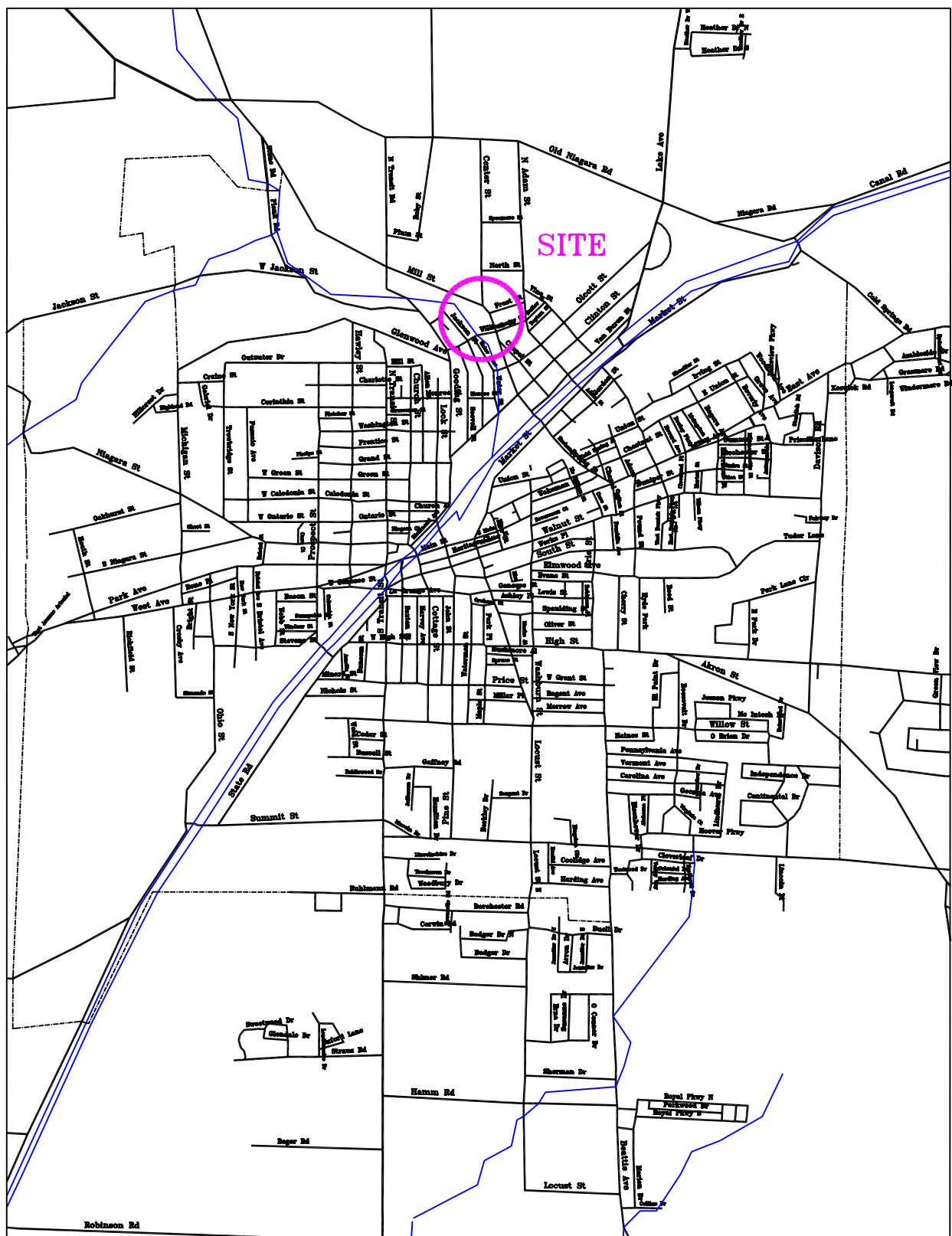
Table 1, below, provides a summary of the costs for the proposed remedial alternative identified in the ROD. Costs of other alternatives that were evaluated and not selected are excluded from the table.

Table 1 – Summary of Proposed Remedial Alternative Costs			
Selected Remedial Alternative	Capital Costs (\$)	Annual Costs (\$)	Total Present Worth (\$)
Alternative 4 – Excavation and Containment	5,552,000	6,800 (annual)	5,614,000

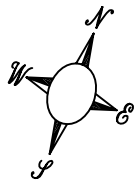
Source: NYSDEC (2006).

Reference

New York State Department of Environmental Conservation (NYSDEC). 2006. *Environmental Restoration Record of Decision: Former Flintkote Plant Site, City of Lockport Niagara County, New York, Site Number B-00161-9*. Prepared by NYSDEC Division of Environmental Remediation.



Lockport Quadrangle Scale Depends on Final Plotted Size	SITE LOCATION MAP DIVISION OF ENVIRONMENTAL REMEDIATION		
	DATE: 08/29/00	DRAWING: LOCATION2.DWG	
SITE: FORMER FLINTKOTE PLANT SITE		FIGURE 1	



Residential Properties
(Not Part of Site)

Water Street

Flintkote Site,
Water Street Section

Residential Properties
(Not Part of Site)

Half Buried
Concrete Structure

Eighteenmile Creek

Timber Debris on
Slopes

Flintkote Site,
198 Mill Street

Partially Demolished
Buildings

Mill Street

William Street

Residential Properties
(Not Part of Site)

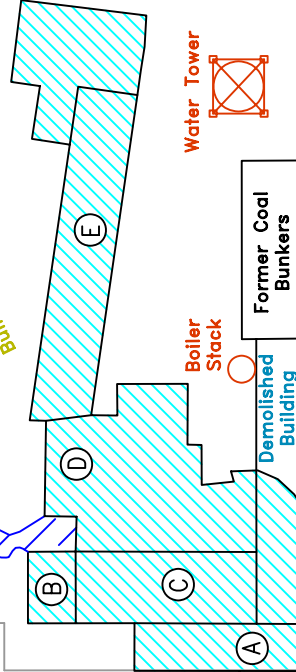
Eighteenmile Creek

Flintkote Site,
The Island

Millrace

Building Debris on Slopes

Flintkote Site,
300 Mill Street



Water Tower

Boiler
Stack

Former Coal
Bunkers

Demolished
Building

Chapel Street

Residential Properties
(Not Part of Site)

Porter St.

Residential Properties
(Not Part of Site)

Frost St.



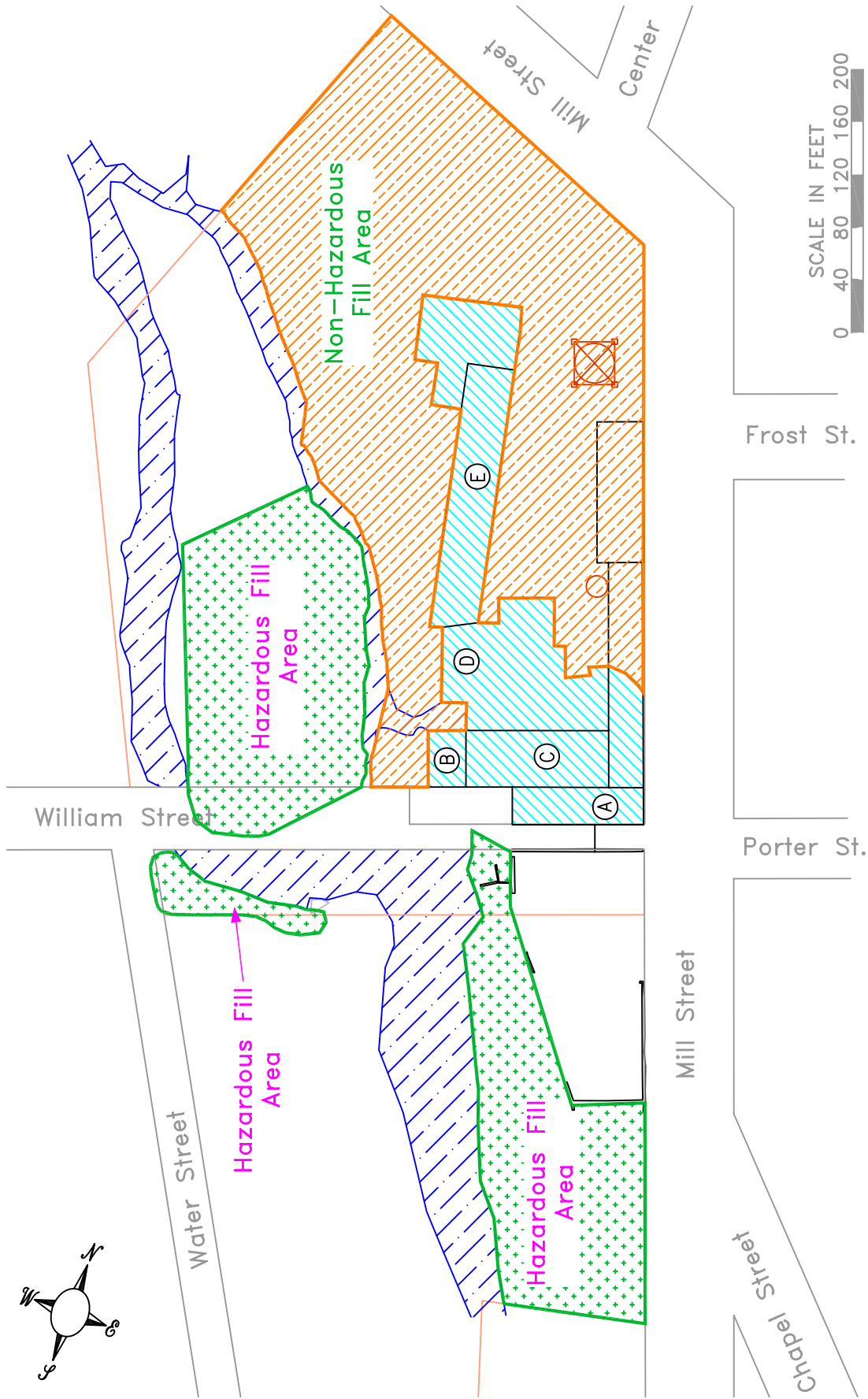
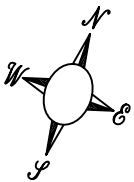
FLINTKOTE SITE MAP

DIVISION OF ENVIRONMENTAL REMEDIATION

DATE: 05/11/00 DRAWING: SITEMAP.DWG

SITE: FORMER FLINTKOTE PLANT SITE

FIGURE 2



Appendix B.2

Range of Sediment Remedial Costs for Great Lakes Sediment Sites

This appendix includes two tables that were used to help understand the cost of sediment remedial work at Eighteenmile Creek. The first table in this appendix was taken from the United States Environmental Protection Agency (EPA) Great Lakes Legacy Act web page (www.epa.gov/glla/remed/GreatLakesSedimentManagementPlan.pdf). The second table includes a subset of sites from the first table for which sediment remedial projects have been completed. Use of the information in these tables to estimate a cost for sediment remediation at Eighteenmile Creek (excluding the Corridor Site in Lockport, New York) is discussed in Section 2.1.

Great Lakes AOC Contaminated Sediment Site Management Plan - (October 29, 2010)										
Site Name / Location	State	AOC	Estimated Volume of Contaminated Sediments	Estimated Cost (Average)	Responsible Office / Authority	Assessment Status	Remediation Complete?	Current Phase	Start Date (Current Phase)	Expected End Date (Current Phase)
MINNESOTA SITES										
St. Louis River/Interlake/Duluth Tar Superfund Site	MN	St. Louis River	455,000	\$45,600,000	State Superfund	Full	No	Implementation		
St. Louis River/Interlake/Duluth Tar Superfund Site - Carbon Mat (GLLA betterment to Superfund Remedy)	MN	St. Louis River	80,000	\$1,200,000	Legacy	Full	Yes	Carbon Mat Complete	2009	2010
St. Louis River/US Steel Superfund Site	MN	St. Louis River	225,000	\$27,500,000	Superfund		No	Assessment		2015
Minnesota Slip	MN	St. Louis River	33,000	\$6,000,000	Not Determined		No	Feasibility		
Minnesota Sites Needing Assessment										
Superior Bay Sites	MN	St. Louis River	4,329,000	\$433 million - \$4.3 billion	Not Determined	Not assessed	No			
St. Louis Bay Sites	MN	St. Louis River	3,418,000	\$342 million - \$3.4 billion	Not Determined	Not assessed	No			
Lower St. Louis River	MN	St. Louis River	4,872,000	\$487 million - \$4.9 billion	Not Determined	Not assessed	No			
Upper St. Louis River	MN	St. Louis River	4,986,000	\$499 million - \$5 billion	Not Determined	Not assessed	No			
WISCONSIN SITES										
St. Louis River/Duluth Harbor/Newton Creek/Superior Bay	WI	St. Louis River	500,000	\$27,500,000	Superfund		No	Assessment		
St. Louis River - Howards Bay	WI	St. Louis River	680,000		Legacy	Partial	No	Assessment	2010	2010
Hog Island / Newton Creek Inlet	WI	St. Louis River	40,000	\$6,300,000	Legacy	Full	Yes	Remediation Complete		2005
Fox River/Lower Green Bay [Superfund: OU 1 - Little Lake Butte des Morts]	WI	Fox River / Green Bay	784,000	\$97,000,000	Superfund	Full	Yes	Remediation Complete		2009
Fox River/Lower Green Bay [Superfund: OU 2 - Appleton to Little Rapids]	WI	Fox River / Green Bay	46,000	\$10,000,000	Superfund	Full	No	Implementation		2011
Fox River/Lower Green Bay [Superfund: OU 3 - Little Rapids to DePere]	WI	Fox River / Green Bay	586,000	\$26,000,000	Superfund	Partial	No	Implementation		2019
Fox River/Lower Green Bay [Superfund: OU 4- DePere to Green Bay]	WI	Fox River / Green Bay	5,880,000	\$258,000,000	Superfund	Partial	No	Implementation		2019
Fox River/Lower Green Bay [Superfund: OU 5 - Green Bay] - Monitored Natural Recovery	WI	Fox River / Green Bay	29,000,000	\$40,000,000	Superfund	Partial	No			
Appleton MGP Site (Lower Fox River)	WI	Fox River / Green Bay			Not Determined	Not Assessed	No			
Hewitt Machines (Lower Fox River	WI	Fox River / Green Bay			Not Determined	Not Assessed	No			
Two MGP Sites in Neenah (Lower Fox River)	WI	Fox River / Green Bay			Not Determined	Not Assessed	No			
Fond du Lac River (Upper Fox River Basin)	WI	Fox River / Green Bay			Not Determined		No			
Silver Creek / Ripon MGP Site (Upper Fox River basin)	WI	Fox River / Green Bay			Not Determined		No			
Oshkosh MGP (Upper Fox River basin)	WI	Fox River / Green Bay			Superfund	Partial	No	Assessment		
Green Bay MGP (Upper Fox River Basin)	WI	Fox River / Green Bay			Superfund	Partial	No	Assessment		
Menominee River [RCRA: Anslu site]	WI	Menominee River	250,000	\$28,750,000	RCRA	Partial	No	Design	2011	2013
Menominee River MGP Site (Boom Landing)	WI	Menominee River	2,000	\$850,000	Superfund	Partial	No			

Site Name / Location	State	AOC	Estimated Volume of Contaminated Sediments	Estimated Cost (Average)	Responsible Office / Authority	Assessment Status	Remediation Complete?	Current Phase	Start Date (Current Phase)	Expected End Date (Current Phase)
Saginaw River/Bay (RCRA, Corps, NRDA)	MI	Saginaw River / Bay		\$1,000,000	Other		No	Assessment		
Clinton River	MI	Clinton River	50000	\$10,000,000	Legacy		No	Assessment		
Deer Lake/Carp River/Carp Creek	MI	Deer Lake	2,500,000	\$49,375,000	Other		No	Monitored Natural Recovery		
Black Lagoon - Trenton Channel	MI	Detroit River	115,000	\$9,300,000	Legacy	Full	Yes	Remediation Complete		2005
Detroit River / Trenton Channel	MI	Detroit River	250,000	\$35,000,000	RCRA / Legacy	Partial	No	Assessment / Feasibility	2010	2011
Conners Creek (City of Detroit)	MI	Detroit River	150,000		Other		No	Monitoring		
Kalamazoo River (Area 1: Plainwell Impoundment)	MI	Kalamazoo River			Superfund					
Kalamazoo River (Area 2: Otsego City Impoundment)	MI	Kalamazoo River		\$36,000,000	Superfund					
Kalamazoo River (Area 3: Otsego Impoundment)	MI	Kalamazoo River		\$44,000,000	Superfund					
Kalamazoo River (Area 4: Trowbridge Impoundment)	MI	Kalamazoo River		\$126,000,000	Superfund					
Kalamazoo River (Area 5: Trowbridge to Allegan City Dam)	MI	Kalamazoo River			Superfund					
Kalamazoo River (Area 6: Lake Allegan)	MI	Kalamazoo River			Superfund					
Kalamazoo River (Area 7: Allegan Dam to Lake Michigan)	MI	Kalamazoo River			Superfund					
Manistique River [Superfund: Manistique River and Harbor non-time critical removal action]	MI	Manistique River	111,000	\$30 - 50 million	Superfund	Full	Yes	Remediation Complete		2004
Manistique River (Legacy)	MI	Manistique River	150,000	\$ 20,000,000	Legacy	Partial	No	Assessment	2010	2011
Ruddiman Creek	MI	Muskegon Lake	90,000	\$ 13,000,000	Legacy	Full	Yes	Remediation Complete		2006
Ryerson Creek	MI	Muskegon Lake	50,000	\$7,500,000	Legacy		No	Assessment		
Division Street Outfall	MI	Muskegon Lake	50,000	\$7,500,000	Legacy		No	Design		
Raisin River	MI	River Raisin	100,000	\$12,000,000	Legacy	Partial	No	Design		2011
Raisin River (Corps strategic dredging / advance Maintenance)	MI	River Raisin	40,000	\$500,000	Corps	Partial	No	Design		2011
Rouge River (Corps 312b, others)	MI	Rouge River			Corps		No			
Lower Rouge River	MI	Rouge River	60,000	\$10,000,000	Legacy		No	Assessment		
St. Marys River, Tannery Bay [Superfund: Cannelton Industries NPL site]	MI	St. Marys River	40,000	\$8,000,000	Legacy	Full	Yes	Remediation Complete		2007
St. Marys River Former MGP Site (Phase 1)	MI	St. Marys River	8,000	\$1,500,000	Legacy	Full	Yes	Remediation Complete	2010	2010
St. Marys River Former MGP Site (Phase 2)	MI	St. Marys River	20,000	\$2,500,000	Legacy	Partial	No	Design	2010	2011
Torch Lake	MI	Torch Lake	4,000,000	\$1,000,000	Superfund		No	Monitoring		
OHIO SITES										
Ashtabula River GLLA Project	OH	Ashtabula	500,000	\$60,000,000	Legacy	Full	Yes	Remediation Complete	2006	2010
Ashtabula River (Corps Fed Channel)	OH	Ashtabula	135,000	\$13,000,000	Corps	Full	Yes	Remediation Complete	2008	2008

[illegible]

Table 2. Range of Costs for Completed Great Lakes Sediment Remediation Projects.

