Final • July 2009

Supplemental Remedial Investigation Report

for the Eighteenmile Creek Corridor Site (Site No. 932121) City of Lockport, New York



Prepared for:

New York State Department of Environmental Conservation

Prepared by:

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International Specialists in the Environment

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Final
Supplemental Remedial Investigation Report
for the
Eighteenmile Creek Corridor Site
(Site No. 932121)
City of Lockport, New York

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Prepared for:

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Table of Contents

Table of Contents (cont.)

Section **Page**

Table of Contents (cont.)

List of Tables

List of Tables (cont.)

List of Tables (cont.)

List of Figures

Table of Figures (cont.)

Figure **Page**

Table of Figures (cont.)

List of Abbreviations and Acronyms

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AMSL	above mean sea level
ASP	Analytical Services Protocols
ASTM	American Society for Testing and Materials
BGS	below ground surface
cfs	cubic feet per second
COPC	chemicals of potential concern
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DER	(New York State) Department of Environmental Remediation
DPT	direct-push technology
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
EEEPC	Ecology and Environment Engineering, P.C.
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
ESA	Environmental Site Assessment
FF/SSH	floodplain forest and successional southern hardwoods
FS	Feasibility Study
FSP	Field Sampling Plan

List of Abbreviations and Acronyms (cont.)

FWIA	Fish and Wildlife Impact Analysis
GIS	Geographic Information System
HASP	Site-specific Health and Safety Plan
HSA	hollow-stem augering
ICP/MS	inductively coupled plasma/mass spectroscopy
ID	inner diameter
IDW	investigation-derived waste
LCS	laboratory control sample
MEDD	multimedia electronic data deliverable
mg/kg	milligrams per kilogram
MS	matrix spike
MSD	matrix spike/matrix spike duplicate
NAD	North American Datum
NAPL	non-aqueous phase liquid
NAVD	North American Vertical Datum of 1988
NCHD	Niagara County Health Department
NHP	(New York State) Natural Heritage Program
NTU	nephelometric turbidity units
NWI	National Wetlands Inventory
NYCRR	New York Code of Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OU	operable unit
PAH	polycyclic (or polynuclear) aromatic hydrocarbon
PCB	polychlorinated biphenyl

List of Abbreviations and Acronyms (cont.)

PID	photoionization detector
PISCES	Passive In Situ Chemical Extraction Sampler
PM	project manager
PPE	personal protective equipment
ppm	parts per million
PQL	practical quantitation limit
PUBHh	plaustrine, permanently flooded, diked/impounded wetlands
PVC	polyvinyl chloride
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	Remedial Investigation
ROD	record of decision
RPD	relative percent difference
SCO	soil cleanup objective
SDG	sample delivery group
SJB	SJB Services, Inc.
SRI	supplemental remedial investigation
SSH	southern successional hardwood
STL	Severn Trent Laboratories
SVOC	semivolatile organic compound
TAGM	Technical Administrative Guidance Memorandum
TAL	Target Analyte List
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound

List of Abbreviations and Acronyms (cont.)

TOC	total organic carbon
TOGS	Technical and Operational Guidance Series
USFWS	United States Fish and Wildlife Service
USGS	United States Geographical Survey
VOC	volatile organic compound

Executive Summary

Ecology and Environment Engineering, P.C. (EEEPC), under contract to the New York State Department of Environmental Conservation (NYSDEC) (Work Assignment No. D004435-019), performed a Supplemental Remedial Investigation (SRI) at the Eighteenmile Creek Corridor Site (Site No. 932121). The Site is located between the New York State Barge Canal (Barge Canal) and Harwood Street in the city of Lockport, Niagara County, New York (see Figure 1-1). The primary purpose of this investigation was to further evaluate sediment contamination in the Eighteenmile Creek stretch between the Barge Canal and Harwood Street and to determine the lateral and vertical extent of contamination in the properties adjacent to the creek. The results of the investigation were also used to assess if Site conditions pose a potential threat to human health or the environment. An Additional Investigation was performed at the Corridor Site in late 2008/early 2009 (EEEPC 2009) to fill in gaps in the RI and SRI data and to facilitate the Feasibility Study (FS). The findings of the Additional Investigation are not included in this report as they will be submitted under separate cover.

The properties associated with the Eighteenmile Creek Corridor Site include the Barge Canal, Upson Park, the White Transportation property, the Former United Paperboard Company property, and the Former Flintkote Plant Site (see Figures 1-1 and 1-2). The headwaters of Eighteenmile Creek (north of the Barge Canal in Lockport, New York) originate from two branches (East and West) immediately north of the Barge Canal. Waters from the East Branch originate from a culverted section of the creek south of the Barge Canal supplemented by water flowing from the Canal through a spillway in the Barge Canal south wall or a plug through the bottom of the canal into an underlying tunnel near the Mill Street bridge. These waters flow north under the Barge Canal near Mill Street toward Clinton Street. The waters from the West Branch originate from the dry dock on the north side of the Barge Canal and flow north toward Clinton Street. Waters from the East and West Branch converge on the south side of Clinton Street and flow under Clinton Street to the Mill Pond on the north side of Mill Street. The Mill Pond is the result of a dam on the United Paperboard property (see Figure 1-2). The waters from Eighteenmile Creek eventually discharge to Lake Ontario in Olcott, New York (located approximately 15 miles north of the city of Lockport). A millrace branching off Eighteenmile Creek containing intermittent flow runs along the

west side of the Former Flintkote Plant Site buildings at 300 Mill Street and empties back into Eighteenmile Creek.

SRI Field Activities

The SRI activities included an initial Site reconnaissance; development of a work plan; a records search; sediment, surface soil, waste (including ash, fill and slag type material), subsurface soil, and groundwater sampling for chemical analysis; health and safety monitoring; development of a Site base map; an investigation-derived waste (IDW) disposal; and preparation of this SRI report. The investigation began in October 2006 with the Site reconnaissance. The final work plan was submitted in March 2007, the field work was performed from April to July 2007, the additional toxicity characteristic leaching procedure (TCLP) analyses of the soil and sediment samples were completed in August 2007, and IDW disposal was conducted in January 2008.

Nature and Extent of Contamination

The following is a summary of the SRI sampling activities and the contaminants of concern detected at the Site.

Sediment. Eighteen sediment coring lines were established perpendicular to the creek at approximately 200-foot intervals (see Figure 2-1). Since north of the Barge Canal the creek originates from two branches (East and West Branches) and because a millrace branches off Eighteenmile Creek along the west side of the Former Flintkote Plant Site buildings at 300 Mill Street, two transects (east and west) were established along lines 1, 2, 3, 14, 15, and 16. A minimum of three sediment cores were attempted in the creek at each transect, but were not always feasible due to the nature of the creek bed (coarse gravel, boulders, or bedrock). A total of 93 sediment samples were collected.

Polychlorinated biphenyls (PCBs) were found in the sediment samples with individual Aroclor concentrations up to 180 parts per million (ppm). Several sediment samples contained PCBs at concentrations greater than the screening level of 0.000023 ppm as specified in the Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999). Moreover, several sediment samples throughout the corridor contained PCBs at concentrations above the higher screening level of 0.06 ppm specified in the draft (not published) Sediment Guidance Values for Use in Assessing Contaminated Sediment in New York State. The Aroclors found in the sediments include 1242 (downstream of the Clinton Street Dam only), 1248 (throughout the Corridor and the Barge Canal), 1254 (throughout the Corridor and the Barge Canal), and 1260 (mainly in the East Branch, one Barge Canal sample, isolated samples along the south United Paperboard parcel, and one downstream sample). Aroclor 1242 was not found in any of the other media.

Lead was found in the creek and canal sediments often at concentrations above the screening levels. Elevated lead levels were found throughout the Site, with a higher concentration downstream of the Clinton Street Dam. Copper was detected

above the screening level in most of these same samples. Polycyclic (or polynuclear) aromatic hydrocarbons (PAHs) were prevalent in the sediment samples throughout the Site.

Surface Soil. Surface soils were collected from off bank soil cores collected along coring lines. Thirty-nine off-bank surface soil samples were collected. Seventeen surface soil samples were also collected at boring locations from the three Corridor properties (Upson Park, White Transportation, and Former United Paperboard Company). In addition, three surface soil samples were collected from a property across from the Former United Paperboard Company property.

PCBs were found in the surface soils throughout the Site at concentrations of total PCBs ranging up to 4.3 ppm (Former United Paperboard Company off-bank sample). PCB levels in several samples exceeded the NYSDEC commercial use Soil Cleanup Objective (SCO) of 1 ppm. The lower unrestricted use SCO of 0.1 ppm was exceeded in several samples at each property. The Aroclors found in the surface soil include: 1248 (sporadic detections throughout the Corridor), 1254 (sporadic detections throughout the Corridor), 1260 (sporadic detections throughout the Corridor), 1262 (only two locations in the downstream section of the Site), and 1268 (only in the former coal plant building east of the United Paperboard property and in two Upson Park samples).

Lead was found in all the samples often at concentrations exceeding the commercial use SCO. Chromium and other metals distribution followed closely the lead distribution in the samples. PAHs were prevalent in the surface soil samples as it was expected for an urban setting.

Subsurface Soils. Forty-three subsurface soil samples were collected from the off-bank core locations established along the sediment/soil coring lines. Additionally, 30 soil borings were installed at the three Corridor properties and 52 subsurface soil samples were collected from these borings. PCBs were detected in several subsurface soil samples at concentration ranging up to 630 ppm (in a boring at the Former United Paperboard Company installed near an area of fill).