Site	Sediment Volume Remediated (cubic yards)	Cost
Baltz Pavilion, WI	5,000	\$2,000,000
St Mary's River, Former MGP Site, MI	8,000	\$1,500,000
Sheboygan River Upper Reach, WI	35,000	\$15,000,000
Hog Island and Newton Creek, WI	40,000	\$6,300,000
St Mary's River, Tannery Bay, MI	40,000	\$8,000,000
Milwaukee Estuary, Moss American Site, WI	64,000	\$18,500,000
Ruddiman Creek, MI	90,000	\$13,000,000
Manistique River and Harbor (non-time critical), MI	111,000	\$40,000,000
Ashtabula River, OH (Corps Federal Channel)	135,000	\$13,000,000
Kinnickinnic River, WI	167,000	\$23,000,000
Ashtabula River, OH (GLLA project)	500,000	\$60,000,000
Fox River OU1, WI	784,000	\$97,000,000

Source: Completed projects only from the U.S. Environmental Protection Agency Great Lakes Legacy Act web page (www.epa.gov/glla/remed/GreatLakesSedimentManagementPlan.pdf).

Appendix B.3
**Rough Cost Estimate for Baseline Sampling and Long-Term, Post-Remedial Monitoring of Fish
from Different Trophic Levels in the Eighteenmile Creek System**

The cost of baseline sampling and one round of post-remedial sampling are estimated to be \$65,950 and \$59,950, respectively. The estimate for post-remedial sampling is less than the estimate for baseline sampling because the Sampling and Analysis Plan (SAP) prepared for baseline sampling is assumed to be useful for post-remedial sampling with little or no modification. The cost estimate for fish monitoring includes four tasks: (1) SAP preparation; (2) field sampling; (3) fish tissue analysis; and (4) reporting. It is expected that SAP development will be a desktop effort requiring approximately one week to complete. Field sampling is expected to be a three day effort by a team of three biologists. The sampling will entail collecting five forage fish composite samples and five game fish samples from each of three reaches of Eighteenmile Creek—below Burt Dam; between Newfane and Burt Dams; and upstream from Newfane Dam—for a total of 30 fish samples. We expect that fish sampling will take one day per reach. The fish samples will be analyzed for PCBs, lipids, and percent moisture. Finally, a report will be drafted and finalized summarizing the findings of fish sampling.

Appendix B.4

Pilot Study on Use of Powdered Activated Carbon to Reduce Bioavailability of Polychlorinated Biphenyls (PCBs) in Eighteenmile Creek Sediment

Introduction

This project will evaluate the effectiveness of using powdered activated carbon (PAC) to reduce bioavailability of polychlorinated biphenyls (PCBs) in Eighteenmile Creek sediment. Up to 90% reduction in PCB bioavailability has been observed at sites where this method has been used (Luthy et al. 2009, Clu-in 2010). The five beneficial use impairments (BUIs) at Eighteenmile Creek are all ultimately linked to high PCBs levels in sediment (see Section 2). If the pilot study proves to be successful (i.e., if PAC is effective in reducing PCB bioavailability in Eighteenmile Creek sediment), then application of this technique *in situ* has the potential to contribute to delisting of these BUIs. If implemented, the results of this study will be incorporated into the Eighteenmile Creek Feasibility Study (FS). Sediment treatment with PAC may be useful in Eighteenmile Creek as a polishing step in areas where sediment dredging is implemented and/or as the principal means of sediment remediation in areas that are difficult or impossible to access for dredging.

Project Specifics

This project will include a laboratory bench-top pilot study with Eighteenmile Creek sediment. Creek sediments representing a range of PCB concentrations will be collected and augmented with a range of PAC concentrations. Bioaccumulation in each treatment will be determined by USEPA (2000) Test Method 100.3 (28-day *Lumbriculus variegatus* Bioaccumulation Test for Sediments). For comparison, bioaccumulation in untreated sediment from Eighteenmile Creek also will be evaluated. Upon test completion, the sediment samples will be analyzed for PCBs and total organic carbon and the test organisms will be analyzed for PCBs and percent lipids. Bioaccumulation will be evaluated by comparing PCB levels in test organisms among treatments and by calculating and comparing biota-sediment accumulation factors among treatments. Additional information regarding this recommended action can be found in the Western Lake Ontario (WLO) factsheet project for regional stakeholders entitled *Pilot Study on Use of Powdered Activated Carbon to Reduce Bioavailability of Polychlorinated Biphenyls (PCBs) in Eighteenmile Creek Sediment*. The factsheet provides additional details on sampling locations and study design.

Rough Cost Estimate

\$70,820 total divided as follows: \$6,000 for preparation of plans; \$5,000 for sediment sampling; \$44,800 for bioaccumulation testing and chemical analysis; and \$15,000 reporting.

References

- Clu-in. 2010. *Contaminated Site Clean-Up Information*. Available online at: <http://www.clu-in.org/contaminantfocus/default.focus/sec/Sediments/cat/Overview/>. Accessed January 12, 2011.
- Luthy, Richard G., Yeo-Myoung Cho, Upal Ghosh, Todd S. Bridges, and Alan J. Kennedy. May 2009. *Field Testing of Activated Carbon Mixing and In Situ Stabilization of PCBs in Sediment*.
- United States Environmental Protection Agency (USEPA). 2000. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition*. USEPA Office of Research and Development, Duluth, Minnesota and Office of Water, Washington, D.C. EPA 600/R-99/064.

Appendix B.5
Rough Cost Estimate for Use of TrophicTrace Model to Establish Site-specific Sediment Remedial Goals for PCBs in Eighteenmile Creek

This appendix contains e-mail correspondence between Karl Gustavson (U.S. Army Engineer Research and Development Center) and Carl Mach (Ecology and Environment, Inc.) regarding the scope and cost of this potential action.

From: Gustavson.Karl@epamail.epa.gov
Sent: Tuesday, March 08, 2011 12:13 PM
To: Mach, Carl
Cc: Katherine von Stackelberg; Hinterberger, Bryan A LRB
Subject: Fw: Eighteenmile Creek TrophicTrace Modeling Project

Attachments: 18MCestimate2-24-2011.xlsx

Carl,

Sorry for the delay on this. I wanted to run it by Bryan first as he is the current project sponsor.

A couple things to note. 1) The list is comprehensive and contains items to satisfy uncertainties at the site that relate directly and indirectly to foodweb modeling. Those uncertainties were identified during review of data and model output for the site. Some efforts may already be planned by others; 2) In that regard, there may be a hierarchy here for what could be supported, depending on your needs. At this point, our intent was to be inclusive; and 3) costs are "back-of-the envelope" estimates to give you a ballpark of what to expect if efforts are pursued.

So, based on where we are at now with modeling, I see two primary efforts.

1) Refine model and impacts to receptors by investigating exposure pathways. (Efforts seek to elucidate potentially unmodeled/unknown dietary source; possible water pathway).

- a. stomach contents of largemouth bass and bullheads during spring and summer timeframe (need to better understand diet during various seasons)
- b. sampling of crayfish contaminant levels (in fall they had a very large crayfish dietary component)
- c. water sampling to define dissolved fraction (we only have one sample of dissolved PCB congeners from 1998)
- d. In fall 2012, duplicate sediment and fish tissue sampling used in model development

2. Use of model to develop remedial goals

- a. evaluate PCB congener vs Aroclor relationship in sediment and biota to define appropriate metric for risk-based remedial goals (there is a large discrepancy between aroclors and congeners; both could be considered "total PCB"; they would give you vastly different results).
- b. use Feb 2011 model to develop risk-based remedial goals; update results based on above studies.
- c. update 2011 model and remedial goals based on Task 1 data
- d. high resolution geochronology and chemistry cores (provide an indication of chemistry changes over time to then predict time to remedial goals under no action, assuming rate continues).

Attached is a very rough cost estimate to give an indication as to the general cost.

Give me a call or email if you'd like to discuss.

(See attached file: 18MCestimate2-24-2011.xlsx)

Karl Gustavson, Ph.D.
US Army Engineer Research and Development Center Duty Station: Contaminated Sediments Team,
USEPA OSRTI
Phone: 703-603-8753
Fax: 703-603-9112

From: "Mach, Carl" <CMach@ene.com>
To: Karl Gustavson/DC/USEPA/US@EPA, "Katherine von Stackelberg"
<kvon@erisksciences.com>
Cc: "Bryan A LRB Hinterberger"
<Bryan.A.Hinterberger@usace.army.mil>, "Erickson, Kris"
<KErickson@ene.com>
Date: 02/18/2011 01:52 PM
Subject: RE: Eighteenmile Creek TrophicTrace Modeling Project

Karl, I would be interested in hearing from you and/or Katherine about the following: (1) how much effort is required to develop a sediment remedial goal for Eighteenmile Creek using the TT model and (2) what additional targeted sampling may be useful to refine the model. Can you provide rough cost estimates for these tasks? I would like to be able to convey in the Eighteenmile Creek AOC Strategic Plan about how much additional funding is needed from GLNPO and/or other sources to move the delisting process forward over the next year or two. Thanks in advance for your reply.

Carl Mach, Ph.D.
Ecology and Environment, Inc.
368 Pleasant View Drive
Lancaster, NY 14086
716-684-8060
cmach@ene.com

Table 1. Summary of Tasks and Cost Estimates for Additional TrophicTrace Modeling Work at Eighteenmile Creek from Karl Gustavson.

TASKS	1) Refine model and impacts to receptors by investigating exposure pathways. a. Stomach contents of largemouth bass and bullheads during spring and summer timeframe (\$51,250) b. Sampling of crayfish contaminant levels (\$48,500) c. Water sampling to define dissolved fraction of PCBs (\$79,750) d. In fall 2012, duplicate sediment and fish tissue sampling used in model development (\$102,500) 2) Use of model to develop remedial goals. a. Evaluate PCB congener vs Aroclor relationship in sediment and biota to define appropriate metric for risk-based remedial goals (\$45,000) b. Use Feb 2011 model to develop risk-based remedial goals (\$63,000) c. Update 2011 model and remedial goals based on Task 1 data (\$63,000) d. High resolution cores, chemistry, and geochronology markers (to indicate expected time to reach remedial goals) (\$59,250)
--------------	--

Appendix B.6

Mink Survey and Exposure Assessment within the Eighteenmile Creek Area of Concern (AOC) and Watershed: Project Description and Cost Estimate

The mink survey and exposure assessment are discussed below in Sections 1 and 2, respectively. The work described in this appendix is a scaled-back version of the work described in the Western Lake Ontario (WLO) factsheet entitled *Survey for Levels of Bioaccumulative Chemicals in Wildlife Prey and Tissues and Wildlife Deformities within Western Lake Ontario and its Tributaries*. If that project is implemented, then the work described in this appendix is unnecessary.

1. Mink Survey

This investigation will take place within the Eighteenmile Creek AOC and watershed and include the following tasks:

- Desktop analysis to identify potential mink habitats within the AOC and watershed and site visits;
- Collection and analysis of video-recorded and field data; and
- Video and field data reporting of pertinent study findings.

1.1 Project Overview and Background

This project is designed to provide data regarding the relative abundance and population structure of mink in the Eighteenmile Creek AOC. This will be done using weather-proof video surveillance equipment as was done by Wellman and Haynes (2006) in and near the Rochester Embayment AOC. This study will be a scaled-down version of the Wellman and Haynes (2006) study, with the objective of determining if mink are present and reproducing in the Eighteenmile Creek AOC. The video surveillance data for Eighteenmile Creek will be compared with similar data collected by Wellman and Haynes (2007) at Iroquois National Wildlife Refuge and Bergen Swamp to qualitatively evaluate whether mink relative abundance at Eighteenmile Creek differs from these reference areas. The data from this study will be useful in determining if BUI #5—Bird or Animal Deformities or Reproductive Problems—is impaired at the Eighteenmile Creek AOC. The mink has been selected as the focus of this investigation for the reasons described below.

American Mink

The American mink (*Neovison vison*) is a medium sized mammal belonging to the *Mustelid* family, which also includes ferrets, weasels, fishers, otters, wolverine and badgers. This species exhibits an elongate body and a long tail with relatively short legs and ears. Mink occur throughout New York and in most areas of the United States (United States Environmental Protection Agency [USEPA] 1993). Mink prefer forested areas within permanent or semipermanent wetlands, riparian areas, lakes and marshes, and generally occupy dens in hollow logs, or those created by other aquatic to semi-aquatic species, such as beavers and muskrats. Within New York, habitat studies conducted by trappers have found mink most often in streams followed by beaver ponds, lakes, and marshes (New York State Department of Environmental Conservation [NYSDEC] 2011).

This species is carnivorous and lives on a diet consisting of animals that occupy riparian to aquatic ecosystems including small to medium-sized mammals, birds, fish, and crayfish (USEPA 1993). Mink are usually solitary animals, however, males and females will begin associating during the late winter, upon initiation of the breeding season (NYSDEC 2011). Between April and June, female mink give birth to between one to eight kits (with an average of four kits; NYSDEC 2011).

Mink have been described as a sentinel species, meaning that their presence/absence may indicate environmental conditions. Environmental contaminants, such as mercury, DDE, DDT, dieldrin, and PCBs have been reported as having negative impacts to mink by causing weight loss and reproductive

issues to captive individuals (NYSDEC 2011). It is for this reason that mink have been chosen as the harbingers of ecosystem health in the Great Lakes AOCs.

1.2 Project Specifics

Proposed Scope of Work for Mink Study in Eighteenmile Creek AOC

The employment of weather-proof video surveillance equipment should help reveal trends in mink relative abundance and population structure within the Eighteenmile Creek AOC and watershed. This information will be used for determining if the BUI for bird or animal deformities or reproductive problems should be designated as impaired or be considered for delisting. The overall scope can be implemented within one field season (February through November) and should be implemented within the next three years (2011, 2012, or 2013).

Task 1 – Desktop Analysis and Site Visit

This proposed project will begin with a brief desktop analysis to locate suitable video surveillance station locations. This task will include use of topographic map and aerial imagery within the Eighteenmile Creek AOC and watershed to locate potential video surveillance stations based on suitable mink habitat (e.g. forested swamps, riparian areas, etc.). Access to public and private land deemed suitable habitat will be coordinated with state and local agencies as well as land owners and any applicable wildlife study permits will be attained from NYSDEC.

A site visit will occur during late winter to field validate potential video station locations. Meetings with local fur trappers, if any—who are aware of local areas harboring mink populations—will also take place during the site visit to aid in video station site selection. Finally, the site visit will also include a time-meander field search. During this time, mink track concentrations that are found will be documented and incorporated as potential video surveillance stations. The two most suitable mink video surveillance sites along Eighteenmile Creek will be selected based on results from the desktop analysis, input from local trappers, and time-meander searches, with the goal of selecting one site above Burt Dam (upper Burt Dam site) and one below the dam (lower Burt Dam site).

Task 2 – Data Collection and Analysis

Eight video surveillance stations (four each at the upper and lower Burt Dam sites) will be set up in mid-May and will continue monitoring until mid-November, which is the post-breeding period, a time when mink families would likely travel together. All video surveillance stations will be visited once per week, during which time batteries and video cassettes will be exchanged, camera lenses will be cleaned and systems checks will be performed. All pertinent information concerning field data will be recorded onto standardized data sheets.

The video data will be analyzed for mink presence; however, other recorded wildlife species will also be noted. Special attention will be paid to the number of recorded mink at any given time, as multiple individuals recorded during the post-breeding season are indicative of family units and mink reproduction. All pertinent information concerning video data will be recorded onto standardized data sheets.

Task 3 – Reporting

A report will be generated outlining key findings and recommendations based on the scope of work within approximately 3 month of completing field work. Also, a presentation of the study findings will be made to the Niagara County Soil and Water Conservation District (NCSWCD), U.S. Army Corps of Engineers (USACE), NYSDEC, and other interested parties.

1.3 Project Goals

To determine if mink are present and reproducing along Eighteenmile Creek above and below Burt Dam.

1.4 Project Outcomes

This project will lead to an understanding of mink presence/absence and population structure in the Eighteenmile Creek AOC and watershed. It will also increase current knowledge of the status of breeding mink within the region. The findings of this study will either support the delisting of BUI #5 at the Eighteenmile Creek AOC due to records of mink breeding (as occurred within the Rochester AOC) or, conversely, provide evidence suggesting that BUI #5 is impaired within the Eighteenmile Creek system.

1.5 Cost

E & E estimates that this task can be accomplished for roughly \$69,400 total (see Table 1 for details). The costs provided are estimates only; final costs could be higher or lower than provided here.

2. Mink Exposure Assessment

E & E (2009) indicated that the status of BUI #3 (Degraded Fish and Wildlife Populations) and BUI #5 (Bird or Animal Deformities or Reproductive Problems) likely are impaired in the Eighteenmile Creek AOC. For both BUIs, our conclusion regarding impairment was based on risk calculations for the mink done with site-specific data on PCB levels in brown bullheads. However, as noted in E & E (2009), mink consume other fish besides bullheads and other prey besides fish, including voles, muskrats, and amphibians, which would be expected to contain different levels of PCBs compared with bullheads. Therefore, assuming that mink consume only bullheads may either under- or overestimate their exposure and risk at the AOC. To better understand PCB exposure for the mink, we recommend that the mink exposure assessment presented in E & E (2009) be updated based on the new data for PCBs in forage and game fish collected from Eighteenmile Creek in 2010 to support the TrophicTrace model (Gustavson et al. 2010). We also recommend examining the importance of fish versus other prey as a source of dietary PCB exposure for mink based on a review of recent relevant literature. Because a large portion of the mink diet may consist of prey other than fish, this exercise will provide information regarding the potential uncertainty in the exposure assessment that may result from the assumption of an all fish diet.

E & E estimates that this task can be accomplished for roughly \$14,000 total (see Table 1 for details).

Table 1: Estimated Cost by Task for Mink Survey and Exposure Assessment

Task No. and Description	Schedule	Cost (\$)
Mink Survey		
1. Desktop analysis and site visit	February	\$ 10,600
2. Data collection and analysis	June – October	\$ 46,000
3. Reporting	November – December	\$ 12,800
SUBTOTAL		\$ 69,400
Mink Exposure Assessment		
1. Update exposure assessment with 2010 forage and game fish data		\$7,000
2. Examine importance of fish versus other prey to PCB exposure		\$7,000
SUBTOTAL		\$ 14,000
TOTAL		\$ 83,400

3. References

Ecology and Environment, Inc. (E & E). 2009. *Beneficial Use Impairment Investigation Report for Eighteenmile Creek, Niagara County, New York*. Prepared for the Niagara County Soil and Water Conservation District, Lockport, NY by E & E, Lancaster, NY.

Gustavson, K., S. Hendrix, and K. von Stackelberg. 2010. *Eighteenmile Creek Area of Concern: Data Gaps for Food Web Modeling*. Prepared for the United States Army Corps of Engineers (USACE) Buffalo District, Buffalo, NY and Niagara County Soil and Water Conservation

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New York State Department of Environmental Conservation (NYSDEC). 2011. *Mink Factsheet*. Accessed at <http://www.dec.ny.gov/animals/9356.html> in January 2011.

United States Environmental Protection Agency (EPA). 1993. *Wildlife Exposure Factors Handbook*. U.S. EPA Office of Research and Development, Washington, D.C., EPA/600/r-93/187a and EPA/600/r-93/187b.

Wellman, S. T., and J. M. Haynes. 2006. Are there differences in the relative abundance of lakeshore and inland mink populations in and out of the Rochester Embayment of Lake Ontario Area of Concern? Monitoring populations using video traps. In Hayes, J. M., Wellman, S. T., and J. J. Pagano. 2007. *RAP Process in the Rochester Embayment of Lake Ontario: Population Monitoring, Trophic Relationships, and Levels of Bioaccumulative Chemicals of Concern in Mink, a Sentinel Species*. A final report to the New York Great Lakes Protection Fund, New York State Department of Environmental Conservation (NYSDEC), 270 Michigan Avenue, Buffalo, NY.

Appendix B.7

Cost Estimate for Stocking Eighteenmile Creek with Salmonid Species

The fishery at Eighteenmile Creek in Newfane, New York is renowned for its salmon fishing, with 15,000 angler visits annually. Presently, the stocking of this fishery falls under the jurisdiction of the New York State Department of Environmental Conservation (NYSDEC). There is a chance, however, that funding limitations due to state budget constraints may halt the state-run stocking effort. If this scenario comes to pass, then the future fish stocking will have to be undertaken by private sector fish hatcheries with funding from other sources.

Ecology and Environment, Inc. (E & E) contacted several private fish hatcheries in New York State to see if estimates could be provided for rearing and stocking the salmonid species typically stocked in Eighteenmile Creek. Fish species typically stocked at Eighteenmile Creek include: 3 to 4-inch Chinook salmon, 4-inch Coho salmon, and 4.5- and 6-inch steelhead (<http://www.dec.ny.gov/outdoor/23245.html>). Most of the hatcheries contacted did not provide estimates, as they usually deal with stocking private lakes and ponds, while NYSDEC stocks public streams and rivers with salmonid species. One hatchery owner in Bliss, New York was able to provide an estimate for this scenario; however, it is important to note that this is a very rough per inch estimate based on the cost to rear, deliver, and stock fish (50 cents per inch for all species). See Table 1 for a breakdown of the proposed cost of fish stocking at Eighteenmile Creek using private hatcheries as the source of fish. Additional details are provided in Table 2.

Table 1 Estimated Cost to Rear, Deliver and Stock Three Salmonid Species in Eighteenmile Creek, Newfane, New York

Length and Type of Fish ^a	Cost per Individual (in US Dollars)	Number of Fish per Group ^a	Cost per Fish Group (in US Dollars)
3" Chinook Salmon	1.50	80,370	120,555
4" Chinook Salmon	2.00	50,000	100,000
4" Coho Salmon	2.00	30,000	60,000
4.5" Steelhead	2.25	3,500	7,875
6" Steelhead	3.00	3,500	10,500
Total Estimated Cost			298,930

Notes:

a = Fish size and numbers stocked in 2009 in Eighteenmile Creek at Newfane, New York from <http://www.dec.ny.gov/outdoor/23245.html>.

Table 2 Estimated Costs for Fish Stocking at Eighteenmile Creek, Newfane, New York

Cost per inch (\$)	Total Effort 0.5	Fish Hatchery Effort Only 0.25
Type and length of fish	cost per fish	cost per fish
cost for 3" chinook salmon	1.5	0.75
cost for 4" chinook salmon	2	1
cost for 4" coho salmon	2	1
cost for 4.5" steelhead	2.25	1.125
cost for 6" steelhead	3	1.5
Type and length of fish	number of fish	number of fish
3" chinook salmon	80,370	80,370
4" chinook salmon	50,000	50,000
4" coho salmon	30,000	30,000
4.5" steelhead	3,500	3,500
6" steelhead	3,500	3,500

Table 2 Estimates costs for fish stocking at Eighteenmile Creek, Newfane, New York

Cost per inch (\$)		Total Effort 0.5	Fish Hatchery Effort Only 0.25
Type and length of fish		Cost per fish type	Cost per fish type
3" chinook salmon		120,555	60,278
4" chinook salmon		100,000	50,000
4" coho salmon		60,000	30,000
4.5" steelhead		7,875	3,938
6" steelhead		10,500	5,250
TOTAL COST (this includes supping and rearing fees)		\$298,930	\$149,465

Notes:

Unit cost based on a call with Todd Garrison of Garrison's Smith Creek Fish Farm, Bliss, NY.

Mr. Garrison provided a rough estimate of the effort cost based on the length of fish to be raised.

Appendix B.8
Rough Cost Estimate for Baseline Sampling and Long-Term, Post-Remedial Monitoring of the Benthic Community in the Eighteenmile Creek System

The cost of baseline sampling and one round of post-remedial sampling are estimated to be \$41,570 and \$33,320, respectively. The estimate for post-remedial sampling is less than the estimate for baseline sampling because the Sampling and Analysis Plan (SAP) prepared for baseline sampling is assumed to be useful for post-remedial sampling with little or no modification. The cost estimate for monitoring the benthic community includes four tasks: (1) SAP preparation; (2) field sampling; (3) laboratory analysis; and (4) reporting. It is expected that SAP development will be a desktop effort requiring approximately 1.5 weeks to complete. Field sampling is expected to be a two day effort by a team of two biologists. The sampling will entail collecting sediment and benthic macroinvertebrate samples at three sites in the AOC. Sediment samples will be analyzed for PCBs, selected metals, toxicity, and ancillary parameters (total organic carbon, grain size, etc.). Benthic macroinvertebrate samples will be evaluated for taxonomic diversity and abundance. We expect that the sampling will take two days to implement. Finally, a report will be drafted and finalized summarizing the findings.

APPENDIX C

Timeline of Significant Investigations and Events

NYSDEC assumes role as AOC RAP coordinator. The creek was designated as an AOC because of water quality and bottom sediment problems associated with past industrial and municipal discharge practices, disposal of waste, and use of pesticides. Chemicals found in sediment and/or fish included PCBs, mercury, dioxins/furans, dieldrin, mirex, DDT, lead, and copper (http://www.epa.gov/greatlakes/aoc/eightheemile.html).	The benthic community was surveyed at three locations. Significant impairment was found at the Cornitt location (near Jacques Road) compared with a control location on the East Branch. Inorganic (toxic) factors were judged to be the cause. High levels of PCBs, metals, and dioxins were found in sediments and invertebrates from this location. The benthic community at the Newfane location was found to be moderately impacted.	BUIs identified as being impaired or likely impaired include: Restrictions on Fish and Wildlife Consumption; Bird or Animal Deformities or Reproductive Problems; Degradation of Benthos; and Restrictions on Dredging. Sources of the problem are listed as contaminated creek sediments, inflow from the NYS Barge Canal, and an unidentified PCB source in Lockport (between Olcott Street and N. Transit Road).	Twelve stations in the creek and Barge Canal were sampled in 1998. High levels of cadmium, chromium, copper, lead, nickel, and zinc were found in sediment core samples from behind Burt and Newfane Dams. High sediment PCB levels were found behind Burt Dam and in sediment in the diversion channel near the Former Flintkote Plant site.	Objectives were to improve public access to the heavily used portion of the creek between Fisherman's Park and Burt Dam while concurrently restoring riparian and aquatic habitats. Three significant reports were developed: Baseline Habitat and Threatened & Endangered Species Coordination; (2) Planting Plan for the Eighteenmile Creek Restoration Work Area; and (3) Restoration Monitoring Plan.	The study suggests greater than expected bioavailability of PCBs in Eighteenmile Creek AOC sediments.	This site is Operable Unit (OU) 2 within the Eighteenmile Creek Corridor Site. Estimated cost of preferred remedial alternative is \$5.6 million.	VOCs, SVOCs (including PAHs), metals, pesticides, and PCBs are found in soil at levels in excess of NYSDEC cleanup standards. NYSDEC concludes that the site is a contaminant contributor to Eighteenmile Creek.	The report presents sediment results for PCBs and metals in the creek between Hawwood Street and Stone Road (8,000 feet); reviews all existing sampling data to identify potential PCB sources; and uses GIS to depict spatial relationships. Sediment levels of PCBs and metals in excess of NYSDEC standards were found throughout the creek segment that was investigated.	Objective is to develop an understanding of in-stream sediment contamination between Lockport, New York and Burt Dam. Phase 1 (Reconnaissance) is done in late 2008. Phase 2 (sediment sampling and sediment volume measurement) occurs in 2009 and 2010. Final report is expected in 2011.	This suggests impairment for two BUIs: Degradation of Fish and Wildlife Populations and Bird or Animal Deformities or Reproductive Problems. The principal cause of both impairments is PCBs in fish.	Estimated cost of preferred remedial alternatives for OUs 1 (creek and millrace sediments), 3 (Former United Paperboard Property), 4 (Upson Park), 5 (White Transportation Property), and 6 (Water Street Residential Properties) is \$16.2 million.	The plan recommends and describes actions needed to eliminate BUIs and provides cost estimates for recommended actions.						
Eighteenmile Creek below Burt Dam is designated as a Great Lakes AOC.	Eighteenmile Creek Biological Stream Assessment (NYSDEC 1990) is completed.	Eighteenmile Creek RAP (NYSDEC 1997) is released.	Eighteenmile Creek/Olcott Harbor Sediment Study (NYSDEC 1998) is completed.	Eighteenmile Creek Sediment Study Final Report (NYSDEC 2001) is released.	Eighteenmile Creek Restoration Project (E & E 2003a,b; 2005) is implemented.	Bioaccumulation Investigation (USACE 2004a,b) is released.	RAP coordination role for Eighteenmile Creek AOC is assumed by NCSWCD.	Former Flintkote Plant Site ROD (NYSDEC 2006a) is released.	Upper Mountain Road SI Report (NYSDEC 2007) is released.	Eighteenmile Creek PCB Source Trackdown Project Final Report (E & E 2007b) is released.	Eighteenmile Creek GLLA Sediment Investigation (Ross et al. 2011) is initiated.	Eighteenmile Creek BUI Investigation (E & E 2009a) is completed.	Eighteenmile Creek Corridor Site RAP (NYSDEC 2010) is released.	Strategic Plan for BUI Delisting for Eighteenmile Creek AOC is prepared.				
1985	1990	1997	1998	2001	2003-2005	2004	2005	2006	2007		2008	2009	2010	2011				
Key: AOC Area of Concern BUI Beneficial Use Impairment E & E Ecology and Environment, Inc. GIS Geographic information system GLLA Great Lakes Legacy Act NCSWCD Niagara County Soil and Water Conservation District NYS New York State NYSDEC New York State Department of Environmental Conservation OU Operable Unit PAHs Polycyclic aromatic hydrocarbons PCBs Polychlorinated biphenyls RAP Remedial Action Plan RI Remedial Investigation SI Site Investigation SVOC Semivolatile organic compound USACE United States Army Corps of Engineers VOC Volatile organic compound Early Assessments and Investigations Recent Comprehensive Investigations and Remedial Planning					The plan was prepared to initiate the process of creating a Comprehensive Watershed Management Plan (CWMF) specific to the Eighteenmile Creek Watershed. The plan also summarizes existing watershed information for Eighteenmile Creek to support the planning process and presents useful guidelines for CWMF development. The Soil Water Assessment Tool (SWAT) was implemented for the Eighteenmile Creek watershed to determine annual sediment yields and critical source areas of erosion in the watershed. Considerable spatial variation in sediment generation within the watershed was found (range of 0.2 to 5.5 tons per hectare per year). A group of agricultural subbasins on the southwestern end of the watershed were found to generate the highest sediment yields and it was recommended that they be targeted for implementation of best management practices. The RI documents: (1) elevated levels of PCBs and metals (arsenic, chromium, copper, lead, and zinc) in sediment in the creek and millrace adjacent to the Former Flintkote Plant Site; (2) contaminated sediment in the NYS Barge Canal immediately upstream from the creek; and (3) contaminated fill at Upson Park, the White Transportation property, the former United Paperboard Company property, and the Former Flintkote Plant site. NYSDEC concluded that the levels of PCBs and metals detected at these areas have the potential to adversely impact Eighteenmile Creek. The report describes existing features, resources, communities, and environmental issues in the Eighteenmile Creek watershed. Goals of the report are to increase awareness and interest in the watershed and the values it provides, promote stewardship, and develop a long-term vision for the basin. Delisting criteria are provided for five BUIs: Restrictions on Fish and Wildlife Consumption; Degradation of Fish and Wildlife Populations; Bird or Animal Deformities or Reproductive Problems; Degradation of Benthos; and Dredging Activities. All five BUIs are linked to high levels of PCBs and metals in sediment throughout the length of the creek. The new data are used to support development of the RAP (NYSDEC 2010) for the site. The work involves an extensive literature review of existing water, sediment, and biota data for Eighteenmile Creek; collection of additional data for PCB congeners in forage and game fish; and collection of additional sediment PCB congener data.													
Eighteenmile Creek Comprehensive Watershed Management Plan Concept Document (E & E 2004) is released.					Sediment Modeling for the Eighteenmile Creek Watershed (Inandar 2005) is implemented. Eighteenmile Creek Corridor Site RI Report (NYSDEC 2006b) is completed. Eighteenmile Creek State of the Basin Report (E & E 2007a) is released. BUI Delisting Criteria for the Eighteenmile Creek AOC (NCSWCD 2008) are finalized. Eighteenmile Creek Corridor Site Supplemental RI (E & E 2009b) is completed. Trophic/Trace food web modeling (Gustavson et al. 2010).													

Figure C-1 Timeline of Significant Investigations and Events for the Eighteenmile Creek AOC from 1985 to 2011

APPENDIX D

Results of Beneficial Use Impairment Investigation for Eighteenmile Creek

**Beneficial Use Impairment
Investigation for
Eighteenmile Creek
Niagara County, New York**

April 2009

Prepared for:
NIAGARA COUNTY SOIL AND WATER CONSERVATION DISTRICT
4487 Lake Avenue
Lockport, NY 14094

Prepared by:
ECOLOGY AND ENVIRONMENT, INC.
368 Pleasant View Drive
Lancaster, New York 14086

3

Results

The results of this investigation are presented in this section in four primary sections: (1) Fish Community Surveys, (2) Wildlife Surveys, (3) Bullhead Chemical Residue Data and Risk Evaluation, and (4) Bullhead Deformities and Liver Pathology.

3.1 Results

Eighteenmile Creek and the reference creek (Oak Orchard Creek) had similar water quality parameters (see Table 3-1). Water temperatures, dissolved oxygen, and conductivity were slightly higher in Oak Orchard Creek in May, but all parameters were within concentrations suitable for fish survival and propagation. While flows are not gauged in either stream, their flows appeared similar during sampling events in each stream. During the May 2007 sampling events, no rainfall had occurred in either watershed for several days prior to and during the sampling events. During the August period, the region experienced drought conditions and both streams were in low flow conditions, influenced by controlled flow releases from the New York State Barge Canal.

Table 3-1 Water Quality Parameters¹ for Eighteenmile Creek (EMC) and Oak Orchard Creek (OOC) during the Fish Community Sampling Collection Periods in 2007.

Sampling Period	Creek	Water Temp (°F)	Air Temp (°F)	DO (mg/L)	pH	Conductivity (µS/cm)
May	EMC	58	55	8.49	9.19	585
May	OOC	65	68	11.05	8.69	698
August	EMC	72	79	7.03	ND	ND
August	OOC	76	82	8.41	ND	ND

Note:

¹ Measured with field meter calibrated as per the manufacturers instructions.

Key:

DO = dissolved oxygen.

ND = No data due to equipment malfunction.

Species Composition and Relative Abundance

Both creeks had similar species composition, with totals of 25 and 24 species being caught in Eighteenmile Creek and Oak Orchard Creek, respectively (see Table 3-2). Twenty-nine species were captured between both creeks, 20 of which were

sampled from both creeks. Species unique to Eighteenmile Creek included golden shiner, green sunfish, hybrid bluegill, silver redhorse, and steelhead. The steelhead, an adult, was captured in shallow water (approximately 1 foot depth) while backpack electro-fishing a riffle in Reach 3. Species unique to Oak Orchard Creek included banded killifish, brook silverside, gizzard shad, and tessellated darter. Several small coho salmon were captured in both creeks, and discussions with local fishermen and the DEC indicated that salmon had been stocked in the creeks several days prior to the sampling trips and that the captures were likely hatchery fingerlings (see Appendix B for fish community survey data-sheets).