PCBs were less common in the subsurface soil samples from the White Transportation and Upson Park and their concentrations were lower than those found elsewhere at the Site. Elevated PCB concentrations in the subsurface samples coincided with the presence of fill. Aroclor 1262 was found in the two subsurface soil samples associated with the surface samples. The highest PCB concentrations were detected in the subsurface soil samples collected from boring 18MC-SB15 installed at the southeast corner of the Former United Paperboard property near Clinton Street. This boring was installed near an area of fill material visible at the ground surface.

Lead and other related metals were found in the subsurface soils at concentrations exceeding the SCOs. Soil boring SB15 contained lower levels of total lead, but an elevated lead concentration was found in the TCLP extract.

Groundwater. Monitoring wells were installed, developed, and sampled at 14 of the soil borings. There were no PCBs found in the groundwater. However, chlorinated volatile organic compounds (VOCs) were found in some wells installed on the west side of the creek. Phenolic compounds were detected in several groundwater and subsurface soil samples primarily on the west side of the creek near the White Transportation property. Glycol-related compounds were detected as Tentatively Identified Compounds (TICs) in the groundwater samples in the same areas. Antimony was detected above groundwater quality standards in most of the groundwater samples, but the levels should be confirmed by further analysis due to the potential interference from high levels of iron.

Other Findings. Comparison of TCLP data to their respective total lead concentrations gathered during this SRI showed inconsistent results. It appears that the leachability of the lead may vary with the type of source material.

Sources

The NYSDEC RI (2006a) found high concentrations of PCBs and metals in sediment in the creek and the millrace adjacent to the Former Flintkote Plant Site; and metals-contaminated fill at locations along the banks of Eighteenmile Creek. The SRI sediment and floodplain (off-bank) soil samples collected for this investigation corroborate NYSDEC's findings. PCB-contaminated sediment in the Barge Canal immediately upstream (to the west) of Eighteenmile Creek was identified by another investigation performed by URS in 2004. Barge Canal sediments collected for the SRI investigation found much lower concentrations of PCBs in the sediment samples adjacent to the property.

The nearby lock and the fluctuations of the water level in the Barge Canal complicate Barge Canal sediment and flow dynamics that may cause irregular and inconsistent contribution of contaminants to the creek. However, based on the available data, including the Additional Investigation findings (EEEPC 2009), Barge Canal sediments do not appear to be currently a significant contributor of PCBs to Eighteenmile Creek sediments. Additionally, the levels of PAHs and metals in the Barge Canal and upstream sediment indicate they are not a source of significant contamination.

The remaining properties along the Eighteenmile Creek Corridor were characterized by areas of high contamination that appear to be related to areas of fill. The type of fill does not appear to be consistent. High levels of lead contamination are found in all fill areas, but PCB contamination was not found in all fill areas. The transport of fill material via erosion and runoff appears to be the primary mechanism for transport of PCBs and lead contamination further downstream.

Significant areas of subsurface fill contaminated with lead were identified in Upson Park, but the high levels of PCBs found during the RI were not confirmed during the SRI. Low concentrations of PCBs were found in the subsurface and off-bank soils at the White Transportation property. A possible source of the low-level PCBs found in the East Branch sediments is the Barge Canal. Although the fill areas on the Upson Park and White Transportation properties could be a source of lead contamination, they are not significant sources of PCB contamination.

On the west side of the Eighteenmile Creek Corridor, the potential fill areas show high levels of lead contamination with a high concentration fill area identified on the west side of the Site near 18MC-MW05 and near line 18MC-L09. Elevated lead concentrations in the fill samples were not associated with significant levels of PCBs. The presence of PCBs in the residential area on the west side of Eighteenmile Creek is most likely due to periodic flooding that has deposited contaminated sediment.

On the east side of the Eighteenmile Creek Corridor, the potential fill areas show both high levels of PCBs and lead contamination. The higher PCB levels found on the east side of the creek may be due to PCB-contaminated fill areas along that side of the creek. An area of high concentration PCB fill was identified southeast of the Former United Paperboard Company property on the east side of the creek. High concentrations of PCBs and lead were also found in the millrace adjacent to the Former Flintkote Plant Site which is a depositional area with intermittent flow. However, the potential for contaminant contribution from fill at this location could not be eliminated based on the data collected.

Surface soils were collected from the property across Mill Street from the Former United Paperboard Company property. Although contamination was found in these samples, there is no apparent transport mechanism for these soils inside the building to reach the creek. Moreover, the only Aroclor detected at this property was Aroclor 1268 found only in four Upson Park off-bank sample locations. Further investigation of this former coal power plant property as a limited source of fill may be warranted.

Due to insufficient data, the source of VOC and glycol contamination in the groundwater was not identified.

Routes of Migration

PCBs and lead were previously identified as the compounds of concern based on historical investigations conducted at the Site and surrounding areas. PCBs were not detected in groundwater. Natural and other man-made mechanisms that can result in the migration of contaminants from their source areas include: surface water flow, infiltration, groundwater flow, subsurface utilities, volatilization, excavation, grading, and vehicular traffic. Because PCBs and lead are not readily volatilized, only surface water flow, infiltration, groundwater flow, subsurface

utilities, and man-made mechanisms are discussed. The observations regarding migration routes are summarized below:

- Surface water flow at the Eighteenmile Creek Corridor Site is a mechanism that potentially allows lateral migration of contaminants from surficial soil into various property drainage ways that discharge into Eighteenmile Creek and could potentially discharge to Lake Ontario in Olcott, New York. Surface water flow at the Eighteenmile Creek Corridor Site occurs primarily during heavy precipitation events or spring snowmelts as surface runoff. The surface areas are mainly covered with vegetation (grassy and wooded areas) but also include areas with exposed soil and fill without vegetative cover, some buildings, and asphalt surface cover.

- Infiltration of precipitation would be expected in areas not covered by relatively impermeable barriers (i.e., concrete or asphalt). PCBs and lead are relatively insoluble in water and are not expected to appreciably leach into groundwater. Other contaminants detected including phenols are more soluble in water and may be subject to infiltration. Twenty-five percent of the corridor is covered by paved areas or buildings that would reduce direct infiltration and facilitate overland flow/runoff.

- Overburden groundwater flow would be expected to allow both vertical and lateral migration of contaminants located within the saturated zone. PCBs and lead are not readily soluble in groundwater and there were no PCB detections and very few lead detections in the groundwater samples. Therefore, PCBs and lead found in Site soils do not appear to impact groundwater at the Site.

- Based on historical review, the only ground utility present in the Eighteenmile Creek Corridor Site is a storm sewer crossing the creek approximately 25 to 50 feet downstream of the dam. Several sewer manholes were observed on both banks (east and west) of the creek. Although PCBs are not readily soluble in water, water flowing through pipe bedding containing PCB-laden particles can provide a means of transport for these particles into or from the creek and potentially beyond the Eighteenmile Creek Corridor Site.

- Considering that there were multiple surface and subsurface soil PCB detections above the SCO, it is possible that PCB-laden Site soils could be transported to other areas on and off Site during daily activities in non-paved areas or if an excavation were to occur. If there are no land restrictions to prevent excavations at this Site; then exposing the contaminated material would also facilitate soil transport via surface water flow.

Qualitative Human Health Risk Evaluation

A qualitative human health exposure risk assessment identified four groups of receptors with distinctly different potentials for human exposure to contaminants in the Eighteenmile Creek Corridor. These receptors include: residents of the

homes along Water Street with back yards abutting the creek (direct contact with contaminated soils in their yards and stream bank sediments and creek water, and through consumption of fish caught from the creek); visitors to the Eighteenmile Creek Corridor (direct contact with soils, sediment and creek water in the Corridor); Eighteenmile Creek anglers (direct contact with soils, sediment, and creek water in the corridor and through consumption of fish from the creek); and site workers at the Former United Paperboard Property (through direct contact with soils on the United Paperboard site).

Screening Level Ecological Risk Assessment

The ecological risk assessment (ERA) determined that the Eighteenmile Creek Corridor Site contains aquatic and terrestrial habitats capable of supporting a wide variety of aquatic organisms and wildlife. These ecological receptors could be exposed to the elevated levels of PCBs, copper, lead, and zinc found in floodplain soil, sediment, and/or surface water. Given that exposure pathways exist between Site-related contaminants and ecological receptors at the Site, if Site soils and sediments are not remediated or exposure pathways are not modified during site remediation to ameliorate the ecological risks, further evaluation, specifically a criteria-specific analysis and toxic effect analysis (Steps 2B and 2C in NYSDEC 1994), may be necessary to quantify these risks.

Recommendations

Additional data necessary to identify potential remedial alternatives to mitigate contamination problems may be necessary. A more detailed examination of the physical properties of the fill material and related contamination, along with a refined delineation of these fill areas may be necessary to characterize the transport and erosion of the material downstream and the extent of potential source material. Analysis of the contamination related to particle size may help predict whether the fill will deposit contamination or transport the contamination. PCB contamination has been found throughout the creek bed all the way to Lake Ontario. The presence of VOCs in the groundwater indicates a potential presence of VOCs in the soils. Testing for VOCs may be necessary for the Feasibility Study.

1 Introduction

1.1 Purpose of the Remedial Investigation

Ecology and Environment Engineering, P.C. (EEEPC) performed a Supplemental Remedial Investigation (SRI) at the Eighteenmile Creek Corridor Site (Site No. 932121) (herein referred to as the Site), located between the New York State Barge Canal (Barge Canal) and Harwood Street in the city of Lockport, Niagara County, New York (see Figure 1-1). This work was performed under the State Superfund Contract Work Assignment No. D004435-019 accepted by EEEPC on September 27, 2006, from the New York State Department of Environmental Conservation (NYSDEC), Division of Environmental Remediation (DER).