Table 3-2 Species Captured in Eighteenmile Creek and Oak Orchard Creek

Eighteenmile Creek	Oak Orchard Creek
Alewife*	Alewife*
Black crappie*	Banded killifish
Bluegill*	Black crappie*
Bluntnose minnow*	Bluegill*
Bowfin*	Bluntnose minnow*
Brown bullhead*	Bowfin*
Coho salmon*	Brook silverside
Common carp*	Brown bullhead*
Common shiner*	Coho salmon*
Emerald shiner*	Common carp*
Golden redhorse*	Common shiner*
Golden shiner	Emerald shiner*
Green sunfish	Gizzard shad
Hybrid Bluegill	Golden redhorse*
Largemouth bass*	Largemouth bass*
Logperch*	Logperch*
Longnose gar*	Longnose gar*
Pumpkinseed*	Pumpkinseed*
Rock bass*	Rock bass*
Shortnose redhorse*	Shorthead redhorse*
Silver redhorse	Slimy sculpin*
Slimy sculpin*	Smallmouth bass*
Smallmouth bass*	Tessellated darter
Steelhead	Yellow perch*
Yellow perch*	

Note:

* = Indicates species found in both creeks.

The most common species captured in the creeks differed. During the May sampling, the top three species captured in Eighteenmile Creek were emerald shiner (115), alewife (110), and rock bass (28). In Oak Orchard Creek, the top three species captured in May were bluegill (45), rock bass (28), and golden redhorse (27). During the May sampling events, many cyprinids and clupeids (e.g., emer-

3. Results

ald shiners and alewives) were concentrated in the sampling reaches of Eighteen-mile Creek. Many alewives were visible on the surface engaged in mating frenzies. While alewives were observed in Oak Orchard Creek engaged in the same behavior, large concentrations of fish were not observed within the sampling reaches.

During the August sampling, the top three species captured in Eighteenmile Creek were bluegill (61), largemouth bass (25), and slimy sculpin (23). In Oak Orchard Creek, the top three species captured were rock bass (21), bluegill (17), and brown bullhead and largemouth bass (13 each) (see Table 3-3). There are two likely reasons why fewer fish were captured during the Oak Orchard Creek sampling event in August. Foremost, only one netter was used; the remaining crew was assisting the brown bullhead processing team as part of the fish analysis. The warm weather and numbers of bullhead captured necessitated as many staff as possible processing fish.

Table 3-3 Totals for Fish Species Captured during Electro-fishing Sampling

Species	May		August	
	Eighteenmile Creek	Oak Orchard Creek	Eighteenmile Creek	Oak Orchard Creek
Alewife	110	1		
Banded killifish				1
Black crappie	3	2	1	
Bluegill	24	45	61	17
Bluntnose minnow	1	11	7	1
Bowfin	3	1	5	3
Brook silverside		1		
Brown bullhead	5	6	6	13
Coho salmon	1	1		
Common carp	1			2
Common shiner	1	19		3
Emerald shiner	115	15		
Gizzard shad		1		
Golden redhorse	3	27		
Golden shiner	2		3	
Green sunfish	3		10	
Hybrid Bluegill	1			
Largemouth bass	5	17	25	13
Logperch	2	1	5	4
Longnose gar		6	1	
Pumpkinseed	25	20	21	10
Rock bass	28	28	30	21
Shortnose redhorse		4	1	
Silver redhorse	1			
Slimy sculpin	15	2	23	12
Smallmouth bass	6	10	5	

Table 3-3 Totals for Fish Species Captured during Electro-fishing Sampling

Species	May		August	
	Eighteenmile Creek	Oak Orchard Creek	Eighteenmile Creek	Oak Orchard Creek
Steelhead	1			
Tessellated darter				1
Yellow perch	13	4	1	2

Catch Per Unit Effort

Eighteenmile Creek had a higher catch per unit effort (CPUE) for both sampling periods (see Table 3-4). These higher catch rates were observed in each of the three reaches during the May sampling period. The average CPUEs for Eighteenmile Creek (6.8 fish/minute) and Oak Orchard Creek (4.8 fish/minute) during the May sampling events were higher than those observed in August for both creeks (3.5 fish/minute and 1.3 fish/minute, respectively). Similarities in the CPUE data indicated that the lowermost reaches (i.e., closest to Lake Ontario) contained the highest abundance of fish during the spring sampling period. This pattern was observed in both creeks. Eighteenmile Creek had a slightly higher abundance of fish, primarily based on the high numbers of cyprinids and clupeids captured during the sampling events. For May, the data suggest that Oak Orchard Creek had a higher abundance of top predator fish (see Table 3-3). During May, Oak Orchard had 17 largemouth bass, compared to 5 largemouth bass in Eighteenmile Creek. In addition, six longnose gar were captured in Oak Orchard Creek, whereas none were captured in Eighteenmile Creek.

Table 3-4 Catch per Unit Effort (CPUE) Data for Community Fish Sampling in Eighteenmile Creek and Oak Orchard Creek

Area	E Time (sec)	Total No. of Fish	CPUE (fish/min)
May			
Eighteenmile Creek			
Reach 1	900	144	9.6
Reach 2	900	109	7.3
Reach 3	1,920	116	3.6
Average	1,240	123	6.8
Oak Orchard Creek			
Reach 1	900	106	7.1
Reach 2	900	89	5.9
Reach 3	1,269	27	1.3
Average	1,023	74	4.8
August			
Eighteenmile Creek			
Reach 1	1,176	58	3.0
Reach 2	1,045	108	6.2
Reach 3	1,760	39	1.3
Average	1,327	68	3.5

Table 3-4 Catch per Unit Effort (CPUE) Data for Community Fish Sampling in Eighteenmile Creek and Oak Orchard Creek

Area	E Time (sec)	Total No. of Fish	CPUE (fish/min)
Oak Orchard Creek			
Reach 1	1,431	32	1.3
Reach 2	1,517	27	1.1
Reach 3	1,680	44	1.6
Average	1,542	34	1.3

Key:

CPUE = total number of fish captured per electrofishing minute.

E Time = Electrofishing time.

During the summer sampling period, opposite patterns were observed. Eighteen-mile Creek had a higher abundance of dominant predators, including largemouth bass (almost twice as many), smallmouth bass (five compared to zero), bluegill (more than three times as many), bowfin, rock bass, and pumpkinseed (see Table 3-3). This pattern is likely a result of the focus on targeted bullhead sampling for the pathology and analytical work during the summer sampling period. The fish community sampling effort on Oak Orchard Creek was conducted during the day-time and with only one netter, whereas the sampling effort on Eighteenmile Creek involved more than one netter and was conducted at night.

Fish Condition

Fish condition also was computed to determine community-level differences in the length and weight relationships. Typically, smaller ratios indicate a healthy, prolific fish community. Due to small sample sizes, only 3 of the top five species caught during all sampling events are presented in this report. Tables 3-5 and 3-6 show the average weights, lengths, and associated condition factors for bluegill, pumpkinseed, and rock bass for Eighteenmile Creek and Oak Orchard Creek, respectively. For these three species in Eighteenmile Creek, fish condition was fairly similar during the May and August sampling events. For bluegill and pumpkinseed, the average condition factor was slightly higher during the May sampling event, whereas rock bass had a higher condition factor in August. In Oak Orchard Creek, condition factors for these three species were lower in August. Bluegill were most similar in Oak Orchard Creek, and rock bass had the largest variation between the two sampling events.

Condition factors closest to 1.0 indicate a healthy fish population. All of the condition factors were higher than one, which may suggest various influences in these waterbodies on the health of the fish community. Factors that influence fish condition include available food sources, environmental changes, and disease.

However, the scope of the fish sampling effort was limited to three sampling events in each creek per season. This small sample size may have influenced the results. Based on the sensitivity of condition factor to age and length of fish, the brown bullhead collected for tumor analysis were used to examine the age-specific condition of fish between the two creeks.

Table 3-5 Length, Weight, and Condition Factor Comparisons of Spring and Summer Sampling Results for Eighteenmile Creek1

May 2007				August 2007			
Species	Average Length (mm)	Average Weight (g)	Average Fulton Condition Factor	Species	Average Length (mm)	Average Weight (g)	Average Fulton Condition Factor
Bluegill	129.50	49.10	1.90	Bluegill	108.31	33.56	1.70
Pumpkinseed	117.28	38.99	2.19	Pumpkinseed	110.33	31.95	2.08
Rock bass	128.21	66.05	2.04	Rock bass	90.64	40.23	2.52

Table 3-6 Length, Weight, and Condition Factor Comparisons of Spring and Summer Sampling Results at Oak Orchard Creek¹

May 2007				August 2007			
Species	Average Length (mm)	Average Weight (g)	Average Fulton Condition Factor	Species	Average Length (mm)	Average Weight (g)	Average Fulton Condition Factor
Bluegill	120.9	42.1	1.99	Bluegill	97.47	22.86	1.85
Pumpkinseed	146.6	73.7	2.08	Pumpkinseed	118.90	35.40	1.87
Rock bass	140.5	92.2	2.68	Rock bass	106.95	30.97	1.86

Note:

¹ Blanks indicate species was not captured

To classify the various size classes of bullheads, length-frequency histograms were developed to determine size categories of fish. Figures 3-1 and 3-2 present the length frequency distribution for bullhead captured in Eighteenmile Creek and Oak Orchard Creek, respectively. Based on these size frequency distributions, the following size categories were established: 250-280 mm, 281-320 mm, 321-350 mm, 351-360 mm, and 361-390 mm. Table 3-7 summarizes the average lengths, weights, and condition factors for bullhead captured in the two creeks. Condition factors in both creeks were similar, ranging from 1.2 to 1.4. Overall, there was no consistent difference in the average weight or condition factor for the various size classes between creeks that would suggest that fish in Eighteenmile Creek were less healthy or fit than those in Oak Orchard Creek. Indeed, for the size class with the greater number of individuals (281 to 320 mm), the average weight and condition factor were greater for Eighteenmile Creek (see Table 3-7).

Table 3-7 Brown Bullhead Lengths and Weights for Various Size Categories in Eighteenmile Creek and Oak Orchard Creek

Length Category	Average Length (mm)	Average Weight (g)	Condition Factor	N
Eighteenmile Creek				
250-280	266.5	240	1.26	6
281-320	302	379	1.38	28
321-350	335	518	1.38	10
351-360	355	582	1.29	3
361-390	380	809	1.48	2
Oak Orchard Creek				
250-280	274	278	1.35	8
281-320	299	344	1.28	30
321-350	331	503	1.39	11
351-360	-	-	-	0
361-390	365	682	1.4	1

3.2 Wildlife Surveys

Wildlife surveys were conducted along Eighteenmile Creek within a stream length of approximately 1.3 miles and along Oak Orchard Creek within a stream length of approximately 3.8 miles. The percent cover was calculated for habitat types parallel to those stream lengths to determine their relative availability (see Table 3-8).

Eighteenmile Creek had more cattail marsh, developed (residential), and early successional habitat than Oak Orchard Creek, whereas Oak Orchard Creek had more agricultural land, open water, and there was a large golf course nearby. Both creeks had a similar relative percentage of surrounding forestland and orchard/vineyard habitat.

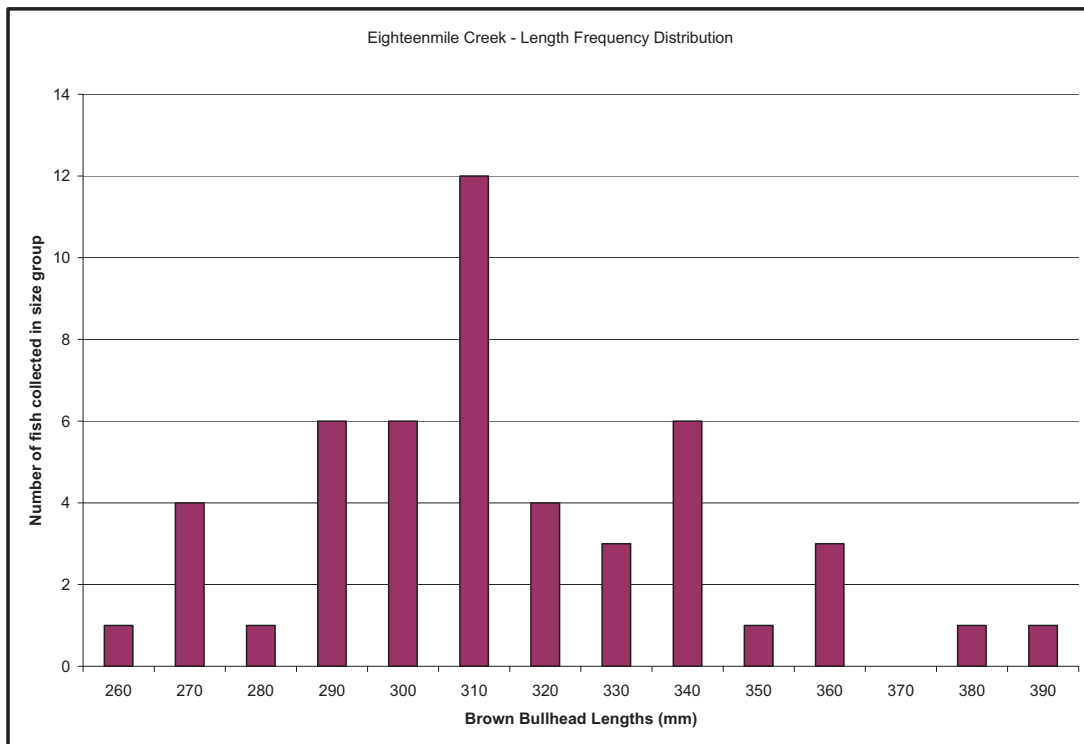


Figure 3-1 Length Frequency Distribution for Brown Bullhead in Eighteenmile Creek, August 2007

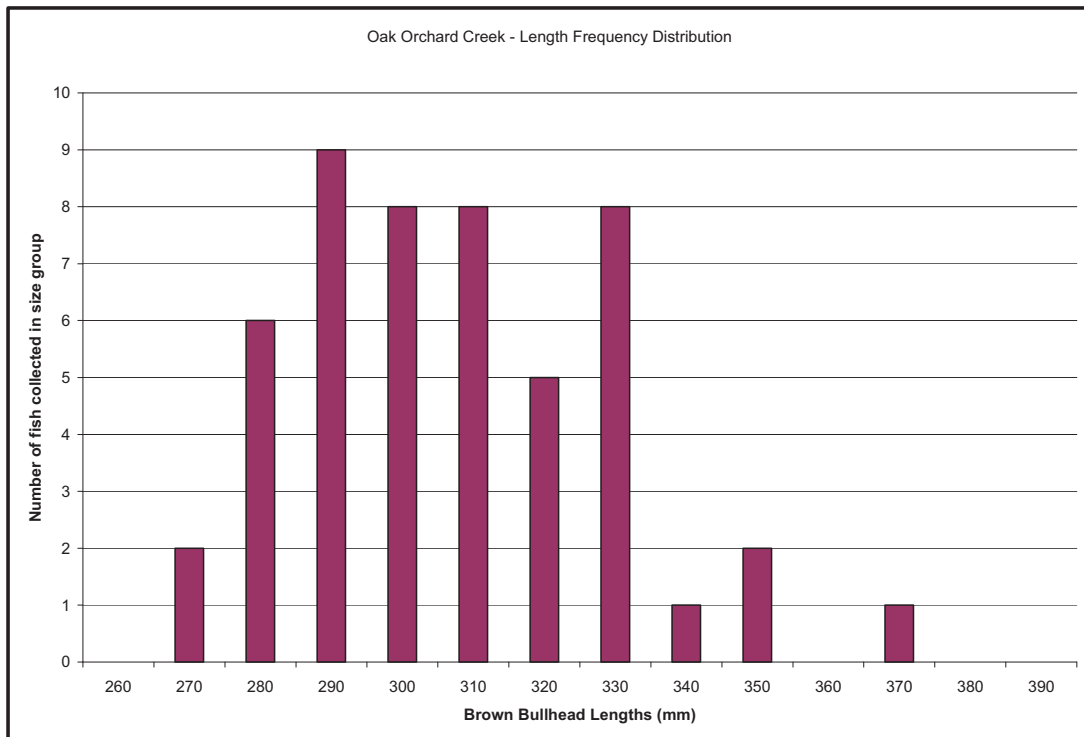


Figure 3-2 Length Frequency Distribution for Brown Bullhead in Oak Orchard Creek, August 2007

Table 3-8 Habitat Types along Eighteenmile Creek and Oak Orchard Creek¹

Habitat	Eighteenmile		Oak Orchard	
	Acres	%	Acres	%
Agricultural	147.70	20.46	464.40	31.71
Cattail Marsh	19.21	2.66	14.58	1.00
Developed	237.84	32.94	235.02	16.05
Forested	169.58	23.49	374.32	25.56
Open Water	34.30	4.75	127.94	8.74
Early Successional	62.22	8.62	6.17	0.42
Orchard/Vineyard	51.14	7.08	144.51	9.87
Golf Course	0.00	0.00	97.58	6.66
Total	721.98	100.00	1464.52	100.00

Note:

¹ Based on analysis of aerial photography.

3.2.1 Birds

Point Count Surveys – Eighteenmile Creek

Point counts were conducted at each of the six point locations along Eighteenmile Creek on May 5, May 19, June 29, July 23, August 19, and September 17, 2007 (see Appendix C for wildlife survey data). In total, 1,309 birds representing 66 species were identified during the six morning bird surveys at Eighteenmile Creek (see Tables 3-9 and C-1). Of the 1,309 birds observed, 431 birds were flyovers. Because the species observed were generally observed throughout the study area, they were believed to be local birds traveling through (versus migrants) and were included in the analyses that follow. The total number of birds observed per survey, defined as the sum of birds from the six point locations on a given survey day, ranged from 134 to 261 birds, with an average of 218 birds. The total number of species identified per survey ranged from 29 to 36, with an average of 32. The most numerous species recorded at Eighteenmile Creek were Red-winged Blackbird (198 birds), Mallard (116 birds), Common Grackle (95 birds), and Canada Goose (92 birds) (see Table C-1). There were no observations of deformed or obviously sick or diseased birds at either of the creeks.

By point location, the total number of birds ranged from eight birds at point B on September 17 to 77 birds at point F on July 23, with an overall average per point location of 36.4 birds at Eighteenmile Creek (see Table 3-9 and Figure 2-3). Total species per survey point location ranged from four species at point B on September 17 to 20 species at point A on June 29, with an overall average of 13.0 species. Point F consistently had higher numbers of birds and species, whereas points B and E usually had lower numbers of birds and species.

Point counts were conducted at each point location along Oak Orchard Creek on May 7, May 18, June 28, July 22, August 18, and September 16, 2007. At Oak Orchard Creek, a total of 1,309 birds representing 71 species were identified during the six morning surveys (see Table 3-9 and Appendix C). Of the 1,309 birds observed, 441 birds were flyovers. Because the species observed were generally

observed throughout the study area, they were believed to be local birds traveling through (versus migrants) and were included in the analyses that follow. The total number of birds ranged from 175 to 290 (see Figure 3-3), with an average of 218, and the total number of species per survey point ranged from 28 to 46 (see Figure 3-4), with an average of 35 species. The most numerous species recorded were Red-winged Blackbird (135 birds), American Goldfinch (114 birds), and Canada Goose (108 birds) (see Table C-1).

By point location at Oak Orchard Creek, the total number of birds ranged from nine at point 4 on August 18 to 79 birds at point 6 on June 28, with an overall average per point location of 36.4 birds (see Table 3-9). The total species per survey point location ranged from six at point 3 on September 16 to 21 at point 1 on June 28, with an overall average of 13.9 species. Point 6 consistently had higher numbers of birds and species, whereas point 2 consistently had lower numbers of birds and species.

The species composition at both creeks were generally consistent with what was anticipated for the habitat and location and was generally consistent with those species typically found in or near Niagara and Orleans counties (E & E 2007). No federally or state-listed threatened or endangered species were identified during the point count surveys; however, two state-listed species of concern (Osprey and Cooper's Hawk) were observed (see Table B-1). Osprey were observed at Eighteenmile Creek on August 19 and at Oak Orchard Creek on September 16. One Cooper's Hawk was observed at Eighteenmile Creek on August 19.

Marsh Monitoring Program Surveys

Marsh Monitoring Program (MMP) surveys were conducted at Eighteenmile Creek on June 14 and 28, 2007. A total of 278 birds representing 28 species were identified during the two surveys at the six Eighteenmile Creek point locations (see Table 3-10). Two hundred and fifty-six of the 278 birds observed were fly-overs; these birds were included in the analyses that follow. The most numerous species recorded were Red-winged Blackbird (85 birds) and Common Grackle (42 birds) (see Table C-2). By point location, the total number of birds on June 14 ranged from 21 to 30, with an average per point location of 26.3, and the total number of birds on June 28 ranged from nine to 29, with an average per point location of 20.0. On June 14, the total species per survey point location ranged from seven to 14, with an average of 11.0, and on June 28 the total species per survey point location ranged from four to nine, with an average per point location of 7.3. There were no observations of deformed or obviously sick or diseased birds at either of the creeks.

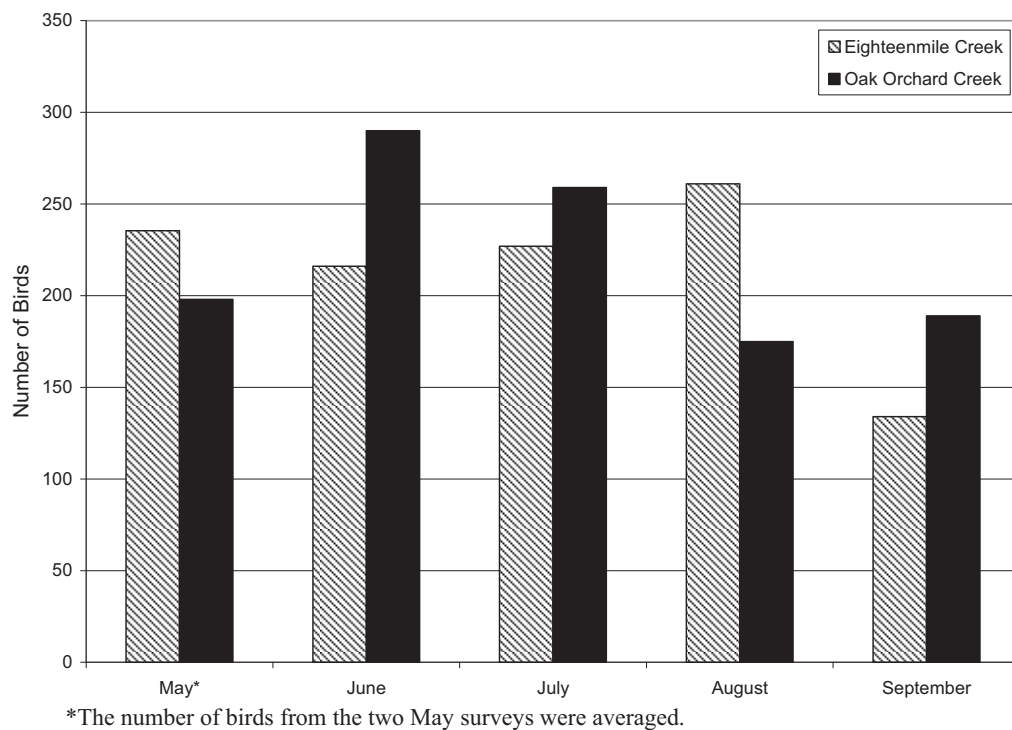


Figure 3-3 The Total Number of Birds Observed during the Monthly Surveys at Eighteenmile Creek and Oak Orchard Creek

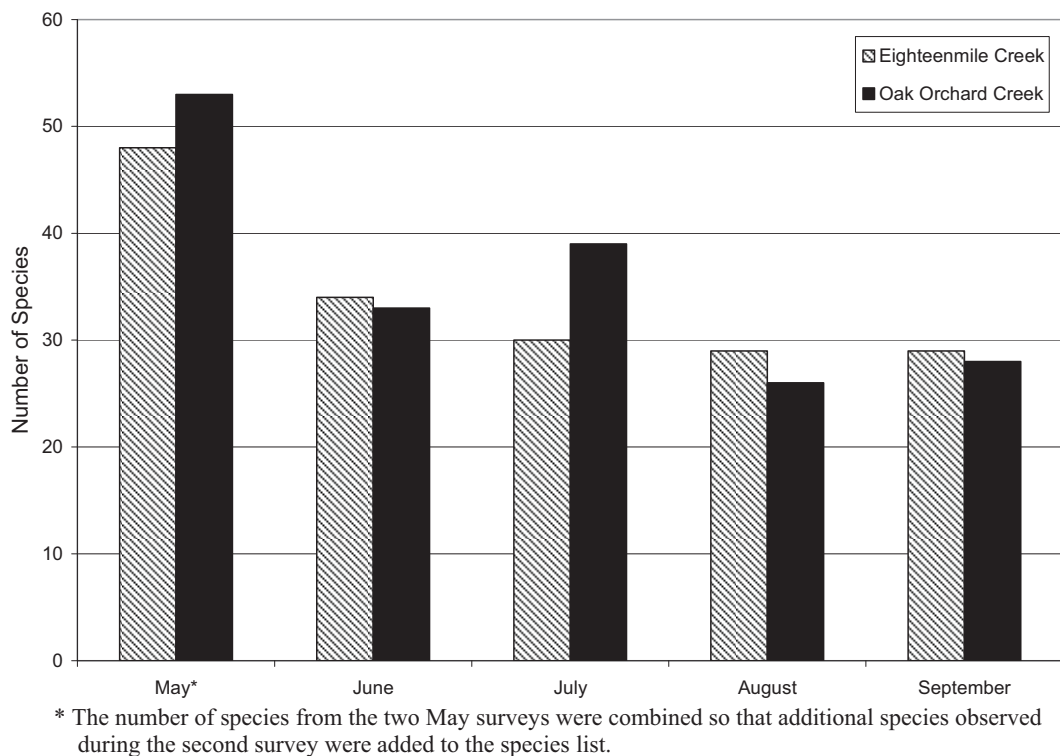


Figure 3-4 The Total Number of Species of Birds Observed during the Monthly Surveys at Eighteenmile and Oak Orchard Creeks

Table 3-9 Summary of Morning Point Count Surveys for Birds by Date and by Point Location along Eighteenmile Creek and Oak Orchard Creek (2007)

Location		5/5	5/19	6/29	7/23	8/19	9/17	Overall
Eighteenmile Creek								
Total Birds	A	35	47	43	27	33	18	203
	B	38	35	22	35	51	8	189
	C	43	33	31	26	76	15	224
	D	44	30	27	29	37	17	184
	E	38	34	20	33	22	23	170
	F	35	59	73	77	42	53	339
	Total	233	238	216	227	261	134	1,309
Species Count	A	17	15	20	15	10	11	38
	B	14	14	12	12	11	4	33
	C	11	14	12	11	16	5	30
	D	12	16	11	14	13	10	40
	E	14	15	10	16	10	13	33
	F	14	16	19	17	12	13	40
	Overall	36	35	34	30	29	29	66
Oak Orchard Creek								
Total Birds	1	27	28	37	46	18	51	207
	2	38	41	36	65	41	32	253
	3	47	44	51	39	37	13	231
	4	27	30	39	36	9	24	165
	5	32	30	48	32	33	42	217
	6	28	24	79	41	37	27	236
	Total	199	197	290	259	175	189	1,309
Species Count	1	14	15	21	15	9	16	38
	2	17	18	17	14	14	11	35
	3	17	15	18	18	12	6	34
	4	10	16	15	15	7	6	38
	5	15	19	14	14	9	9	40
	6	17	17	16	16	9	10	44
	Overall	37	46	33	39	26	28	71

MMP surveys were conducted at Oak Orchard Creek on June 12 and 27, 2007. A total of 263 birds representing 38 species were identified during the two surveys at the six Oak Orchard Creek point locations (see Table 3-10). Two hundred and twenty-one of the 263 birds observed were flyovers; these birds were included in the analyses that follow. The most numerous species recorded were Red-winged Blackbird (68 birds), Cedar Waxwing (20 birds), and American Robin (18 birds) (see Table C-2). By point location, the total number of birds on June 12 ranged from 17 to 37, with an average per point location of 25.0, and on June 27 the total number of birds ranged from nine to 37, with an average per point location of 18.8. On June 12, the total number of species per survey point location ranged from nine to 17, with an average of 11.7, and on June 27, the total number of species ranged from three to 13, with an average per point location of 8.5.

Species detected during the evening surveys that were not detected during the morning surveys include Common Yellowthroat at Eighteenmile Creek and Least Flycatcher, Eastern Kingbird, and Eastern Bluebird at Oak Orchard Creek.

Bird Species List and Threatened/Endangered Species

During the surveys and other activities (e.g., installation of traps, paddling between point locations) in the Project Area, E & E identified a total of 79 species at Eighteenmile Creek and 94 species at Oak Orchard Creek throughout the study period (see Table 3-11). Sixty-four of the species were detected at both creeks, 15 were detected only at Eighteenmile Creek, and 30 were detected only at Oak Orchard Creek (see Table 3-12). Canada Goose, Mute Swan, Wood Duck, and Mallard were observed throughout the study; other species of waterfowl were observed only in early spring and late summer. Migrants were detected primarily in May and early June. Species observed from late June to mid-August were believed to be breeding birds. Observations of Osprey were limited to August and September. The species identified during the study period were generally consistent with those species expected for the geographic area (E & E 2007). Table C-3 identifies species presence by survey point location.

Some of the differences in species present at each creek can be attributed to differences in habitat availability. Species such as the Virginia Rail, Sora, Common Moorhen, Marsh Wren, and Swamp Sparrow that are often associated with cattail marsh were observed only at Eighteenmile Creek (see Table 3-11). Although there was only approximately 1.5% more of the area in cattail marsh at Eighteenmile Creek compared to Oak Orchard Creek (see Table 3-1), the expanses of cattail marshes along Eighteenmile were much larger than those at Oak Orchard Creek and may provide more suitable habitat for these marsh-dwelling species. More neotropical migrants (Tennessee Warbler, Nashville Warbler, Northern Parula, Magnolia Warbler, Black-throated Blue Warbler, Bay-breasted Warbler, American Redstart, Hooded Warbler, Scarlet Tanager, and Indigo Bunting) were observed at Oak Orchard Creek than at Eighteenmile Creek, possibly due to the lack of residential development along the forested riparian corridor.

Six state-listed species were identified, and no federally listed species were identified (see Table 3-11). At Eighteenmile Creek, Osprey (special concern) and Cooper's Hawk (special concern) were observed. At Oak Orchard Creek, American Bittern (special concern), Osprey (special concern), Bald Eagle (threatened), Northern Harrier (threatened), and Red-shouldered Hawk (special concern) were observed.

Table 3-10 Summary of MMP Surveys for Birds by Date and by Point Location at Eighteenmile Creek and Oak Orchard Creek (2007)

	Point	6/14	6/28	Overall
Eighteenmile Creek				
Total Birds	A	30	16	46
	B	27	29	56
	C	28	28	56
	D	22	19	41
	E	21	19	40
	F	30	9	39
	Total	158	120	278
Species Total	A	12	8	14
	B	13	9	14
	C	8	9	12
	D	14	7	16
	E	7	7	11
	F	12	4	13
	Overall	26	24	28
Oak Orchard Creek				
Total Birds	1	19	9	28
	2	27	12	39
	3	37	37	74
	4	17	12	29
	5	21	23	44
	6	29	20	49
	Total	150	113	263
Species Total	1	9	3	10
	2	9	8	13
	3	12	13	17
	4	10	6	13
	5	13	10	18
	6	17	11	21
	Overall	33	25	38

Table 3-11 Summary of Bird Species Detected at Eighteenmile Creek and Oak Orchard Creek (2007)

Common Name	Eighteenmile Creek	Oak Orchard Creek
Canada Goose	X	X
Mute Swan	X	X
Wood Duck	X	X
Gadwall	-	X
American Wigeon	-	X
American Black Duck	X	X
Mallard	X	X
Blue-winged Teal	X	X
Greater Scaup	X	-
Lesser Scaup	-	X
Bufflehead	X	X
Common Goldeneye	X	X
Hooded Merganser	-	X
Common Merganser	-	X
Red-breasted Merganser	X	-
American Bittern (SC)	-	X
Great Blue Heron	X	X
Green Heron	X	X
Black-crowned Night Heron	X	-
Turkey Vulture	X	X
Osprey (SC)	X	X
Bald Eagle (T)	-	X
Northern Harrier (T)	-	X
Cooper's Hawk (SC)	X	-
Red-shouldered Hawk (SC)	-	X
Red-tailed Hawk	X	X
American Kestrel	-	X
Virginia Rail	X	-
Sora	X	-
Common Moorhen	X	-
American Coot	-	X
Killdeer	X	X
Greater Yellowlegs	-	X
Spotted Sandpiper	X	X
American Woodcock	X	-
Ring-billed Gull	X	X
Caspian Tern	X	-
Rock Pigeon	X	X
Mourning Dove	X	X
Great Horned Owl	-	X

Table 3-11 Summary of Bird Species Detected at Eighteenmile Creek and Oak Orchard Creek (2007)

Common Name	Eighteenmile Creek	Oak Orchard Creek
Chimney Swift	X	X
Ruby-throated Hummingbird	X	X
Belted Kingfisher	X	X
Red-bellied Woodpecker	X	X
Yellow-bellied Sapsucker	-	X
Downy Woodpecker	X	X
Hairy Woodpecker	-	X
Northern Flicker	X	X
Eastern Wood-Pewee	X	X
Least Flycatcher	X	X
Eastern Phoebe	X	X
Great Crested Flycatcher	X	X
Eastern Kingbird	X	-
Blue-headed Vireo	X	X
Warbling Vireo	X	X
Red-eyed Vireo	X	X
Blue Jay	X	X
American Crow	X	X
Purple Martin	X	X
Tree Swallow	X	X
Northern Rough-winged Swallow	X	X
Barn Swallow	X	X
Black-capped Chickadee	X	X
White-breasted Nuthatch	X	X
Brown Creeper	X	X
Carolina Wren	X	-
House Wren	X	X
Marsh Wren	X	-
Golden-crowned Kinglet	X	X
Ruby-crowned Kinglet	-	X
Eastern Bluebird	-	X
Swainson's Thrush	X	X
Wood Thrush	X	X
American Robin	X	X
Gray Catbird	X	X
European Starling	X	X
Cedar Waxwing	X	X
Tennessee Warbler	-	X
Nashville Warbler	-	X
Northern Parula	-	X

Table 3-11 Summary of Bird Species Detected at Eighteenmile Creek and Oak Orchard Creek (2007)

Common Name	Eighteenmile Creek	Oak Orchard Creek
Yellow Warbler	X	X
Chestnut-sided Warbler	X	X
Magnolia Warbler	-	X
Black-throated Blue Warbler	-	X
Yellow-rumped Warbler	X	X
Black-throated Green Warbler	X	X
Blackburnian Warbler	X	X
Pine Warbler	X	-
Bay-breasted Warbler	-	X
American Redstart	-	X
Ovenbird	X	X
Common Yellowthroat	X	X
Hooded Warbler	-	X
Scarlet Tanager	-	X
Chipping Sparrow	X	X
Song Sparrow	X	X
Swamp Sparrow	X	-
Dark-eyed Junco	-	X
Northern Cardinal	X	X
Rose-breasted Grosbeak	X	X
Indigo Bunting	-	X
Bobolink	X	-
Red-winged Blackbird	X	X
Eastern Meadowlark	-	X
Common Grackle	X	X
Brown-headed Cowbird	X	X
Baltimore Oriole	X	X
American Goldfinch	X	X
House Sparrow	-	X
Species Count	79	94

Key:

E = State-listed as endangered

T = Threatened

SC = Special concern

Table 3-12 Species Observed Only at Eighteenmile Creek or Oak Orchard Creek (2007)

Species Detected Only at Eighteenmile Creek	Species Detected Only at Oak Orchard Creek	
Greater Scaup	Gadwall	Ruby-crowned Kinglet
Red-breasted Merganser	American Wigeon	Eastern Bluebird
Black-crowned Night Heron	Lesser Scaup	Tennessee Warbler
Cooper's Hawk	Hooded Merganser	Nashville Warbler
Virginia Rail	Common Merganser	Northern Parula
Sora	American Bittern	Magnolia Warbler
Common Moorhen	Bald Eagle	Black-throated Blue Warbler
American Woodcock	Northern Harrier	Bay-breasted Warbler
Caspian Tern	Red-shouldered Hawk	American Redstart
Eastern Kingbird	American Kestrel	Hooded Warbler
Carolina Wren	American Coot	Scarlet Tanager
Marsh Wren	Greater Yellowlegs	Dark-eyed Junco
Pine Warbler	Great Horned Owl	Indigo Bunting
Swamp Sparrow	Yellow-bellied Sapsucker	Eastern Meadowlark
Bobolink	Hairy Woodpecker	House Sparrow

3.2.2 Mammals

As indicated in Section 2.2.2, observations of mammals within the subject creeks were recorded coincident with the bird and amphibian surveys. Nine mammal species were identified at Eighteenmile Creek, and 13 species were identified at Oak Orchard Creek (see Table 3-13). Nine species were identified at both creeks, and four species were identified only at Oak Orchard Creek. No threatened or endangered species were observed. There were no observations of deformed or obviously sick or diseased individuals at either of the creeks.