The purposes of this SRI were to:

- Better define the nature and extent of sediment contamination in Eighteenmile Creek from the Barge Canal to Harwood Street to assist in the evaluation of remedial alternatives;
- Determine the thickness of Eighteenmile Creek and millrace sediment throughout the Eighteenmile Creek Corridor Site;
- Determine the lateral and vertical extent of contamination in soil, fill, and groundwater at properties adjacent to the Site that could be potential sources of contaminants to the creek;
- Generate a qualitative human health exposure risk assessment that documents whether conditions at the Site pose an actual or potential human health exposure risk;
- Generate an ecological risk assessment (ERA) that documents whether conditions at the Site pose a potential ecological risk; and
- Provide the data necessary to identify potential remedial alternatives to mitigate contamination problems that pose threats to public health or the environment.

1.2 Site Background

1.2.1 Site Description

The properties associated with the Eighteenmile Creek Corridor Site include the Barge Canal, Upson Park, White Transportation property, Former United Paperboard Company property, and the Former Flintkote Plant Site (see Figures 1-1 and 1-2). The headwaters of Eighteenmile Creek (north of the Barge Canal in Lockport, New York) originate from two branches (East and West) immediately north of the Barge Canal. Waters from the East Branch originate at the spillway in the Barge Canal near the Mill Street bridge where canal waters join with water from the culverted section of Eighteenmile Creek south of the Barge Canal. These waters flow north under the Barge Canal near Mill Street toward Clinton Street. The waters from the West Branch originate from the dry dock on the north side of the Barge Canal and flow north toward Clinton Street. Waters from the East and West Branch converge on the south side of Clinton Street and flow under Clinton Street to the Mill Pond on the north side of Mill Street. The Mill Pond is the result of a dam on the United Paperboard property (see Figure 1-2). The waters from Eighteenmile Creek eventually discharge to Lake Ontario in Olcott, New York.

Eighteenmile Creek, located in the heart of Niagara County, is surrounded by six residential townships, and many citizens own creek-front property. The creek is used extensively for fishing, boating, and recreation. The sampling locations are primarily in a residential area. Sediment contamination in the project area has impacted residential properties adjacent to the creek.

During operation, the Barge Canal discharges approximately 50 cubic feet per second (cfs) of water into the East and West Branches of the creek. During dry periods, the Barge Canal provides a significant portion of the creek's flow.

1.2.2 Site History

Upson Park

Upson Park is located at 100 Clinton Street in the city of Lockport, Niagara County, New York (see Figure 1-2). The Site is bordered by Clinton Street and a residential area to the north, the West Branch of Eighteenmile Creek and the Barge Canal Authority to the east, the Barge Canal to the south, and a wooded area to the west. The land is currently listed as a town park and contains picnic areas and a walking trail along the canal. There is a parking area on the Site, but no standing buildings. The City of Lockport Assessor's Office lists the parcel (Parcel ID 109.10-1-76) as consisting of 5.9 acres of land owned by the City of Lockport. In the mid 1880s, this property contained a canal boat building company that was no longer in operation by 1892. A pulp mill operated at the Upson Park property between 1919 and 1928 and the pulp company operated until at least 1928. In 1914, the mill company name changed to the United Paper Board Company. By 1948, operations at the mill had been shut down and the buildings on the property were vacant. By 1969, the buildings on the property had been

demolished. Additional detail concerning the history of this property can be found in the 2007 Phase I Environmental Site Assessment (ESA) report prepared by EEEPC.

The White Transportation Property

The White Transportation property is located at 30-40 Mill Street in the city of Lockport, Niagara County, New York (see Figure 1-2). The property is bordered by the Barge Canal to the south, Mill Street to the east, Clinton Street to the north, and the East Branch of Eighteenmile Creek to the west. The northern portion of the White Transportation property operated as the New York Cotton Batting Company from at least 1909 until at least 1920, as the James O-Ring Company during the early 1940s, and White Transportation from 1948 until the late 1990s when operations ceased. Use of the northern portion of the White Transportation property during the 1920s and 1930s is unknown. The southern portion of the subject property operated as the Niagara Paper Mill from at least 1875 until approximately 1898, as a box factory by D.C. Graham in at least 1903, as a cold storage facility by L. Huston from at least 1903 until at least 1937, as the Lockport Leather Board Company from at least 1909 until sometime in 1914, as the Simon William Brewery from at least 1940 to 1952; and White Transportation from 1952 until the late 1990s, when operations ceased. The entire subject property (109.10-1-60, 109.10-1-61, 109.10-1-58, and 109.10-1-59) is owned by Gertrude W. White (estate attorney is Mr. Ben May). Currently, there are only three trailers on Site: one locked trailer located near the front of the Site building facing Mill Street and two trailers near the bank of the East Branch of Eighteenmile Creek. One of the trailers along the bank contained 55-gallon drums, two of which were lying on the ground behind the trailer. One of the drums on the ground had an open bung and contained an oily liquid. The NYSDEC Spills Department was notified on the day of the inspection (October 25, 2006) by NYSDEC personnel present during the Site visit. The trailers and drums were later removed from the property under the supervision of NYSDEC. Additional detail concerning the history of this property can be found in the 2002 Phase I ESA report prepared by TVGA Consultants (TVGA 2002) and the updated 2007 Phase I ESA prepared by EEEPC (EEEPC 2007a).

The Former United Paperboard Company Property

The Former United Paperboard Company property is located at 62 and 70 Mill Street (see Figure 1-2). Sixty-two Mill Street is the larger of the two parcels and is bordered by Olcott Street to the north, Mill Street to the east, Clinton Street to the south, and Water Street to the west. The property is currently occupied by Duraline Abrasives, Inc., and contains one warehouse building. Seventy Mill Street is a vacant lot with fill material and building ruins and is bordered by the Flintkote site to the north, Mill Street to the east, Olcott Street to the south, and Eighteenmile Creek to the west. An abandoned transformer pad and poles are present on the west bank of the creek, immediately downstream of the dam located in the creek behind the building on 62 Mill Street. The ponded water behind the dam is referred to as the Mill Pond. A storm sewer line also crosses the creek

approximately 25 to 50 feet downstream of the dam, and several sewer manholes were observed on both banks (east and west) of the creek. Water in the pond was high (close to the top of the dam), and flow beneath the dam was swift. Water from the pond leaks around the west side of the dam and flows adjacent to or over the top (during high flow conditions) of the abandoned transformer pad. The City of Lockport Assessor's Office lists the parcel (Parcel ID 109.10-1-57) as consisting of 3.7 acres and Parcel 109.06-3-11 as consisting of 1.2 acres of land owned by Tri-Side LLC.

In late 1880s and early 1890s, the 62 Mill Street United Paperboard property was owned and operated by the Jackson Lumber Company with the building designated as the Saw Mill and Sash & Blind Manufacturing. In 1892, Sash & Blind added a pulp mill and box facility to its operations. By 1898 the lumber company had shut down their operations and the area previously occupied by Sash & Blind became the Traders' Paper Company paper mill, which became United Box Board and Paper Company (Mutual Risk) in 1903. The 70 Mill Street United Paperboard property was owned by United Box Board Company in 1909. United Box Board Company became United Paper Board Company in 1914, which changed its name to United Paperboard Company in 1928, which then became United Board's Carton Corporation in 1948 and Beaverboard Company, Inc., in 1969. By 1969 the buildings have been vacated and dismantled. Additional detail concerning the history of this property can be found in the 2007 Phase I ESA report prepared by EEEPC.

The Former Flintkote Plant Site

The Former Flintkote Plant Site (198, 225, and 300 Mill Street) in the city of Lockport, Niagara County, New York (see Figure 1-2) is bounded by Eighteenmile Creek to the west, Mill Street to the east, a commercial property to the north, and vacant land of the Former United Paperboard Company to the south. William Street, which is no longer open to vehicular traffic, bisects the site. A dam approximately 10 feet high diverts Eighteenmile Creek westward for approximately 300 feet along William Street (located on top of the dam). The creek continues northward and returns to its original natural channel farther downstream. The two sluice gates located at the east end of the dam have been closed for at least 30 years. A millrace containing a sluggish stream approximately 6 inches to 1 foot deep runs along the west side of the buildings at 300 Mill Street and empties into Eighteenmile Creek (see Figure 1-2). The Flintkote property was purchased from the Beckman Dawson Roofing Company in 1928 and was operated as a manufacturer of felt and felt products. Production of sound-deadening and tufting felt for use in automobiles began at Flintkote in 1935 and continued until operations ceased and the plant closed in December 1971. It is suspected that composite laminates observed at the southernmost demolished building on the 198 Mill Street Property may have also been manufactured at Flintkote. A portion of the Flintkote property at 300 Mill Street near William Street was formerly listed as Site No. 932072 in the Registry of Inactive Hazardous Waste Disposal Sites in New York State (NYS) with a classification code of 3 because of seven drums

containing sweepings, solid materials and polychlorinated biphenyl (PCB) transformer oil that were stored in the basement of an on-site building. In January 1984, these drums were removed from the site by a waste oil processor and the site was removed from the Registry in 1985. In 1989, a number of drums containing chemicals were found in various locations throughout the buildings at 300 Mill Street with 28 of these drums containing hazardous wastes. These drums were disposed of off-site in May 1991 during a NYSDEC drum removal action. Additional detail concerning the history of this property can be found in the Record of Decision (ROD) prepared by NYSDEC in March 2006 (NYSDEC 2006b).