Table 3-13 Mammal Species Observations at Eighteenmile Creek and Oak Orchard Creek (2007)

Common Name	Eighteenmile Creek	Oak Orchard Creek
Bat Species	X	X
Beaver	X	X
Eastern Chipmunk	X	X
Gray Squirrel	X	X
Meadow Vole	-	X
Mouse (<i>Peromyscus</i> sp.)	-	X
Muskrat	X	X
Raccoon	X	X
Red Squirrel	X	X
Shrew Species	X	X
White-tailed Deer	X	X
Woodchuck	-	X
Unknown Small Mammal	-	X
Species Count	9	13

Species diversity appeared to be greater nearer to the dams at both creeks (see Table C-3). The species most frequently observed or heard along the entire length of both creeks was the eastern chipmunk. Commonly observed species within both stream corridors included beaver, gray squirrel, and red squirrel. Other species were observed at only a few locations along the creeks. For example, bats were primarily observed near the wooded areas in the vicinities of the dams at both creeks, and meadow voles were only found in the pitfall traps at Oak Orchard Creek at points 2 and 3, which were located on islands in the creek (see Section 3.2.3).

Generally, the diversity and overall numbers of wildlife species occurring within a given area are directly related to the number, size, and quality of the existing habitat types, and the degree to which land has been developed. Wildlife habitat contains a combination of resources (e.g., water, forage, cover) and environmental conditions (climate, temperature, predators, competitors) that promote the presence of certain species and allow for the relatively successful survival and reproduction of species over time (Morrison, Marcot, and Mannan 1998). An in-depth analysis of habitat structure, functions, and values were beyond the scope of this investigation. However, the slightly greater number of species observed along Oak Orchard Creek may be related to the larger overall area within which observations were made compared to the Eighteenmile Creek survey area. Additionally, there were minor differences in overall habitat structure and availability between the two study areas. Eighteenmile Creek is more characterized by a canyon or ravine environment where the walls are steep and rocky, which provides less habitat area for burrowing animals such as small mammals and woodchucks compared to Oak Orchard Creek.

3.2.3 Amphibians and Reptiles

Pitfall and Minnow Traps

Traps were open for a total of six nights at each creek (see Table 3-14). Individual traps were considered closed if a minnow trap was lost (i.e., vegetation occasionally made minnow traps difficult to find between surveys) or in the case of one trap, when the bucket popped out due to flooding and the hole collapsed.

Very few amphibians or reptiles were captured in the pitfall traps. One painted turtle was captured at Eighteenmile Creek (see Table 3-15). In addition, one shrew was captured in a pitfall trap at Eighteenmile Creek, but species identification could not be confirmed. At Oak Orchard Creek, two Eastern American toads were captured. Six meadow voles and two shrews (unknown species) also were found in the pitfall traps.

3. Results

Table 3-14 Nights on Which Individual Traps Were Open (2007)

Eighteenmile Creek							
Location	Trap Type	5/4-5/5	5/18-5/19	6/28-6/29	7/22-7/23	8/18-8/19	9/16-9/17
A	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X
B	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	C	X	X	X
C	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X
D	Pitfall	X	C	C	C	C	C
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X
E	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X
F	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X
Oak Orchard Creek							
Location	Type	5/6-5/7	5/17-5/18	6/27-6/28	7/21-7/22	8/17-8/18	9/15-9/16
1	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X
2	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	C	R	X	X
3	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X
4	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X
5	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	C	C	C	C
6	Pitfall	X	X	X	X	X	X
	Pitfall	X	X	X	X	X	X
	Minnow	X	X	X	X	X	X

Key:

- C = Closed trap.
- R = Replaced trap.
- X = Trap was open.

A number of small fish of a variety of species, including bass, brown bullhead, crappie, round goby, minnows, red-ear sunfish, and other sunfish species, were found in the minnow traps (see Table 3-15). One crayfish and one snail were also found in the minnow traps at Eighteenmile Creek. At Oak Orchard Creek, one crayfish and one snail were captured. Five tadpoles of two species (leopard frog and green frog) were captured at Oak Orchard Creek, but only one bullfrog tadpole was captured at Eighteenmile Creek.

Overall, 26 animals of ten species were captured at Eighteenmile Creek, and 44 animals of 14 species were captured at Oak Orchard Creek (see Table 3-15). Seven species were captured at both creeks, four species were captured only at Eighteenmile Creek, and eight species were captured only at Oak Orchard Creek. No threatened or endangered species were captured.

Marsh Monitoring Program Surveys

Four frog and toad surveys were conducted at Eighteenmile Creek on May 4 and 18 and June 14 and 28, 2007, and four frog and toad surveys were conducted at Oak Orchard Creek on May 6 and 17 and June 12 and 27, 2007 (see Table C-4). During MMP surveys, 63 individuals of six species were identified at Eighteenmile Creek and 66 individuals of six species were identified at Oak Orchard Creek (see Table 3-16). More frogs and toads were identified in the middle portions of both creeks (survey point locations B, C, D, 2, 3, and 4) than elsewhere. Few or individual frogs or toads were heard more often than larger groups of frogs or toads during surveys, and very few full choruses were detected (see Table 3-17). The most common species at both creeks were spring peeper, green frog, and bullfrog.

Amphibian and Reptile Species List and Threatened/Endangered Species

During trapping, surveys, and other activities in the Project Area (e.g., installation of traps, paddling between point locations), a total of 11 amphibian or reptile species were observed or heard at Eighteenmile Creek and 12 amphibian or reptile species were observed or heard at Oak Orchard Creek (see Table 3-18). No federally or state-listed species were identified.

Table 3-15 Summary of Species Captured in Pitfall and Minnow Traps at Eighteenmile Creek and Oak Orchard Creek in 2007

Common Name ¹	Eighteenmile Creek												Total
	5/5		5/19		6/29		7/23		8/19		9/17		
	Pitfall	Minnow	Pitfall	Minnow	Pitfall	Minnow	Pitfall	Minnow	Pitfall	Minnow	Pitfall	Minnow	
Bass	-	-	-	-	-	-	-	-	-	2	-	-	2
Bullfrog	-	-	-	-	-	1	-	-	-	-	-	-	1
Crappie	-	-	-	-	-	-	-	-	-	1	-	-	1
Crayfish	-	-	-	-	-	-	-	-	-	3	-	-	3
Goby	-	-	-	1	-	-	-	1	-	7	-	1	10
Minnow	-	1	-	-	-	-	-	-	-	2	-	-	3
Painted Turtle	-	-	-	-	-	-	-	-	-	-	1	-	1
Shrew	-	-	-	-	-	-	1	-	-	-	1	-	2
Snail	-	-	-	-	-	-	-	-	-	1	-	-	1
Sunfish	-	-	-	-	-	-	-	-	-	-	-	2	2
Grand Total	0	1	0	1	0	1	1	1	0	16	2	3	26
Species Count	0	1	0	1	0	1	1	1	0	6	2	2	10

Table 3-15 Summary of Species Captured in Pitfall and Minnow Traps at Eighteenmile Creek and Oak Orchard Creek in 2007

Common Name ¹	Oak Orchard Creek												Total
	5/7 Pitfall	5/7 Minnow	5/18 Pitfall	5/18 Minnow	6/28 Pitfall	6/28 Minnow	7/22 Pitfall	7/22 Minnow	8/18 Pitfall	8/18 Minnow	9/16 Pitfall	9/16 Minnow	
American Toad	-	-	-	-	2	-	-	-	-	-	-	-	2
Bass	-	-	-	-	-	-	-	1	-	1	-	1	3
Bass/sunfish?	-	2	-	-	-	-	-	-	-	-	-	-	2
Brown Bullhead	-	-	-	2	-	-	-	5	-	-	-	1	8
Crappie	-	-	-	-	-	-	-	-	-	-	-	1	1
Crayfish	-	-	-	-	-	1	-	-	-	-	-	-	1
Goby	-	-	-	1	-	-	-	-	-	-	-	1	2
Green Frog	-	2	-	-	-	-	-	2	-	-	-	-	4
Leopard Frog	-	-	-	-	-	-	-	1	-	-	-	-	1
Meadow Vole	-	-	1	-	1	-	2	-	1	-	1	-	6
Minnow	-	2	-	5	-	-	-	-	-	-	-	-	8
Redear Sunfish	-	-	-	-	-	-	-	-	-	-	-	1	1
Shrew	-	-	-	-	2	-	-	-	-	-	-	-	2
Sunfish	-	-	-	-	-	-	-	-	-	-	-	2	2
Waterbug	-	1	-	-	-	-	-	-	-	-	-	-	1
Grand Total	0	7	1	8	5	1	2	9	1	1	1	7	44
Species Count	0	4	1	3	3	1	1	4	1	1	1	6	14

¹ Species in bold were observed in only one creek.

Table 3-16 Summary of MMP Surveys for Frogs and Toads by Date and by Point Location at Eighteenmile Creek and Oak Orchard Creek (2007)

Eighteenmile Creek						
	Point	5/4	5/18	6/14	6/28	Overall
Total Frogs/ Toads	A	0	0	1	1	2
	B	4	5	3	1	13
	C	7	3	3	5	18
	D	6	4	3	4	17
	E	1	1	3	4	9
	F	1	0	0	3	4
	Total	19	13	13	18	63
Species	A	0	0	1	1	2
	B	1	2	3	1	4
	C	3	1	3	2	5
	D	3	2	3	2	5
	E	1	1	3	2	4
	F	1	0	0	2	3
	Overall	3	3	4	2	6
Oak Orchard Creek						
	Point	5/6	5/17	6/12	6/27	Overall
Total Frogs/ Toads	1	0	0	3	4	7
	2	0	6	3	2	11
	3	0	4	2	7	13
	4	6	3	2	9	20
	5	1	2	3	3	9
	6	3	0	3	0	6
	Total	10	15	16	25	66
Species	1	0	0	1	1	1
	2	0	2	3	2	6
	3	1	1	2	3	4
	4	2	1	2	3	4
	5	1	1	3	2	4
	6	1	0	3	0	4
	Overall	2	2	3	3	6

Table 3-17 Species, Number of Individuals, and Call Level Code for Frogs Detected at Eighteenmile Creek and Oak Orchard Creek (2007)

Common Name	Eighteenmile Creek				Oak Orchard Creek			
	Code			Total	Code			Total
	1	2	3		1	2	3	
American Toad	4	-	-	4	1	-	-	1
Gray Tree Frog	1	1	-	2	1	2	-	3
Green Frog	14	3	-	17	17	3	1	21
Spring Peeper	3	22	-	25	6	17	0	23
Bullfrog	10	1	1	12	7	-	4	11
Pickerel Frog	1	2	-	3	-	-	-	0
Leopard Frog	-	-	-	0	7	-	-	7
Grand Total	33	29	1	63	39	22	5	66

Key:

Code 1 = Individuals can be counted; calls not simultaneous.

Code 2 = Calls distinguishable; some simultaneous calling.

Code 3 = Full chorus; calls continuous and overlapping.

Table 3-18 Summary of Reptile and Amphibian Species Identified at Eighteenmile Creek and Oak Orchard Creek (2007)

Common Name	Eighteenmile Creek	Oak Orchard Creek
Amphibians		
Bullfrog	X	X
Eastern American Toad	X	X
Gray Treefrog	X	X
Green Frog	X	X
Northern Leopard Frog	X	X
Northern Redback Salamander	X	-
Northern Spring Peeper	X	X
Pickerel Frog	X	X
Wood Frog	X	X
Reptiles		
Common Snapping Turtle	-	X
Diamondback Terrapin	-	X
Northern Watersnake	X	X
Painted Turtle	X	X
Species Count	11	12

3.2.4 Summary of Similarities and Differences Between Study Areas

The wildlife survey results suggest that the species assemblages at the two creeks are similar, implying that both creeks are equally capable of providing the ecological services (e.g., food, shelter, nesting sites) needed by the bird and mammal species typically found in this part of New York State. The number of species observed at the two creeks throughout the season was similar, but a greater diversity of species was observed at Oak Orchard Creek (i.e., 15 more bird species, four more mammal species, and one more amphibian/reptile species) than at Eighteenmile Creek. In addition, greater numbers of tadpoles were observed at Oak Orchard Creek, possibly indicating better water quality; however, very few amphibians were observed overall, and this apparent difference between creeks may simply be an artifact of sampling. The species assemblages were also similar at the two creeks. A slightly greater diversity of waterfowl, raptors, and neotropical migrants were observed at Oak Orchard Creek.

The differences observed in species assemblages can mostly be attributed to differences in habitat availability. Overall, the two study areas were found to be comprised of similar cover types, with a few minor exceptions. The area evaluated immediately adjacent to Eighteenmile Creek is characterized by more areas of cattail marsh, developed (residential), and early successional habitat compared to Oak Orchard Creek, whereas Oak Orchard is characterized by areas containing agricultural land, open water, and a large golf course. Both creeks have similar amounts of surrounding forested land and orchard/vineyard habitat.

Amphibian values from 2007 may not be typical. The spring and summer of 2007 were particularly dry, which may have limited frog/toad calling rates and breeding. Further, very little immigration or emigration was detected, as indicated by the limited number of amphibians caught in the pitfalls traps, which also may be a result of the dry weather. In terms of the numbers of frogs detected, the instability of nighttime temperatures in the spring may have affected when frogs and toads were calling. In spite of the dry and unstable weather conditions, most of the species expected for this area of New York State were identified.

The similarity of wildlife, in terms of numbers and species, detected at both creeks and the relatively high diversity of species indicates that Eighteenmile Creek likely offers habitat of similar quality as Oak Orchard Creek.

3.3 Bullhead Chemical Residue Data and Ecological Risk Evaluation

In August 2007, eight brown bullheads were collected from both Eighteenmile and Oak Orchard creeks and analyzed for PCBs. Two bullheads from each creek also were analyzed for dioxins/furans. The data were collected to: (1) determine whether levels of PCBs and dioxins/furans in bullheads from Eighteenmile Creek are elevated compared with the levels in bullheads from Oak Orchard Creek; (2) determine whether these chemicals pose a potential risk to bullheads in these creeks; and (3) determine whether these chemicals pose a potential risk to fish-

eating birds and mammals at these creeks. These three topics are discussed in turn below.

3.3.1 Chemical Residues in Bullhead

Whole-body concentrations of Aroclors 1248, 1254, and 1260 and total PCBs were an order of magnitude greater in brown bullheads from Eighteenmile Creek compared with the levels in brown bullheads from Oak Orchard Creek (see Table 3-19). The less-chlorinated PCB Aroclors (1016, 1221, 1232, and 1242) were not detected in bullheads from either creek (see Appendix D). Whole-body concentrations of dioxins/furans (expressed as the TCDD toxic equivalent [TEQ]) in bullheads from Eighteenmile Creek were approximately five times greater than in bullheads from Oak Orchard Creek (see Table 3-20).

Elevated levels of PCBs and dioxins/furans in bullheads from Eighteenmile Creek probably are the result of historic industrial activities in the upstream reaches of the creek near Lockport, New York (NYSDEC 2006; EEPC 2007a). These historic activities have resulted in elevated sediment concentrations of PCBs and dioxins in the lower reaches of Eighteenmile Creek, and these contaminants have been shown to be bioavailable in laboratory bioaccumulation studies (USACE 2004). The bullhead data collected for this study also indicate that sediment contaminants in the lower reaches of Eighteenmile Creek are bioavailable.

The principal Aroclor detected in the bullhead samples collected for this investigation was 1248 (see Table 3-19). Interestingly, Aroclor 1248 was the principal Aroclor found in sediment in lower Eighteenmile Creek by USACE (2008) and one of the principal Aroclors found in sediment in upper Eighteenmile Creek near Lockport (EEPC 2007a). Hence, it appears that the fish in Eighteenmile Creek are accumulating the principal Aroclor present in the system.

3.3.2 Risk Evaluation for the Brown Bullhead

Potential risks to bullheads from PCBs and dioxins/furans were assessed by comparing the measured whole-body concentrations of these chemicals with critical tissue concentrations from the literature. The following critical tissue concentrations were used:

- PCBs (all Aroclors): 440 micrograms per kilogram ($\mu\text{g/kg}$) wet weight (Dyer et al. 2000); and
- 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD): 72 nanograms per kilogram (ng/kg) wet weight (Windward 2004).

Whole-body concentrations of Aroclors 1248 and 1254 and total PCBs in bullheads from Eighteenmile Creek often exceeded the PCB critical tissue concentration (see shaded values in Table 3-19). No sample from Oak Orchard Creek exceeded the PCB critical tissue concentration. In both Eighteenmile Creek and

Table 3-19 Whole-Body PCB Concentrations in Brown Bullheads from Eighteenmile and Oak Orchard Creeks

Location	Sample1	Aroclor 1248		Aroclor 1254		Aroclor 1260		Total PCBs		Percent Lipids
		ug/kg wet	ug/g lipid	ug/kg wet	ug/g lipid	ug/kg wet	ug/g lipid	ug/kg wet	ug/g lipid	
Eighteenmile Creek	EMC-01-BB-LP	2000	50	960	24	230	5.8	3200	80	3.98
	EMC-05-BB-LP	1200	46	440	17	120	4.6	1800	69	2.6
	EMC-07-BB-LP	650	50	230	18	57	4.4	890	69	1.29
	EMC-18-BB-LP	2300	87	1400	53	380	14	3700	140	2.65
	EMC-19-BB-LP	4100	74	2000	36	570	10	6100	111	5.52
	EMC-25-BB-LP	3200	67	1500	31	380	7.9	4700	98	4.79
	EMC-31-BB-LP	1000	57	350	20	95	5.4	1400	80	1.76
	EMC-34-BB-LP	2700	82	1400	43	380	12	4100	125	3.29
	Minimum	650	46	230	17	57	4.4	890	69	1.29
	Maximum	4100	87	2000	53	570	14	6100	140	5.52
	Average	2144	64	1035	30	277	8.0	3236	96	3.24
Oak Orchard Creek	OOC-07-BB-LP	23	0.76	62	2.0	37	1.2	120	3.9	3.04
	OOC-08-BB-LP	19	0.59	35	1.1	28	0.88	63	2.0	3.2
	OOC-09-BB-LP	33	0.92	73	2.0	64	1.8	170	4.7	3.58
	OOC-16-BB-LP	30	0.77	50	1.3	31	0.79	110	2.8	3.91
	OOC-19-BB-LP	26	0.92	84	3.0	61	2.1	170	6.0	2.84
	OOC-28-BB-LP	43	0.74	100	1.7	66	1.1	210	3.6	5.84
	OOC-31-BB-LP	35	0.90	97	2.5	59	1.5	190	4.9	3.88
	OOC-38-BB-LP	71	1.18	230	3.8	160	2.6	460	7.6	6.04
	Minimum	19	0.59	35	1.1	28	0.79	63	2.0	2.84
	Maximum	71	1.18	230	3.8	160	2.6	460	7.6	6.04
	Average	35	0.85	91	2.2	63	1.5	187	4.4	4.04
EMC versus OOC	Mann-Whitney U Statistic	64	64	63.5	64	57	64	64	64	21
	Probability	0.001	0.001	0.001	0.001	0.008	0.001	0.001	0.001	0.248
	Significantly Different?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

Key:

EMC = Eighteenmile Creek

OOC = Oak Orchard Creek

PCB = Polychlorinated biphenyl

ug/kg wet = microgram per kilogram wet weight

ug/g lipid = microgram per gram lipid

Notes:

1. Aroclors 1016, 1221, 1232, and 1242 were undetected in all bullhead samples from both creeks (see Appendix D [Analytical Data]).

2. Shading = Sample concentration equals or exceeds critical tissue concentration (440 ug/kg for all aroclors; Dyer et al. 2000) for effects on fish.

Table 3-20 Whole-Body Dioxin/Furan Concentrations in Brown Bullheads from Eighteenmile and Oak Orchard Creeks

Location	Sample ¹	TCDD TEQ (Fish) ²		TCDD TEQ (Mammalian) ²		TCDD TEQ (Avian) ²		Percent Lipids
		ng/kg wet ³	ng/kg lipid	ng/kg wet	ng/kg lipid	ng/kg wet	ng/kg lipid	
Eighteenmile Creek	EMC-01-BB-LP	-	-	-	-	-	-	3.98
	EMC-05-BB-LP	-	-	-	-	-	-	2.6
	EMC-07-BB-LP	-	-	-	-	-	-	1.29
	EMC-18-BB-LP	-	-	-	-	-	-	2.65
	EMC-19-BB-LP	7.5	136	6.3	114	16.9	306	5.52
	EMC-25-BB-LP	5.2	109	4.8	100	10.8	224	4.79
	EMC-31-BB-LP	-	-	-	-	-	-	1.76
	EMC-34-BB-LP	-	-	-	-	-	-	3.29
Oak Orchard Creek	OOC-07-BB-LP	-	-	-	-	-	-	3.04
	OOC-08-BB-LP	-	-	-	-	-	-	3.2
	OOC-09-BB-LP	1.0	27.9	0.95	26.5	1.76	49.2	3.58
	OOC-16-BB-LP	-	-	-	-	-	-	3.91
	OOC-19-BB-LP	-	-	-	-	-	-	2.84
	OOC-28-BB-LP	0.74	12.7	0.69	11.8	1.59	27.2	5.84
	OOC-31-BB-LP	-	-	-	-	-	-	3.88
	OOC-38-BB-LP	-	-	-	-	-	-	6.04

Key:

- (dash) = not analyzed
- EMC = Eighteenmile Creek
- ng/kg wet = nanogram per kilogram wet weight
- ng/kg lipid = nanogram per kilogram lipid
- NOAEL = no observed adverse effect level
- OOC = Oak Orchard Creek
- TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
- TEQ = toxic equivalent
- TEF = toxic equivalency factor

Notes:

¹ Only two fish from each creek were analyzed for dioxins/furans. See Appendix D for congener-specific concentrations.² Fish and avian TEFs were taken from Van den Berg (1998). Mammalian TEFs were taken from Van den Berg (2006). See text for further explanation.³ No samples exceeded the TCDD, NOAEL-based, critical tissue concentration (72 ng/kg, Windward 2004) for effects on fish.

Oak Orchard Creek, whole-body concentrations of dioxins/furans in bullheads were well below the critical tissue concentration (see Table 3-20). Overall, these results suggest that bullheads from Eighteenmile Creek may be at risk from elevated tissue residues of PCBs but not from dioxins/furans. These chemicals pose no risks to fish in Oak Orchard Creek.

3.3.3 Risk Evaluation for Fish-Eating Wildlife

Potential ecological risks to fish-eating wildlife from PCBs and dioxins/furans were assessed in accordance with accepted ecological risk assessment guidance (EPA 1993; Sample and Suter 1996). In brief, the bullhead data for total PCBs and dioxins/furans collected for this study were used to estimate exposure and risk for the great blue heron (*Ardea herodias*) and mink (*Mustela vison*), two wildlife species known to use lower Eighteenmile Creek and Oak Orchard Creek.

3.3.3.1 Heron and Mink Exposure to PCBs and Dioxins/Furans

Dietary exposure for the heron and mink was estimated separately for Eighteenmile Creek and Oak Orchard Creek using the following equation:

$$EE_{\text{diet}} = (C_f \times IR/BW) \times \text{SUF} \times \text{ED}$$

where:

EE_{diet} = estimated exposure from diet (mg/kg-day);

C_f = chemical concentration in fish (mg/kg wet weight);

IR = ingestion rate of receptor (kg/day wet weight);

BW = body weight of receptor (kg);

SUF = site use factor (unit-less); and

ED = exposure duration (unit-less), equal to fraction of year spent at site.

The SUF is the portion of a receptor's home range represented by the site. For this analysis, it was assumed that mink and heron at Eighteenmile Creek use only Eighteenmile Creek to satisfy their food and habitat needs, and those at Oak Orchard Creek use only Oak Orchard Creek. Hence, the SUF was set equal to 1 for the mink and heron at both creeks. Exposure duration (ED) is the percentage of the year spent at the site by the receptor species. A value of 1 (year-round resident) was assumed for the mink and 0.5 was assumed for the heron to account for the migratory nature of this species. The exposure parameters and estimated dietary exposure for the heron and mink for total PCBs are presented in Tables 3-21 and 3-22, respectively. Tables 3-23 and 3-24 present analogous information for dioxin/furans for the heron and mink, respectively.

Wildlife also may be exposed to chemicals through drinking contaminated surface water and by incidental ingestion of contaminated sediment. These exposure routes were not quantitatively evaluated in this assessment because they typically account for only a negligible portion of total chemical exposure for piscivorous wildlife, especially for highly bioaccumulative contaminants (Sample et al. 1998).

Table 3-21 Risk Analysis for Total PCBs for Great Blue Heron at Eighteenmile and Oak Orchard Creeks

Parameter	Units	Value	References and Notes
Heron Exposure Factors			
Body Weight (BW)	kg	2.23	USEPA (1993) for herons in eastern North America.
Food Ingestion Rate (FIR)	kg/d (wet wt.)	0.31	Calculated from body weight using allometric equation for all birds USEPA (1993) assuming 68% food moisture content.
Site Use Factor (SUF)	unitless	1	Assumed value of 1 implies that herons at EMC forage only at EMC and that herons at OOC forage only at OOC.
Exposure Duration (ED)	unitless	0.5	Assumed based on migratory nature of this species.
Avian Toxicity Reference Values			
Chronic NOAEL	mg/kg-day	0.18	Dahlgren et al. (1972) as cited in Sample et al. (1996); based on reproductive-effects study with ring-necked pheasants with Aroclor 1254.
Chronic LOAEL	mg/kg-day	1.8	Dahlgren et al. (1972) as cited in Sample et al. (1996); based on reproductive-effects study with ring-necked pheasants with Aroclor 1254.
Heron Exposure and Risk - Eighteenmile Creek			
Diet	Percent	100	Fish from Eighteenmile Creek assumed to be sole food source.
			95 percent upper confidence limit on the arithmetic average concentration for eight samples listed in Table 3.3.1 as calculated by ProUCL version 4 from USEPA .
Fish PCB Concentration	mg/kg (wet wt.)	4.43	
Estimated Exposure from Diet	mg/kg-day	0.30	$((\text{Fish PBC Concentration}) \times \text{FIR} / \text{BW}) \times \text{SUF} \times \text{ED}$
HQ-NOAEL	unitless	1.7	Estimated Exposure from Diet / NOAEL
HQ-LOAEL	unitless	0.17	Estimated Exposure from Diet / LOAEL
Heron Exposure and Risk - Oak Orchard Creek			
Diet	Percent	100	Fish from Oak Orchard Creek assumed to be sole food source.
			95 percent upper confidence limit on the arithmetic average concentration for eight samples listed in Table 3.3.1 as calculated by ProUCL version 4 from USEPA.
Fish PCB Concentration	mg/kg (wet wt.)	0.29	
Estimated Exposure from Diet	mg/kg-day	0.020	$((\text{Fish PBC Concentration} \times \text{FIR}) / \text{BW}) \times \text{SUF} \times \text{ED}$
HQ-NOAEL	unitless	0.11	Estimated Exposure from Diet / NOAEL
HQ-LOAEL	unitless	0.01	Estimated Exposure from Diet / LOAEL

Key:

BW = body weight

EMC = Eighteenmile Creek

FIR = food ingestion rate

HQ = hazard quotient

LOAEL = lowest observed adverse effect level

NOAEL = no observed adverse effect level

OOC = Oak Orchard Creek

PCBs = polychlorinated biphenyls

shading = HQ exceeds 1.0 (see Section 3.3.3.2 for further explanation).

Table 3-22 Risk Analysis for Total PCBs for Mink at Eighteenmile and Oak Orchard Creeks

Parameter	Units	Value	References and Notes
Mink Exposure Factors			
Body Weight (BW)	kg	0.974	USEPA (1999).
Food Ingestion Rate (FIR)	kg/d (wet wt.)	0.21	Calculated from body weight using allometric equation for all mammals USEPA (1993) assuming 68% food moisture content.
Site Use Factor (SUF)	unitless	1	Assumed value of 1 implies that mink at EMC forage only at EMC and that mink at OOC forage only at OOC.
Exposure Duration (ED)	unitless	1	Year-round resident.
Mammalian Toxicity Reference Values			
Chronic NOAEL	mg/kg-day	0.14	Aulerich and Ringer (1977) as cited in Sample et al. (1996); based on reproductive-effects study with mink with Aroclor 1254.
Chronic LOAEL	mg/kg-day	0.69	Aulerich and Ringer (1977) as cited in Sample et al. (1996); based on reproductive-effects study with mink with Aroclor 1254.
Mink Exposure and Risk - Eighteenmile Creek			
Diet	Percent	100	Fish from Eighteenmile Creek assumed to be sole food source.
Fish PCB Concentration	mg/kg (wet wt.)	4.43	95 percent upper confidence limit on the arithmetic average concentration for eight samples listed in Table 3.3.1 as calculated by ProUCL version 4 from USEPA.
Estimated Exposure from Diet	mg/kg-day	0.95	$((\text{Fish PBC Concentration} \times \text{FIR}) / \text{BW}) \times \text{SUF} \times \text{ED}$
HQ-NOAEL	unitless	6.8	Estimated Exposure from Diet / NOAEL
HQ-LOAEL	unitless	1.4	Estimated Exposure from Diet / LOAEL
Mink Exposure and Risk - Oak Orchard Creek			
Diet	Percent	100	Fish from Oak Orchard Creek assumed to be sole food source.
Fish PCB Concentration	mg/kg (wet wt.)	0.29	eight samples listed in Table 3.3.1 as calculated by ProUCL version 4 from USEPA.
Estimated Exposure from Diet	mg/kg-day	0.062	$((\text{Fish PBC Concentration} \times \text{FIR}) / \text{BW}) \times \text{SUF} \times \text{ED}$
HQ-NOAEL	unitless	0.44	Estimated Exposure from Diet / NOAEL
HQ-LOAEL	unitless	0.09	Estimated Exposure from Diet / LOAEL

Key:

BW = body weight

EMC = Eighteenmile Creek

FIR = food ingestion rate

HQ = hazard quotient

LOAEL = lowest observed adverse effect level

NOAEL = no observed adverse effect level

OOC = Oak Orchard Creek

PCB = polychlorinated biphenyl

shading = HQ exceeds 1.0 (see Section 3.3.3.2 for further explanation)

Table 3-23 Risk Analysis for Dioxins/Furans for Great Blue Heron at Eighteenmile and Oak Orchard Creeks

Parameter	Units	Value	References and Notes
Heron Exposure Factors			
Body Weight (BW)	kg	2.23	USEPA (1993) for herons in eastern North America.
Food Ingestion Rate (FIR)	kg/d (wet wt.)	0.31	Calculated from body weight using allometric equation for all birds USEPA (1993) assuming 68% food moisture content.
Site Use Factor (SUF)	unitless	1	Assumed value of 1 implies that herons at EMC forage only at EMC and that herons at OOC forage only at OOC.
Exposure Duration (ED)	unitless	0.5	Assumed based on migratory nature of this species.
Avian Toxicity Reference Values			
Chronic NOAEL	mg/kg-day	0.000014	Nosek et al. (1992) as cited in Sample et al. (1996); based on reproductive-effects study with ring-necked pheasants with 2,3,7,8-TCDD.
Chronic LOAEL	mg/kg-day	0.00014	Nosek et al. (1992) as cited in Sample et al. (1996); based on reproductive-effects study with ring-necked pheasants with 2,3,7,8-TCDD.
Heron Exposure and Risk - Eighteenmile Creek			
Diet	Percent	100	Fish from Eighteenmile Creek assumed to be sole food source.
Fish Dioxin/Furan Concentration	mg/kg (wet wt.)	0.0000169	Maximum TCDD TEQ (avian) for bullhead from Eighteenmile Creek (Table 3.3.2)
Estimated Exposure from Diet	mg/kg-day	0.0000012	$((\text{Fish dioxin/furan concentration} \times \text{FIR}) / \text{BW}) \times \text{SUF} \times \text{ED}$
HQ-NOAEL	unitless	0.08	Estimated Exposure from Diet / NOAEL
HQ-LOAEL	unitless	0.01	Estimated Exposure from Diet / LOAEL
Heron Exposure and Risk - Oak Orchard Creek			
Diet	Percent	100	Fish from Oak Orchard Creek assumed to be sole food source.
Fish Dioxin/Furan Concentration	mg/kg (wet wt.)	0.0000018	Maximum TCDD TEQ (avian) for bullhead from Oak Orchard Creek (Table 3.3.2)
Estimated Exposure from Diet	mg/kg-day	0.00000012	$((\text{Fish dioxin/furan concentration} \times \text{FIR}) / \text{BW}) \times \text{SUF} \times \text{ED}$
HQ-NOAEL	unitless	0.009	Estimated Exposure from Diet / NOAEL
HQ-LOAEL	unitless	0.001	Estimated Exposure from Diet / LOAEL

Key:

BW = body weight

EMC = Eighteenmile Creek

FIR = food ingestion rate

HQ = hazard quotient

LOAEL = lowest observed adverse effect level

NOAEL = no observed adverse effect level

OOC = Oak Orchard Creek

TCDD TEQ (avian) = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration (based on avian TEFs)

TEF = toxic equivalency factor

Table 3-24 Risk Analysis for Dioxins/Furans for Mink at Eighteenmile and Oak Orchard Creeks

Parameter	Units	Value	References and Notes
Mink Exposure Factors			
Body Weight (BW)	kg	0.974	USEPA (1999).
Food Ingestion Rate (FIR)	kg/d (wet wt.)	0.21	Calculated from body weight using allometric equation for all mammals USEPA (1993) assuming 68% food moisture content.
Site Use Factor (SUF)	unitless	1	Assumed value of 1 implies that mink at EMC forage only at EMC and that mink at OOC forage only at OOC.
Exposure Duration (ED)	unitless	1	Year-round resident.
Mammalian Toxicity Reference Values			
Chronic NOAEL	mg/kg-day	0.000001	Murray et al. (1979) as cited in Sample et al. (1996); based on reproductive- effects study with rats with 2,3,7,8-TCDD.
Chronic LOAEL	mg/kg-day	0.00001	Murray et al. (1979) as cited in Sample et al. (1996); based on reproductive- effects study with rats with 2,3,7,8-TCDD.
Mink Exposure and Risk - Eighteenmile Creek			
Diet	Percent	100	Fish from Eighteenmile Creek assumed to be sole food source.
Fish PCB Concentration	mg/kg (wet wt.)	0.0000063	Maximum TCDD TEQ (mammalian) for bullhead from Eighteenmile Creek (Table 3.3.2)
Estimated Exposure from Diet	mg/kg-day	0.0000014	$((\text{Fish dioxin/furan concentration} \times \text{FIR}) / \text{BW}) \times \text{SUF} \times \text{ED}$
HQ-NOAEL	unitless	1.4	Estimated Exposure from Diet / NOAEL
HQ-LOAEL	unitless	0.14	Estimated Exposure from Diet / LOAEL
Mink Exposure and Risk - Oak Orchard Creek			
Diet	Percent	100	Fish from Oak Orchard Creek assumed to be sole food source.
Fish PCB Concentration	mg/kg (wet wt.)	0.0000010	Maximum TCDD TEQ (mammalian) for bullhead from Oak Orchard Creek (Table 3.3.2)
Estimated Exposure from Diet	mg/kg-day	0.0000002	$((\text{Fish dioxin/furan concentration} \times \text{FIR}) / \text{BW}) \times \text{SUF} \times \text{ED}$
HQ-NOAEL	unitless	0.20	Estimated Exposure from Diet / NOAEL
HQ-LOAEL	unitless	0.02	Estimated Exposure from Diet / LOAEL

Key:

BW = body weight

EMC = Eighteenmile Creek

FIR = food ingestion rate

HQ = hazard quotient

LOAEL = lowest observed adverse effect level

NOAEL = no observed adverse effect level

OOC = Oak Orchard Creek

shading = HQ exceeds 1.0 (see Section 3.3.3.2 for further explanation)

TCDD TEQ (mammalian) = 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent (based on mammalian TEFs)

TEF = toxic equivalency factor.