1.2.3 Previous Investigations

Between 1987 and 1998 NYSDEC collected 10 sediment samples from Eighteenmile Creek between Remick Parkway south of the Barge Canal and the Former Flintkote Plant Site in the city of Lockport (see Figure 1-3). In 1996 the NYSDEC DER collected six additional sediment samples from the area between Clinton Street and the Former Flintkote Plant site. PCBs were detected in all 15 samples analyzed. PCB levels in 11 of these samples exceeded NYSDEC's sediment criteria (606.0 micrograms per kilogram [µg/kg]) for chronic toxicity to benthic aquatic life and the NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) No. 4046 surface soil cleanup objective (1,000 µg/kg). Lead was detected in all 11 samples analyzed, with concentrations exceeding the sediment criteria (110 milligrams per kilogram [mg/kg]) for the severe effect level in 10 samples and concentrations exceeding the TAGM 4046 soil cleanup objective (400 mg/kg) in five samples. Other inorganic contaminants also present in Eighteenmile Creek sediment at concentrations exceeding sediment criteria include arsenic, cadmium, chromium, and iron (once); nickel (twice); mercury (three samples); silver (four samples); copper (nine samples); and zinc (ten samples) (NYSDEC 2006a). The most contaminated sample was a sediment sample collected near the Former Flintkote Plant site.

In April 2002, the owner of the 143 Water Street property submitted a request to the Niagara County Health Department (NCHD) for sample collection and evaluation of soils from their property. In response to this request NCHD and NYSDEC conducted an inspection of the property. Discussions with the property owners revealed that: (1) a family case of cancer inspired research into available environmental data regarding the creek; (2) due to debris or ice blocking the cross-culverts under William Street, Eighteenmile Creek occasionally floods the yard of 143 Water Street (severe flooding once every two years and lesser flooding several times per year); (3) a small strip of wooded property (about 20 feet wide) between Eighteenmile Creek and the 143 Water Street property also frequently floods. The property owners raised concerns over possible contaminant migration from Eighteenmile Creek (especially elevated PCB levels) and over the poor maintenance of the creek by the city of Lockport that contributes to the flooding issues. During the site visit the NCDH identified a portion of the 143 Water Street yard that would flood during high water events and a small vegetable garden was observed within the reported flood area. Per the NCHD's request,

NYSDEC collected four samples (SS-1 through SS-4) from the property at 143 Water Street (see Figure 1-4). Based on the results of this sampling event, the NYS Department of Health (NYSDOH) requested 15 additional samples from properties along Water Street, including one sediment sample from Eighteenmile Creek and two waste samples from wooded property south of the Former Flintkote Plant site on Mill Street (NYSDEC 2002). These samples (SS-5, and SS-8 through SS-21; SED-6; and SS-6 and SS-7, respectively) were collected on July 23, 2002 (see Figure 1-4 and 1-5). Two soil samples (SS-6 and SS-7) and three sediment samples (SED-7, SED-8 and SED-9) near the Clinton Street dam from an area identified as a potential source of PCBs to Eighteenmile Creek were collected in November 2002 by NYSDEC (see Figure 1-4) (NYSDEC 2003).

In the fall of 2005 NYSDEC completed a remedial investigation (RI) of the Eighteenmile Creek Corridor Site in order to better define the nature and extent of sediment contamination in Eighteenmile Creek and the millrace, to further evaluate the impact of creek flooding on residential properties along Water Street, and to evaluate potential sources of contaminants to the creek (NYSDEC 2006a). These source areas include the Former Flintkote Plant Site, the White Transportation property, the Former United Paperboard Company property, Upson Park, and the Barge Canal (see Figure 1-2). Sample locations from the RI are included on Figures 1-4 through 1-7. During this RI, elevated concentrations of PCBs and metals (i.e., arsenic, chromium, copper, lead, and zinc) were found in sediment samples from Eighteenmile Creek and the millrace adjacent to the Former Flintkote Plant site. Additionally, contaminated sediment was found in the Barge Canal upstream of Eighteenmile Creek. PCBs, arsenic, chromium, copper, lead, and zinc levels detected in the fill at Upson Park, the White Transportation property, the Former United Paperboard Company property, and the Former Flintkote Plant Site may potentially adversely impact Eighteenmile Creek. However, these potential source areas were not fully investigated and the volume of contaminated sediment requiring remediation was not quantified during the RI.

The NYSDEC RI identified several sites adjacent to the Eighteenmile Creek Corridor Site as potential suspected contributors of contaminants to Eighteenmile Creek. A brief description of previous evaluations and investigations completed at these sites is presented below.

A Phase I ESA for the United Paperboard Company and Upson Park was prepared by EEEPC for NYSDEC. No other previous investigations have been completed at these properties

As stated above, a Phase I ESA of the White Transportation property was completed in 2002 by TVGA Consultants for the Niagara County Department of Planning, Development, and Tourism (TVGA Consultants 2002). On November 3, 2005, a Site reconnaissance was conducted by NYSDEC as part of the Eighteenmile Creek Corridor RI. In early 2007, EEEPC updated the Phase I ESA (EEEPC 2007a).

The Former Flintkote Plant Site was cited by the NYSDEC Division of Water as a potential source of contaminants to Eighteenmile Creek based on analytical results for two ash samples collected by NYSDEC (NYSDEC 1996). Two more samples from the island collected by the DER in August 1996 failed the Toxicity Characteristic Leaching Procedure (TCLP) regulatory limit for lead (characteristic hazardous waste D008). A site investigation of the Flintkote property conducted in 1999 by NYSDEC determined that the Flintkote property had received various wastes, refuse, and debris over the years, with much of the waste being visible at the surface and along the Eighteenmile Creek embankments and millrace (NYSDEC 2000). In 2003, a site investigation of the Former Flintkote Plant Site was conducted by Niagara County under NYSDEC's Brownfield program to fill in data gaps in NYSDEC's 1999 investigation. The results of the Niagara County site investigation were consistent with the NYSDEC site investigation results. A ROD for the Former Flintkote Plant Site was issued in March 2006 (NYSDEC 2006b).

1.2.4 Additional Investigation

An additional field investigation was performed at the Corridor Site in late 2008/early 2009 (EEEPC 2009) to fill in gaps in the RI and SRI data and to facilitate the Feasibility Study (FS). The objectives of the Additional Investigation were to:

- Determine whether the Barge Canal is a significant source of contamination to Eighteenmile Creek by qualitatively estimating the contribution of contamination to Eighteenmile Creek from the canal and gain a better understanding of sediment transport from the canal to Eighteenmile Creek. These data will be used to complete the FS for the Site; and
- Understand the presence of volatile organic compounds (VOCs) in the groundwater in the Upson Park and former United Paperboard properties, even though groundwater is not part of the FS operable units (OUs).

The findings of the Additional Investigation were submitted as an addendum to the Final SRI report (EEEPC 2009).

2 Supplemental Remedial Investigation Activities

2.1 Site Reconnaissance and Records Search

Prior to work plan development, EEEPC reviewed Site records, conducted a Site reconnaissance visit with the NYSDEC project manager (PM) on October 25, 2006, and made supplemental Site visits on November 30, 2006 and January 8, 2007. The main purpose of these Site visits was to identify potential sampling locations and equipment access with Site personnel.

As part of this Supplemental RI, NYSDEC provided EEEPC with copies of pertinent historical Site investigation reports. These reports were reviewed and incorporated into the work plan and this SRI report.

EEEPC reviewed available reports from previous Site investigation activities including:

- *NYSDEC. March 2006. Record of Decision for the Former Flintkote Plant Site;*
- *NYSDEC. 2006. Draft Remedial Investigation Report for the Eighteenmile Creek Corridor Site;*
- *NYSDEC. June 2002. Sampling Report, Former Flintkote Plant Site, 143 Water Street, City of Lockport, Niagara County, New York;*
- *NYSDEC. March 2003. Sampling Report, Water Street Properties, City of Lockport, Niagara County, New York;*
- *NYSDEC. December 2001. Final Report Eighteen Mile Creek Sediment Study;*
- *TVGA. 2005. Final Remedial Alternatives Report, former Flintkote Site;*
- *TVGA. 2002. Phase I Environmental Site Assessment for White Transportation 30-40 Mill Street, Lockport. Niagara Country, New York; and*

- *URS. 2006. Summary Report for PCBs Detected in NYS Barge Canal Sediments During the Investigation of NYSEG's Transit Street and State Road Former MGP Sites.*

The environmental geographic information system (GIS) shape files and property ownership data were obtained and used for this Site. An additional literature search included visiting various town and county offices to obtain historical aerial photographs and property data and obtaining and reviewing Sanborn maps.

Following the background review, a Phase I ESA for the source area properties was completed. This ESA was completed in conformance with current American Society for Testing and Materials (ASTM) standards, and included a Site reconnaissance; regulatory database review; and review of historical land title records and state and local records, historical aerial photographs; historical Sanborn facility maps, and historical United States Geographical Survey (USGS) topographic maps. On January 10, 2007, after reviewing the existing Site documentation and completing the Phase I ESA for the United Paperboard Company and Upson Park properties, EEEPC held a meeting with NYSDEC regarding the draft work scope. A Site base map was also developed prior to initiation of the field investigation (see Figure 2-1).

2.2 Field Activities

Field activities at the Eighteenmile Creek Corridor Site included: sediment thickness investigation; sediment, surface soil, waste (including ash, fill and slag type material), subsurface soil, and groundwater sampling for chemical analysis; installation of soil borings and groundwater monitoring wells; health and safety monitoring; development of a Site base map; and investigation-derived waste (IDW) disposal.

The first part of the field activities was conducted between April 16 and July 12, 2007. During this effort, 30 soil borings were installed and sampled. Monitoring wells were installed and developed at 14 of these borings. The sample collection effort included, 59 surface soil (includes 39 off-bank surface soil samples, 17 surface soil samples collected from the three Corridor properties, and three surface soil samples collected from a property across from the Former United Paperboard Company property), 95 subsurface soil (includes 43 off-bank subsurface soil samples and 52 subsurface soil samples collected from borings installed at the three Corridor properties), 93 sediment samples, and 14 groundwater samples. All samples were analyzed for PCBs and select metals (arsenic, chromium, copper, lead, and zinc). Select samples were also analyzed for semivolatile organic compounds (SVOCs), pesticides, target analyte list (TAL) metals, and total organic carbon (TOC). A summary of the samples collected and the analyses performed is presented in Table 2-1. Table 2-2 presents a list of the SRI samples collected from the transects. Prior to initiation of sampling activities, sample locations were staked by EEEPC during two separate Site visits (March 26 and April 9, 2007).

All SRI field activities were performed in accordance with the work plan for the Eighteenmile Creek Corridor SRI developed by EEEPC and approved by NYSDEC in February 2007 (EEEPC 2007b). All samples were labeled, packaged, and shipped according to procedures outlined in the Field Sampling Plan (FSP). Sample locations are presented in Figure 2-1 and a sample collection summary, including sample identification and analyses performed, is provided in Tables 2-1 and 2-3. Sample depths and locations are summarized in Table 2-4.

Deviations from the work plan, including total number of samples, sample locations, and sampling procedures, occurred as a result of unanticipated field conditions and were approved by NYSDEC during the course of the investigation. These deviations included:

- Shallow refusal encountered during soil boring installation led to a change in the drilling method from the planned direct-push technology (DPT), to hollow-stem augering (HSA) and continuous sampling via split spoon;

- Due to shallow bedrock and rubble encountered during HSA, wells 18MC-MW09, -MW14, -MW15, and -MW16 required bedrock coring in order to drill to the required depth;

- Since all monitoring wells were installed with a drill rig (HSA and in some case rock coring), the wells were completed using 2-inch polyvinyl chloride (PVC) riser and screen instead of the 1-inch PVC riser and screen planned;

- 18MC-MW02 was first drilled via HSA and the first subsurface soil sample was collected. Due to early refusal, the boring was re-drilled adjacent to the first borehole and the second subsurface soil sample was collected from the new boring. Therefore, the 18MC-MW02-Z2 was not collected from the same boring/location as the associated surface soil (SS02) and Z1 shallow subsurface soil (18MC-MW02-Z1);

- To offset increased drilling costs resulting by the change in drilling techniques, two monitoring wells were eliminated (18MC-MW03 and 18MC-MW07) prior to resuming field activities, with the approval of the NYSDEC PM. The associated borings and subsurface soil samples were also eliminated;

- 18MC-MW02 was relocated slightly southwest of the originally proposed location, toward the location of eliminated well 18MC-MW03;

- 18MC-MW05 was relocated slightly southeast of the originally proposed location, closer to Eighteenmile Creek, and toward the location of eliminated well 18MC-MW07;

- A groundwater sample was not collected from monitoring well 18MC-MW09 because it was dry;
- Soil boring 18MC-SB11 was moved approximately 50 feet west of the planned location due to shallow (1 to 2 feet below ground surface [BGS]) refusal;
- One soil boring was added in the field by the NYSDEC PM (18MC-SB15);
- One additional sediment coring location (two samples: 18MC-AS-S01-Z1 and –Z2) was installed in the southwest portion of the White Transportation property per the NYSDEC PM's request;
- Collection of mid-channel sediment samples was not possible along transects 18MC-L01E, -L10, -L15 and -L16, and collection of an east bank sediment sample was not possible along transect 18MC-L18 due to the absence of sediment at the bottom of the channel at these locations;
- Due to various matrix interferences encountered in the analysis of the soil and sediment samples, pesticide analysis of some samples was not performed on the subsurface soil samples collected from the monitoring well borings. For the same reasons, a sample clean-up step was added to the analysis of the samples that were analyzed for pesticides;
- Samples 18MC-L01W-S02-Z1 and –Z2 were not analyzed for TOC, however, the two samples from the corresponding S01 location (west bank) were analyzed for TOC;
- All but one of the centerline deep samples (Z2) were analyzed for SVOCs and pesticides as well as the planned PCB, selected metals, and TOC analyses; and
- Some surface sediment samples were not collected from the 0 to 2–inch depth interval, due to the presence of gravel in the top portion of the creek bed.

The methodologies and specific goals of each of the aforementioned activities are described in Sections 2.2 through 2.6. Analytical test results are discussed in Sections 4 and 5. A photographic log of the activities and sampling locations is presented in Appendix A.

2.2.1 Health and Safety Monitoring

During the field investigation, the Site safety officer performed air monitoring to characterize potential airborne vapor and particulate concentrations, including those of volatile organic vapors and explosive gases. The air monitoring was conducted for the protection of Site workers and the community and to characterize environmental samples. Action levels for each monitoring instrument were detailed in the Site-specific Health and Safety Plan (HASP) (EEEPC 2007b).

Levels of organic vapors were measured in the workers' breathing zone, for which action levels are based, and downwind of intrusive sampling activities. Oxygen and combustible gas monitors were positioned at a location (e.g., at the top of the boreholes) that measured a worst-case contaminant level and provided the earliest possible warning that a hazardous condition may form.

Continuous organic vapor monitoring was conducted during drilling/sampling using a photoionization detector (PID) (MiniRAE 2000) equipped with a 10.6 electron-volt lamp. Concentrations were monitored directly on the instrument display by the EEEPC Site-safety officer and were frequently recorded in a notebook during intrusive activities. No organic vapor concentrations were detected above background during drilling activities.

Prior to initiating intrusive subsurface activities, EEEPC's drilling subcontractor (SJB Services, Inc., of Hamburg, New York [SJB]) coordinated with the Underground Facilities Protection Organization to identify and locate underground utilities.

2.2.2 Coring and Sampling in the Creek and the New York State Barge Canal

Coring was performed between April 18 and April 25, 2007. In order to determine sediment thickness in Eighteenmile Creek and the nature and extent of contaminated sediment and soil along the creek for the purpose of evaluating remedial alternatives, 18 lines were established at approximately 200-foot intervals perpendicular to the creek (see Figure 2-1). Some of the lines (1, 2, 3, 14, 15, and 16) have both an east and west component. A minimum of three sediment cores was attempted in the creek at each transect. These cores were collected at the two banks and at the centerline of the creek. Additional soil cores were collected off-bank at 50-foot intervals along most of the lines (see Figure 2-1 and Tables 2-2 and 2-3). As per the work plan, off-bank cores were established only at areas with data gaps.

As stipulated in the work plan, transect and core locations were slightly modified from the planned locations based on field conditions. The cores were advanced to refusal, which on average was encountered between 1 and 1.5 feet below the top of the creek bed. Sampling was conducted in accordance with the methodologies presented in the FSP (Appendix A of the SRI Work Plan).

Coring was performed by the drilling subcontractor (SJB) and was overseen by EEEPC. Sediment and soil coring along transects was performed using a coring device comprised of a macrocore-type sampler with dedicated acetate liners. The sample collection device was driven by a slam bar until refusal was encountered. Upon retrieval of the core, the acetate liner was cut open and the contents screened for VOCs using a PID. The contents of the liner were then logged, described, and where applicable, a sample(s) was collected for laboratory analysis. Sediment texture, visual observations, presence or absence of sheens and odors,

potential sources of contamination (e.g., non-aqueous phase liquid [NAPL]) and water depth were recorded for each core. Table 2-4 summarizes observations made during coring. Table 2-5 summarizes the sediment coring depths and recoveries, as well as the estimated sediment thickness. Samples were collected for analysis as described below. A portion of each sample was also archived by the laboratory for potential TCLP metals analysis. Upon review of the results from the metals analyses of the sediment and off-bank soil samples collected from the 18 transects, 29 samples were submitted for TCLP analysis.

Sediment Core Samples

Seventy-nine sediment coring locations were planned for this SRI, including 24 cores in the Eighteenmile Creek centerline (-S02) and 48 in the Eighteenmile Creek banks (-S01 and -S03, west and east bank, respectively) of the creek, one upgradient (18MC-UP-S01), and six in the Barge Canal (18MC-BC01 through –BC06). Collection of mid-channel sediment samples was not possible along transects 18MC-L01E, -L10, -L15 and -L16, and collection of an east bank sediment sample was not possible along line 18MC-L18 due to the rocky creek bottom. In addition, swift current at the mid-channel location of transect 18MC-L01E made collection of a mid-channel sediment sample impossible due to concern for worker safety.

A total of 75 cores were established in the creek. The upgradient sediment core location was established upstream of the Barge Canal and upstream of the culverted portion of the creek (18MC-UP-S01). The upstream location was intended to serve as background samples to be used to assess the nature and magnitude of contamination that can be attributed to the study area. A total of 93 sediment samples were collected. At least one sample was collected at each core location. At 16 locations two samples were collected (-Z1 and -Z2) and at one location three samples were collected (-Z1 through –Z3).

Centerline Cores (20). At each location, at least one sample (-Z1) was collected. At most core locations, this sample was collected from the 0 to 2-inch interval. At locations where there was no sediment in the top 2 inches (i.e., gravel was present), the top sample (-Z1) was collected from a deeper interval. The selection of the interval sampled depended (no deeper than 1 foot) on the core recovery and field (visual and olfactory observations and PID readings) observations. Where core penetration (eight locations) was more than 1 foot, an additional sample was collected (-Z2). Location 18MC-L05W-S02 core penetration reached 3 feet. However, due to poor recovery, a third sample was not collected at this location. Similar to the Z1 interval selection, the Z2 depth interval depended on the field observations. The majority of the centerline samples were submitted for PCB, select metals (arsenic, chromium, copper, lead, and zinc), SVOC, pesticide, and TOC analysis. The two samples from location 18MC-L01W-S02 (-Z1 and –Z2) were not analyzed for TOC and 18MC-L02W-S02-Z2 was not analyzed for pesticides and SVOCs.

Bank Cores (48). At least one sample was collected at the bottom of each core. At eight locations, where core penetration was deeper than 1 foot, an additional sample was collected from the native soil if encountered, or from the interval that exhibited different lithology than the shallow sample, or from the bottom of the core. One location (18MC-L05W-S03), where the coring extended to 4 feet below the top of the creek bottom and there was sufficient core recovery, a third sample was collected (-Z3).