3.3.3.2 Heron and Mink Risks from PCBs and Dioxins/Furans

The potential risks posed by PCBs and dioxins/furans were estimated by calculating a hazard quotient (HQ) for each receptor and chemical group. The HQ was calculated by dividing dietary exposure (EE_{diet}) by a no observed adverse effect level (NOAEL) or lowest observed adverse effect level (LOAEL), as shown in the following equations:

$$HQ_{\text{NOAEL}} = EE_{\text{diet}}/\text{NOAEL}$$

$$HQ_{\text{LOAEL}} = EE_{\text{diet}}/\text{LOAEL}$$

For a given receptor and chemical, an HQ_{NOAEL} greater than 1 indicates that the estimated exposure exceeds the highest dose at which no adverse effect was observed. Such a result does not imply that the receptor is at risk, especially if the HQ_{NOAEL} is only marginally above 1. An HQ_{LOAEL} greater than 1 suggests that a chronic adverse affect is possible to an individual receptor, assuming that the estimated exposure for that receptor is accurate. For both the heron and mink, the NOAEL and LOAEL used in this assessment are based on a reproductive-effects study (see Tables 3-21 to 3-24 under mammalian and avian toxicity reference values). Hence, the resulting HQs for the heron and mink relate directly to the potential for reproductive impairment, or lack thereof, in the study areas.

Table 3-25 lists the HQs for the heron and mink at Eighteenmile Creek and Oak Orchard Creek. At Oak Orchard Creek, neither PCBs nor dioxins/furans pose a risk to the heron or mink, as all HQs are less than 1. Mink and heron exposure to total PCBs and dioxins/furans at Eighteenmile Creek is greater than at Oak Orchard Creek (see exposure estimate in Tables 3-21 to 3-24), and this difference is reflected in the magnitude of the HQs in Table 3-25, many of which exceed 1 at Eighteenmile Creek. Most importantly, the HQ_{LOAEL} for the mink for total PCBs exceeds 1 at Eighteenmile Creek, suggesting that mink reproduction at Eighteenmile Creek may be adversely impacted by PCBs. The heron at Eighteenmile Creek does not appear to be at risk from either total PCBs or dioxins/furans. Although the heron HQ_{NOAEL} for PCBs marginally exceeds 1 (see Table 3-25), this results does not necessarily indicate that the heron is at risk, for the reason noted above.

Table 3-25 Summary of Heron and Mink Hazard Quotients for Total PCBs and Dioxins/Furans at Eighteenmile and Oak Orchard Creeks

Receptor	Chemical	HQ _{NOAEL}	HQ _{LOAEL}
Eighteenmile Creek			
Heron	Total PCBs	1.7	0.17
	Dioxins/Furans	0.08	0.01
Mink	Total PCBs	6.8	1.4
	Dioxins/Furans	1.4	0.14
Oak Orchard Creek			
Heron	Total PCBs	0.11	0.01
	Dioxins/Furans	0.009	0.001
Mink	Total PCBs	0.44	0.09
	Dioxins/Furans	0.20	0.02

Key:

HQ = hazard quotient
 LOAEL = lowest observed adverse effect level
 NOAEL = no observed adverse effect level
 PCBs = polychlorinated biphenyls

Note:

- ¹ HQ_{NOAEL} and HQ_{LOAEL} are from Tables 3-21 to 3-24.
- ² Shading = HQ exceeds 1. See Section 3.3.3.2 for further explanation.

3.3.3.3 Uncertainty Evaluation

It is common in risk assessments to indicate the main uncertainties affecting the exposure and risk estimates and indicate whether they would tend to under- or over-estimate exposure and risk. The main uncertainties associated with the risk evaluation presented in this section are described below:

- **Chemical Concentrations in Prey.** Measured concentration of total PCBs and dioxins/furans in brown bullheads were used to estimate dietary exposure to the heron and mink. Using these data in the risk evaluation eliminated the uncertainty associated with using modeling approaches to predict chemical concentrations in the prey of these receptors. However, the bullheads analyzed for this study were 9 to 12 inches in length and, therefore, would be considered large prey, particularly for the heron. In reality, the heron and other piscivorous birds in the study areas probably consume smaller fish from various species. Using only data for 9- to 12-inch bullheads in the risk evaluation likely overestimates exposure and risk for the heron because smaller forage fish typically contain lower levels of bioaccumulative contaminants.
- **Diet Composition.** The diet of the heron and mink were conservatively assumed to consist entirely of fish. For the heron, this assumption seems reasonable. However, mink consume other prey, including meadow voles, muskrats, and ducklings (EPA 1993), all of which would be expected to contain lower levels of sediment contaminants than bullheads. Therefore, assuming that mink consume only bullheads likely overestimates their exposure and risk in the study areas.

- **Site Use.** Both the heron and mink were assumed to acquire all of their prey from either Eighteenmile Creek or Oak Orchard Creek, depending on which creek they were assumed to reside at. For the mink, this assumption seems reasonable given the length of the creeks compared with the average home range size of the mink—about 2 kilometers (km) of stream length (EPA 1993). However, the heron is known to forage over a wider area (up to 20 km from colony sites; EPA 1993) and in reality probably forages at various aquatic habitats in the general vicinity of the study creeks. These other foraging areas could contain prey with either lower or higher levels of bioaccumulative contaminants compared with the study areas. Hence, assuming a site use factor of 1.0 for the heron (see Section 3.3.3.1) may lead to either an under- or overestimation of exposure and risk for this receptor.

3.4 Bullhead Deformities and Liver Pathology

This section describes the results of the external and internal examination of brown bullheads for tumors and other deformities (Section 3.4.1) and summarizes the liver pathology evaluation (Section 3.4.2).

3.4.1 External and Internal Examination Results

One hundred brown bullheads, 50 from Eighteenmile Creek and 50 from Oak Orchard Creek, were collected during the August sampling event. The majority of the specimens collected resulted from the targeted sampling efforts; a small number of specimens were incidentally collected during the fish community surveys. The external and internal condition of each fish from both creeks was visually evaluated and recorded according to the procedures outlined in Section 5.3 of the *Field Manual for Assessing Internal and External Anomalies in Brown Bullhead (Ameiurus nebulosus)* (Rafferty and Grazio, 2006; see Appendix A of the QAPP). The datasheets used were similar to the Fish Health Data Sheet in Rafferty and Grazio (2006) and are presented in Appendix F. Digital photography was used to provide further documentation of the external conditions of fish and of the livers (see Appendix F).

Differences were noted between the two creeks regarding the number of types of morphological aberrations (missing/truncated barbels, raised skin lesions, black/yellow pigmentation, ulcers, etc.) and their severity. Fish in Eighteenmile Creek exhibited a broader range of external aberrations and greater frequency of severity scores of 2 and 3 (on a scale of 0 to 3, with 3 being the most severe) compared with Oak Orchard Creek fish. In addition, while just less than half of the fish examined (21) from Oak Orchard Creek exhibited no morphological aberrations at all (score of 0 for each type of aberration), only three fish from Eighteenmile Creek scored 0 for all types of aberrations.

Table 3-26 compares the number and severity of four common types of aberrations observed in fish from the two creeks—raised mouth lesions, raised skin lesions, ulcers, and barbel deformities. The incidence (i.e., rate of occurrence) and severity of raised mouth lesions and barbell deformities was significantly greater

in fish from Eighteenmile Creek than in fish from Oak Orchard Creek. Overall, there was a very low incidence (2) of the most severe type (severity score 3) of ulcers, raised skin/mouth lesions, or barbel deformities. Only one fish from Eighteenmile Creek (EMC-27-BB-LP; see datasheets and photographs in Appendix F) exhibited the most severe rating of 3 for raised mouth and skin lesions (and black pigmentation). No fish from Oak Orchard Creek displayed such severe aberrations.

Table 3-26 Number and Severity of Raised Mouth Lesions, Raised Skin Lesions, Ulcers, and Barbel Deformities in Brown Bullheads from Eighteenmile and Oak Orchard Creeks

External Aberration Categories	Number ¹ and Severity ² of Aberrations		
	Eighteenmile Creek	Oak Orchard Creek	Probability
Raised Mouth Lesions	6 fish with score of 1 2 fish with score of 2 1 fish with score of 3 9 total	1 fish with score of 1 1 fish with score of 2 0 fish with score of 3 2 total	0.027
Raised Skin Lesions	1 fish with score of 1 1 fish with score of 2 1 fish with score of 3 3 total	1 fish with score of 1 0 fish with score of 2 0 fish with score of 3 1 total	0.300
Ulcers	8 fish with score of 1 1 fish with score of 2 0 fish with score of 3 9 total	2 fish with score of 1 1 fish with score of 2 0 fish with score of 3 3 total	0.072
Barbels	19 fish with score of 1 1 fish with score of 2 0 fish with score of 3 20 total	6 fish with score of 1 1 fish with score of 2 0 fish with score of 3 7 total	0.004

Notes:

¹ Out of 50 fish per creek.

² On a scale of 0 to 3 (0=normal, 1=mild, 2=moderate, 3=severe).

³ Two-tailed probability based on Mann Whitney U test (see Section 2.3.3).

According to Baumann and Dabrowski (2006), external aberrations such as those described in this section should not be used to determine the status of the *Fish Tumors and Other Deformities* BUI, but are relevant to the *Degraded Fish and Wildlife Populations* BUI. The greater incidence of raised mouth lesions and barbel deformities in fish from Eighteenmile Creek compared with Oak Orchard Creek suggests that bottom-dwelling fish in the AOC are experiencing some level of impairment.

Lesion: An area of abnormal tissue.

Parasite: An organism that lives on or in another from which it draws its nourishment. Flatworms are common fish liver parasites

Neoplasm: An abnormal mass of tissue that results when cells divide more than they should or do not die when they should. Neoplasms may be benign (not cancerous), or malignant (cancerous); also called tumor.

Hyperplasia: A general term referring to the proliferation of cells within an organ or tissue beyond that which is ordinarily seen. Hyperplasia may result in the gross enlargement of an organ, the formation of a benign tumor, or may be visible only under a microscope. Hyperplasia is considered to be a physiological response to a specific stimulus, and the cells of a hyperplastic growth remain subject to normal regulatory control mechanisms. This stands in contrast to neoplasia (the process underlying cancer and some benign tumors), in which genetically abnormal cells proliferate in a non-physiological manner which is unresponsive to normal stimuli

Alter focus: A pre-neoplastic lesion.

Internal visual observations of the fish from Eighteenmile Creek indicated that there appeared to be a relatively high incidence of discoloration and/or granular appearance to the livers (40 fish had some degree of pale discoloration, and many of those exhibited a granular texture [see photos in Appendix F]). However, the results for the Oak Orchard Creek specimens were similarly high, with 43 fish exhibiting the same or similar characteristics. Observations of parasites and lesions on the livers also were similar (and in low numbers) for specimens from both creeks. Overall, the incidence of visual liver abnormalities in fish from the two creeks was comparable.

3.4.2 Bullhead Liver Pathology

The objective of the liver pathology evaluation was to determine the prevalence of tumors and other abnormalities in the livers of brown bullheads collected from Eighteenmile Creek and Oak Orchard Creek. The work was done to provide data needed to assess the first BUI to be evaluated as part of the current investigation—existence of fish tumors and other deformities (status unknown). The liver histopathology was conducted by Dr. Jeffrey Wolf of Experimental Pathology Laboratories, Inc., in Sterling, Virginia, using 50 bullhead livers each from Eighteenmile Creek and Oak Orchard Creek. The livers were harvested in the field by personnel from Ecology and Environment, Inc. (E & E), preserved, and shipped to Experimental Pathology Laboratories as described in Section 2.1.2.2. Appendix E describes the laboratory methods used to process and examine the livers. The livers were examined for three primary categories of abnormalities: (1) proliferative epithelial lesions such as altered foci, hyperplasia, and neoplasia; (2) pigmented macrophage aggregates and hepatocellular vacuolation; and (3) other non-neoplastic lesions such as inflammation, necrosis, and endoparasitism. Definitions and examples of these abnormalities are provided in Blazer et al. (2006). A summary of the results for each of these categories of abnormalities is provided in Table 3-27 and discussed below. Appendix E provides a complete discussion of the results.

3.4.2.1 Proliferative Epithelial Lesions

A variety of proliferative epithelial lesions, including a low number of benign hepatocellular and bile duct neoplasms, various foci of hepatocellular alteration, and bile duct hyperplasia, were observed in the livers of fish collected from Eighteenmile Creek and Oak Orchard Creek. Proliferative bile duct lesions (bile duct hyperplasia and cholangiomas) were observed only in fish from Eighteenmile Creek; however, the incidences of these two findings were low, and the overall incidences of tumors and altered foci were not significantly different between sites (see Table 3-27).

Table 3-27 Summary of Statistical Comparison of Bullhead Liver Pathology Data from Eighteenmile and Oak Orchard Creeks

Parameter	Count		Probability ¹	Remarks
	Eighteenmile Creek (EMC)	Oak Orchard Creek (OOC)		
Proliferative Epithelial Lesions				
Altered foci	10 total	13 total	0.635	No difference between creeks.
Hyperplasia	4 total	0 total	0.117	No difference between creeks.
Neoplasia (benign)	5 total	2 total	0.436	No difference between creeks.
Pigmented Macrophage Aggregates and Hepatocellular Vacuolation ²				
Pigmented Macrophage Aggregates	34 (grade 1)	44 (grade 1)	0.017	EMC had fewer grade 1 and more grade 2 than OOC.
	13 (grade 2)	5 (grade 2)		
	3 (grade 3)	1 (grade 3)		
	0 (grade 4)	0 (grade 4)		
Hepatocellular Vacuolation	16 (grade 1)	24 (grade 1)	0.007	EMC had more grade 3 than OOC.
	16 (grade 2)	22 (grade 2)		
	18 (grade 3)	4 (grade 3)		
	0 (grade 4)	0 (grade 4)		
Selected Non-Neoplastic Lesions				
Inflammation	62 total	41 total	0.002	Greater in EMC.
Necrosis	15 total	16 total	0.829	No difference between creeks.
Endoparasitism	28 total	17 total	0.027	Greater in EMC.

Key:

- (dash) = no remarks

 Shading = significant difference ($p < 0.05$).

Notes:

1. See Section 2.3.3 for description of statistical methods used.

2. Grade 1 is least severe and grade 4 is most severe.

3.4.2.2 Pigmented Macrophage Aggregates and Hepatocellular Vacuolation

Pigmented macrophage aggregate (PMA) and hepatocellular vacuolation (HV) scores were significantly higher ($p < 0.05$) in fish from Eighteenmile Creek than in fish from Oak Orchard Creek (see Table 3-27). Because these are nonspecific indicators of stress and condition, and because the differences were not dramatic, the biological importance of these results is uncertain.

3.4.2.3 Selected Non-Neoplastic Lesions

The incidences of inflammation and endoparasitism also were significantly higher ($p < 0.05$) in Eighteenmile Creek fish than in Oak Orchard Creek fish (see Table 3-27). Although inflammatory and parasitic lesions were common in the livers of fish from both creeks, the severity of the lesions was often minimal and never

greater than mild. The levels of inflammation and endoparasitism that were evident in the livers of brown bullheads in this study are considered typical for wild caught fish.

3.4.2.4 Relevance to BUI Assessment

Only some of the bullhead liver pathology data collected for this investigation are relevant to understanding the status of the *Fish Tumors and Other Deformities* BUI. Baumann and Dabrowski (2006) recommend that the delisting criteria for this BUI be based on bullhead liver neoplasia (i.e., tumors) because they are reliably associated with contaminant (principally PAH) exposure. Three results from the current study suggest that Eighteenmile Creek may be delisted regarding fish tumor impairments:

- No malignant tumors were observed in the livers of brown bullheads from Eighteenmile Creek;
- There was no significant difference in the number of benign liver tumors in brown bullheads from Eighteenmile and Oak Orchard Creeks; and
- There was no significant difference in the incidence of altered foci in the livers of brown bullheads from either creek. Altered foci are potential pre-neoplastic lesions (i.e., lesions that could lead to liver tumor formation) and therefore are also relevant to evaluating this BUI.

The finding of no fish tumor impairments at the Eighteenmile Creek AOC is not surprising given that the principal contaminant in the AOC are PCBs, not PAHs.

The other types of liver abnormalities evaluated in this study (e.g., vacuolation, inflammation, endoparasitism, etc.) are not considered relevant to determining the status of the fish tumor impairment BUI. These other types of liver abnormalities may provide some overall indication of fish health, but no specific guidance is available regarding the use of these data for assessing BUIs in Great Lakes AOCs.