All bank sediment samples were submitted for PCB and select metals (arsenic, chromium, copper, lead, and zinc) analysis. Two samples (18MC-L01W-S01-Z1 and –Z2) were also submitted for TOC analysis; and two samples (18MC-L01E-S01-Z1 and 18MC-L01E-S03-Z1) were also submitted for pesticides, SVOC, and TOC analysis. Finally, the samples from the added coring location at the area where kids were observed playing (18MC-AS-S01-Z1 and –Z2) were submitted for TAL metals/mercury, PCBs, pesticides, and SVOCs.

Upstream Core (one). A core was established at the centerline of the creek upstream of the Barge Canal just before the stream is culverted. Two samples were collected at this location, one from each foot penetrated during coring. All upstream samples were tested for PCBs, select metals (arsenic, chromium, copper, lead, and zinc), SVOCs, pesticides, and TOC.

Barge Canal Cores (six). Cores were established at six locations in the Barge Canal (transects 18MC-BC01 through -BC06) to collect sediment samples from the bottom of the Barge Canal. Three cores were established in the vicinity of the spillway and three in the vicinity of the dry dock. Barge canal sediment core samples were collected from the top 2 inches of each core. In all cases, refusal was encountered within 2 to 5 inches of the surface of the canal bed. Also, due to the limited amount of sediment present at each location, the Barge Canal sample was a composite from the centerline and the area adjacent to the two banks. At locations 18MC-BC01, -BC02, -BC03, and -BC06 the material found was rounded, poorly sorted gravel. Slightly more sediment was present at locations 18MC-BC04 and -BC05. The Barge Canal sampling was performed by the drilling subcontractor using a floating work platform and a combination of a slam bar, macrocore sampler, and dedicated acetate liners. All samples were analyzed for PCBs, select metals (arsenic, chromium, copper, lead, and zinc), SVOCs, pesticides, and TOC.

Off-bank Cores

In addition to the bank and centerline sediment cores, off-bank soil cores were obtained at 15 of the 18 sediment/soil coring lines. A total of 39 off-bank cores were installed. From each off-bank core at least one surface soil (0 to 2-inch) sample was collected. Where core refusal was reached at 1 foot or less, no other samples were collected. At 37 core locations, where core penetration was more than 1 foot, at least one additional sample was collected. At 12 locations, core refusal was encountered deeper than 2 feet and at six of these locations, a third

sample (Z3) was collected. At the remaining six locations where core refusal was deeper than 2 feet, the third sample was not collected due to poor recovery and no change in the lithology.

All off-bank core soil samples were submitted for PCB and TAL Metals (including mercury) analysis. Additionally, one off-bank surface soil sample on each line was selected randomly for SVOC and pesticide analysis. For the two lines that are split into east and west transect (18MC-L02E and 18MC-L03E), two surface soil samples were collected for a total of 17 samples submitted for SVOC and pesticide analysis.

2.2.3 Surface Soil Sampling

According to the SRI work plan, 20 surface soil samples (18MC-SS01 through -SS20) were collected from the 0-to-2-inch depth interval to assess the potential for direct contact exposure and assess the surface soil conditions across the Site. These surface soil samples were analyzed for TAL Metals, PCBs, and SVOCs. Pesticide analysis was also performed on all surface soil samples except the two samples collected inside the dilapidated former power plant building located on the east side of Mill Street (18MC-SS18 and 18MC-SS19) and the sample collected on the same property outside and south of the building (18MC-SS20). Samples 18MC-SS18 and 18MC-SS19 consisted of miscellaneous debris from the deteriorating building (e.g., roofing, wood fragments), materials (dust and soil) blown in from outside, as well as material (dust and debris) that appear to have collected on the floor of the building during operation of the plant. Sample SS18 was collected from a depression on the floor from what appeared to be an area where equipment might have been present when the plant was in operation, whereas sample SS19 was collected near the west wall of the building where a lot of debris was present. Similar to the sediment samples, a portion of each surface soil sample was archived by the laboratory for potential TCLP metals analysis. Upon review of the results from the TAL Metals analyses of the surface soil samples, two surface soil samples were submitted for TCLP analysis.

In addition to these 20 surface soil samples, off-bank coring included surface soil sampling as well. These surface soil samples were discussed earlier.

2.2.4 Borehole/Well Drilling and Subsurface Soil Sampling

Thirty soil borings were installed to supplement the subsurface soil sampling data (geologic subsurface information and subsurface soil/waste analytical data) collected during the NYSDEC RI. Soil boring 18MC-SB15 located on the southeast portion of the Former United Paperboard property was added at the request of the NYSDEC PM and planned soil borings 18MC-MW03 and 18MC-MW07 were not installed. Fifteen of the 30 soil borings were converted to groundwater monitoring wells.

All soil borings were advanced to the water table or refusal, whichever came first. The soil borings selected to be converted to groundwater monitoring wells were

further advanced to approximately 10 feet below the water table. As specified in the SRI work plan, 12 borings (18MC-SB03 through 18MC-SB10 and 18MC-SB12 through 18MC-SB15) were installed using a truck-mounted DPT rig. Continuous sampling was performed using a macrocore sample device and dedicated acetate sleeves. Due to early refusal, drilling techniques were modified and the remaining borings (18MC-SB01, 18MC-SB02, 18MC-SB11, 18MC-MW01, 18MC-MW04 through 18MC-MW06, and 18MC-MW08 through 18MC-MW17) were advanced via HSA techniques using a CME-550 all terrain drill rig. Continuous soil sampling was performed using split spoons.

Due to HSA refusal above the water table at boreholes 18MC-MW09, -MW14, -MW15, and -MW16, rock coring was performed to further advance the borings. Rock coring was conducted at 18MC-MW09, 18MC-MW14, 18MC-MW15, and 18MC-MW16 due to hollow stem auger (HSA early refusal). Groundwater monitoring wells were installed in the bedrock at all four wells. At borehole 18MC-MW09, HSA refusal was encountered at 9 feet BGS and the borehole was further advanced to 16 feet BGS via rock coring. There were no significant fractures observed on the cores; however, there was water encountered during rock coring. After well completion and development, it was discovered that this well was dry. Well 18MC-MW14 was advanced to 20.5 feet BGS via HSA and to 30.5 feet BGS via rock coring. Due to borehole collapse during rod retrieval, the well was installed at a total depth of 25 feet BGS. Well 18MC-MW15 was advanced to 16.7 feet BGS via HSA and to 21.7 feet BGS via rock coring. Well 18MC-MW16 was advanced via HSA to 15 feet BGS and to 25 feet BGS via rock coring.

Upon removal from the ground, the acetate liner/split spoon was opened and the contents were screened for VOCs using a PID. The contents of the sampling device were then logged in a geotechnical boring log (see Appendix B), described, and at least one subsurface soil sample was collected from each borehole for laboratory analysis. A second subsurface soil sample (Z2) was collected at 21 of the soil borings due to the presence of suspected waste or other potential contamination as determined based on field screening evidence or change in lithology. At soil boring location 18MC-SB05, a third subsurface soil sample (Z3) was collected due to the presence of a slight petroleum or metallic odor and wood fragments. At soil boring locations 18MC-SB04 and 18MC-SB11 only the shallow sample was collected due to shallow refusal (3.5 and 4 feet BGS, respectively). Samples were collected using a dedicated stainless-steel spoon, and homogenized using dedicated stainless-steel bowls.

A total of 52 subsurface soil samples were collected and submitted for PCBs and TAL metals analysis. The monitoring well subsurface soil samples were also analyzed for SVOCs. Since there were no VOCs detected with the PID, no samples were submitted for VOC analysis. Similar to the sediment samples, a portion of each sample was archived by the laboratory for potential TCLP metals analyses.

Upon review of the results from the TAL metals analyses of the subsurface soil samples, five samples were submitted for TCLP analysis.

Boreholes not used for monitoring well installation were backfilled with soil cuttings, plugged with bentonite, and covered with topsoil upon sampling completion.

2.3 Groundwater Investigation

2.3.1 Monitoring Well Installation

Seventeen boreholes collocated with surface soil samples were planned for completion as groundwater monitoring wells (no monitoring wells were planned for the three surface soil locations in the property of the former power plant building located on the east side of Mill Street). However, no wells were installed at surface soil sample locations 18MC-SS03 and 18MC-SS07, since these wells were eliminated during the field investigation. Additionally, since monitoring well locations 18MC-MW02 and 18MC-MW05 were adjusted in the field, these wells are not collocated with the associated surface soil samples (18MC-SS02 and 18MC-SS05, respectively).

The 15 wells were constructed with a 2-inch inner diameter (ID), flush joint Schedule 40 PVC screen (0.010-inch slot size), threaded bottom plugs, and flush-threaded 2-inch ID Schedule 40 PVC riser. Nine wells were constructed with a 10-foot screen and the other five were constructed with a 5-foot screen. All PVC connections were flush-threaded, with a PVC cap placed on the bottom of the screen. A sand pack of U.S. Silica #0 sand extended from the bottom of the screen to 2 feet above the screen and was followed by a 2-foot-thick pelletized bentonite seal. Following a minimum 30-minute respite that allowed the bentonite to hydrate, a 5% bentonite/cement grout was installed from the top of the seal to 1 foot BGS.

Ten monitoring wells were completed aboveground with a 2.5-foot tall locking steel protective casing with an approximate 1.5-foot round anti-percolation pad. Five monitoring wells were completed flush with the ground using 8-inch diameter by 12-inch deep steel, flush-mount protective casings. All wells were fitted with a locked water-tight cap (J-plug). Table 2-6 summarizes the monitoring well construction data. Geotechnical well boring and construction logs are presented in Appendix B.

2.3.2 Monitoring Well Development

The EEEPC field team developed all the newly installed monitoring wells between June 27 and July 3, 2008. The development was performed using a decontaminated submersible pump at a maximum flow rate that would not draw the water level down to the pump. The pump was slowly moved to different depth intervals within the screen to draw fine sediments out of the sand pack and into the well for removal without surging the well. Temperature, pH, conductivity, and turbidity measurements were recorded to monitor the progress of the development

process. Development was considered complete when pH, specific conductance, and temperature stabilized over three consecutive readings. At most wells turbidity of the discharge at the end of development was 50 nephelometric turbidity units (NTUs) or less. Appendix C contains the well development records for each well.

2.3.3 Groundwater Sampling

Monitoring wells were sampled at least 24 hours after development was completed in order to allow the well to recover and have natural groundwater flow conditions return in the immediate vicinity of the well (between July 9 and 11, 2008).

Prior to sampling the monitoring wells, static water levels were measured in each well (see Table 2-7). The volume of water in each well was then calculated, and at least three volumes of water standing in the well casing were removed. Submersible pumps with dedicated tubing were used for purging the wells prior to groundwater sampling. New dedicated bailers and new dedicated nylon cord were used for sampling all the wells. Temperature, pH, conductivity, and turbidity measurements were recorded throughout the well purging process, and immediately prior to sampling. Purging was continued until either groundwater turbidity was below 50 NTUs or five well volumes were purged. Table 2-8 presents sample numbers, dates, and final groundwater quality measurements at the time of sampling. Appendix D contains the well purge records.

2.4 Laboratory Analysis

Severn Trent Laboratories (STL) of Buffalo, New York (now Test America Buffalo) performed laboratory analysis of the soil and sediment samples, and Mitkem Corporation, of Warwick, Rhode Island performed analysis of the groundwater samples collected. Samples analyzed by STL were delivered to the laboratory at the end of each day. Samples analyzed by Mitkem were shipped overnight by FedEx. The laboratories followed NYSDEC Analytical Services Protocol (ASP) 2005 for all analytical methods, quality assurance (QA)/quality control (QC), holding times, and reporting requirements. Laboratory data were reported with Category B data package deliverables and standard laboratory electronic data deliverable (EDD) consistent with the EEEPC corporate format or EPA Region 2 Multimedia Electronic Data Deliverable (MEDD) format. More detailed information on the laboratory analysis is provided in Section 4.

For metals analysis, most soil samples were submitted for select metals (arsenic, copper, chromium, lead, and zinc) that were anticipated to potentially pose the greatest human health exposure risk at the Site. A portion of the samples submitted for metals analysis was analyzed for the full TAL of metals. Additionally, a portion of all the solid samples (soil and sediment) were submitted for TCLP analysis of barium, cadmium, chromium, and lead. All the groundwater samples were analyzed for both total and dissolved TAL metals.

2.5 Site Survey

Popli Consulting of Rochester, New York, performed a Site survey between July 10 and 20, 2007. Surveying included the horizontal locations and vertical elevations of 15 soil boring locations, 15 monitoring well/surface soil locations, three additional surface soil sample locations, and 114 sediment coring locations as well as other key Site features, including the creek, the canal, structures, and roads.

Elevations were referenced to the North American Vertical Datum of 1988 (NAVD 88). Vertical control was established in United States survey feet to an accuracy of 0.1± feet for all ground shots, and 0.01± feet for monitoring well inner casing elevations. Coordinate values were referenced to the North American Datum of 1983 (utilizing the New York Continually Operation Reference Stations), New York State Plane Coordinate System, West Zone (North American Datum of 1983 [CORS] – NYSPCS, West Zone). Coordinates were reported in United States survey feet to an accuracy of 0.5± feet.

2.6 Investigation-derived Waste Handling

The following types of IDW were generated: soil from subsurface drilling; decontamination water; groundwater from development, purging, and sampling; and spent personal protective equipment (PPE) and sampling equipment. Investigation-derived soils and water were containerized in 55-gallon steel drums (eight soil drums and seven water drums). All IDW was stored on site in Upson Park until samples were collected and analyzed. A composite waste soil sample and a composite waste water sample were submitted to the laboratory to determine whether these wastes were potentially contaminated with PCBs VOCs, SVOCs, or metals above regulatory levels. These waste samples were also analyzed to determine ignitability, reactivity, and corrosivity. The analytical results for the IDW are presented in Table 2-9.

Trace amounts of barium, cadmium, chromium, lead, and selenium were detected in the soil, well below regulatory limits. Trace amounts of barium, chromium, lead, and selenium were detected in the water, well below regulatory limits. Based on the analytical results and per the NYSDEC PM's approval, the decontamination, development and purge water was released on Site. The soil was removed from the Site and disposed of as non-hazardous waste by Op-Tech Environmental Services on January 24, 2008.

3 Physical Characteristics of the Study Area

3.1 Environmental Setting

The Eighteenmile Creek Site has moderate relief, with elevations that range between approximately 450 and 515 feet above mean sea level (AMSL) (see Figure 1-1). The Site is covered by a portion of Eighteenmile Creek, measuring an estimated 0.5 miles long, four separate commercial/industrial properties, as well as residential properties, and undeveloped woodlands. Land use within 1 mile of the Site is primarily residential, with some commercial and light industrial use.

The Barge Canal is immediately south of the Site and Lock No. 34 is located around 0.5 miles upstream (southwest) from Upson Park, on the canal. Eighteenmile Creek empties into Lake Ontario, which is located around 15 miles north of the city of Lockport.

According to the National Wetlands Inventory (NWI), two reaches of Eighteenmile Creek within the study area are considered palustrine, permanently flooded, diked/impounded wetlands (for more information, see Section 8).

Niagara County, where the Site is located, is characterized by a humid continental climate representative of the humid climate of the northeastern United States, with mild summers and very cold winters when temperatures tend to be in the 20s. Although rainfall is fairly evenly distributed throughout the year, minimum monthly precipitation is less in the winter than the other seasons. Since most atmospheric systems affect Niagara County as they move across the continent or up the Atlantic Coast, the weather in the region is very variable with temperatures and other atmospheric elements undergoing noticeable changes within a few days. The climate is influence mainly by the proximity of lakes Erie and Ontario. The cold lake waters function like a sink that retards normal air temperature rising during the spring and they tend to restrict extreme high temperatures in the summer. In the fall the lake waters reduce cooling at night. Since the area is relatively flat, elevation has a lesser influence over the climate in Niagara County.

Eighteenmile Creek is surrounded by six residential townships, and many citizens own creek-front property. The creek is used extensively for fishing, boating, and recreation.

The headwaters of Eighteenmile Creek (north of the Barge Canal in Lockport, New York) originate from two branches (East and West) immediately north of the Barge Canal. East Branch waters originate at the spillway in the Barge Canal near the Mill Street bridge where canal waters join with water from the culverted section of Eighteenmile Creek south of the Barge Canal. These waters flow north under the Barge Canal near Mill Street to Clinton street. Eighteenmile Creek flows north and eventually discharges to Lake Ontario in Olcott, New York. West Branch waters originate from the dry dock on the north side of the Barge Canal and flow north to Clinton Street. Waters from the East and West Branch converge on the south side of Clinton Street and flow under Clinton Street to the Mill Pond on the north side of Mill Street. A dam is located in the creek behind the building on 62 Mill Street, the larger of the two United Paperboard parcels. Water from the Mill Pond, leaks around the west side of the dam and flows adjacent to or over the top (during high flow conditions) of the abandoned transformer pad. The Mill Pond is the result of the dam (see Figure 2-1). A storm sewer line also crosses the creek approximately 25 to 50 feet downstream of the dam, and several sewer manholes were observed on both banks (east and west) of the creek. In the area of the Former Flintkote Plant Site, a dam approximately 10 feet high diverts Eighteenmile Creek westward for approximately 300 feet along William Street (located on top of the dam). The creek continues northward and returns to its original natural channel farther downstream. The two sluice gates located at the east end of the dam have been closed for at least 30 years. A millrace containing a sluggish stream approximately 6 inches to 1 foot deep runs along the west side of the buildings at 300 Mill Street and empties into Eighteenmile Creek (see Figure 2-1).

During operation, the Barge Canal discharges approximately 50 cfs of water into the East and West Branches of the creek. During dry periods, the Barge Canal provides a significant portion of the creek's flow.

Surface topography at the Upson Park property slopes from Clinton Street to a large parking area and from the parking area steeply downward toward Eighteenmile Creek and steeply upward to the west (elevation ranges from approximately 490 to 530 feet AMSL). Topography of the White Transportation property is terraced, sloping from east to west, toward the East Branch of Eighteenmile Creek. Topography of the Former United Paperboard Company property and the Former Flintkote Plant Site dips toward Eighteenmile Creek. Specifically, along Mill Street surface topography is generally flat and the Water Street portion of the United Paperboard property slopes steeply downward toward Eighteenmile Creek (elevation ranges from 470 to 490 feet AMSL).

3.2 Geology

3.2.1 Regional Geology

The study area is located in the city of Lockport, in central Niagara County, New York, around 15 miles south of Lake Ontario and 25 miles northeast of Lake Erie. It falls within the Ontario Lowlands physiographic province.

The advance and retreat of glaciers during past ice ages have largely defined regional topography, geology, and soils. The surficial geology of the watershed consists mostly of glacial deposits formed about 10,000 to 15,000 years ago during the Pleistocene, when glaciers covered the area. These glacial deposits are generally less than 50 feet thick in the watershed area (La Sala 1968). The most common deposits found in the watershed area are glacial tills and lacustrine silts and clays. Glacial and lacustrine (pertaining to lakes) are descriptors that indicate the conditions that the deposits formed in. The glacial tills were deposited beneath the glacial ice. They have a variable texture and consist of non-sorted clay, silt, sand, and gravel. The lacustrine silt and clay deposits formed as sediment settled out in lakes fed by melting glacial ice. The deposits generally consist of laminated silt and clay and are usually calcareous with low permeability (NYS Museum 2004; La Sala 1968).

Less widespread glacial deposits in the watershed area include kame moraine, lacustrine beach, and sand and till moraine. The kame moraine was deposited at an active ice margin during the retreat of a glacier. It is composed of a variable texture, from boulders to sand, with calcareous cement. Lacustrine beach deposits were deposited at the shoreline of a glacial lake. They are generally well-sorted sand and gravel and are stratified, permeable, well-drained, and generally non-calcareous. Lacustrine sand deposits were generally laid down nearshore in proglacial lakes. (A proglacial lake is a body of water in a basin in front of a glacier, generally in direct contact with the lake.) The deposits typically consist of stratified, well-sorted quartz sand that is permeable. Till moraine was deposited adjacent to the glacial ice, which has a variable texture and is generally low in permeability (NYS Museum 2004).

The bedrock in the watershed consists of Ordovician and Silurian rocks that dip gently southward at 20 to 60 feet per mile (La Sala 1968). The bedrock found in the watershed from north to south (and also from oldest to youngest) includes the Queenston Formation, the Thorold Sandstone, the Irondequoit Limestone, the Decew Dolostone, and the Guelph Dolostone.

The Queenston Formation was deposited in the Upper Ordovician and is a member of the Richmond Group. During the Ordovician, as the Taconic mountains rose toward the east, the Queenston Formation is traditionally thought to have formed as sediments began eroding from the mountains. Thus, the Queenston consists of red non-marine or continental shale, siltstone, and sandstone (NYS Museum 1991).

The remaining formations found in the watershed are part of the Niagaran Series. They are generally richly fossiliferous and were deposited in shallow inland seas during the Silurian. The Niagaran Series includes the Medina, Clinton, and Lockport Groups (Brett et al. 1995).

The Thorold Sandstone is in the Medina Group. It ranges in thickness from 4.5 to 20 feet, with an average of 12 feet. From Rochester to Lockport, it is a mottled pink to red, cross-bedded, channel sandstone with numerous trace fossils. From Lockport and west it consists of a light gray to white, massive, clayey, pelletal sandstone. It is typically interbedded with thin green silty shale layers whose number increases toward the top of the unit (Brett et al. 1995).

Irondequoit Limestone and Decew Dolostone are members of the Clinton Group. The Irondequoit Limestone is a thick- to massive-bedded, medium greenish-grey to pinkish-grey, dolomitic, fossiliferous limestone. Thin tongues of shale are common and increase in abundance in the upper portion of the unit. The Irondequoit ranges in thickness from 5 to 22 feet with an average of 15 feet (Brett et al. 1995).

The Decew Dolostone ranges in thickness from 8 to 12 feet with an average of 9 feet. It consists of variably bedded, dark gray to olive gray, clayey to sandy, fine-grained dolomite. Its most characteristic feature is soft sediment deformation features. Fossils are rare, but have occasionally been observed (Brett et al. 1995).

The Guelph Dolostone is a part of the Lockport Group. It is a medium to dark gray laminated, fine-grained dolostone with partings of dark greenish-gray to nearly black shale. Both the shale and dolomite are petroliferous and sparsely fossiliferous. The Guelph can be as thick as 300 feet (Brett et al. 1995).

3.2.2 Site Geology

The majority of the Site is believed to generally consist of mostly glacial tills and lacustrine silts and clays, with localized areas of fill material overlying bedrock. Overburden also includes areas where massive pieces of bedrock are believed to have been backfilled, and was encountered at depths as shallow as 1 to 3 feet BGS.

The nature of the overburden was characterized during this SRI through split-spoon sampling during borehole drilling. Depth of bedrock and thickness of fill and native overburden varied between boreholes. Borehole and monitoring well drilling logs are presented in Appendix B and include boring descriptions; depth and unit from which soil samples were collected; identification of suspected fill; relative soil densities based on blow counts recorded during split-spoon sampling; and construction diagrams of monitoring wells.

Suspected fill material was observed at the ground surface as well as in the subsurface at varying depths. Two distinct fill units were observed throughout the Site, including:

- Unconsolidated slag material colored dark gray to black, ranging from moderately to well sorted fine to medium sand with gravel content ranging from zero

to 50%. Found at the Upson Park, White Transportation, and Former Flintkote Plant Site properties.

- Unconsolidated red-brown poorly sorted cinder material containing fragments of red brick, rubber, metal, glass, and buttons found at various locations at the Site but specifically at the Former United Paperboard Company property.

Additional possible fill was observed consisting of gray clay-matrix material containing varying proportions of unsorted sand and fine gravel. Color of the sand and gravel varied between black, gray, brown, tan, red, yellow, and more.

Thickness of fill at the corridor was difficult to determine as it was encountered mixed at different proportions with other overburden material but it generally ranged from less than 1 foot to more than 10 feet.

Native overburden consisted of brown silty, sandy soil with varying dolostone gravel; dark brown silt to silty clay; and dark gray fine silty clay. Bedrock observed consisted of light to dark gray dolostone with interbedded gray clay, and no fossils. Bedrock depth ranged from 9 feet in 18MC-MW09 to more than 30 feet in 18MC-MW02. Groundwater was found between 6 and 20 feet BGS.

Refusal using hollow stem auger drilling occurred prior to encountering groundwater while drilling monitoring wells 18MC-MW09, -MW14, -MW15, and -MW16, and rock coring was used to complete these installations.

Both gray-black slag fill and red-brown cinder fill were observed in Upson Park. A total of eight soil borings were installed on the property (see Figure 2-1). Geologic conditions observed during the subsurface investigation at Upson Park are summarized below:

- Refusal was encountered in all but one boring (18MC-MW17) and rock coring was conducted at 18MC-MW14, -MW15 and -MW16.

- Dry, sandy soil with a high proportion of dolostone fragments ranging in size from sand to coarse gravel was encountered at 18MC-SB11 (west of Eighteenmile Creek in the northern portion of Upson Park east of the driveway).

- Suspected fill was encountered at18MC-SB12 (west of Eighteenmile Creek near Clinton Street, between the two Upson Park driveways) from the surface to refusal (12 feet BGS). The fill was comprised of a clay-matrix with fragments of red brick, and varying colored pieces of coarse sand and fine gravel. A fine sand-sized black ash layer was observed at approximately 6 to 6.8 feet BGS.

- Black sand to fine gravel-sized slag was encountered in the top 2 feet of 18MC-SB13 (west of Eighteenmile Creek, west edge of the parking lot in Up-

son Park) to a total depth of 7 feet BGS, followed by possible fill comprised of clay matrix containing sand and gravel.

- Suspected fill was encountered at 18MC-SB14 (west of Eighteenmile Creek, along the east edge of the parking lot) from the surface to auger refusal (15 feet BGS). Dark gray to black sandy slag was observed at high proportions in the top several feet. Gray to tan clay-matrix material with mixed gravel, fragments of brick, rootlets, and organic peat was found to increase in proportion with depth.

- Mixed sand and gravel-rich soil was found in the top several feet of 18MC-MW14 (west of Eighteenmile Creek, along the shoulder of Clinton Street) followed by varying-sized pieces of dolostone. Poorly consolidated gray and brown silt and clay with sand and gravel was found from 10 to 20 feet BGS, however, poor soil recovery hampered precise description of the borehole in this interval. HSA refusal was encountered at 20.5 feet BGS.

- Red-brown sandy silt with varying proportions of dolostone gravel was found at 18MC-MW15 (west of Eighteenmile Creek, to the east of the Upson Park driveway) from just below the ground surface to around 10 feet BGS, where the soil graded to red-brown fine silt. Auger refusal was encountered at 16.7 feet.

- Gray, brown and red silty soil was encountered at18MC-MW16 (west of Eighteenmile Creek, to the west of the Upson Park driveway) from just below the surface to top of bedrock (15 feet BGS) with clay increasing in proportion in the bottom 3 feet of the overburden.

- Gray-brown silt and clay was encountered at 18MC-MW17 (north of the Barge Canal, south of the Canal Corporation yard). Poorly sorted dolostone gravel was also found from the surface to the total depth. Poor recovery hampered precise description of much of this borehole.

Both gray-black slag fill and red-brown cinder fill were observed on the White Transportation property, with much slag visible on the ground surface. A total of nine soil borings were installed on the property (see Figure 2-1). Geologic conditions observed during the subsurface investigation at the White Transportation property are summarized below:

- Dark gray to black slag comprised of sand to fine gravel was encountered at 18MC-SB06 (northwest portion of the property, east of Eighteenmile Creek) from the surface to approximately 2.3 feet BGS, followed by approximately 7 feet of poorly consolidated gray to brown mixed silt to gravel-size weathered dolostone. Dark gray to black clay that appeared to be native was found at a depth of approximately 12 feet BGS.

- Sand and gravel of varying size and color were encountered throughout 18MC-SB07 (northwestern portion of the property, east of Eighteenmile Creek). Suspected fill at the borehole was comprised of gray, brown, and black unsorted sand and gravel slag material; black, well sorted fine sand slag; mixed-size dolostone gravel; and red-brown sand.

- Dark gray mixed sand and gravel slag fill and brown clay matrix with mixed-size sand to fine gravel of varying color were observed at 18MC-SB08 (eastern portion of the property).

- Mixed-size slag comprised of sand and gravel colored dark gray to black was encountered at 18MC-SB09 (southeastern portion of the White Transportation property). Brown clay-matrix with mixed size sand to fine gravel of varying colors was also observed.

- Dark gray to black sand to gravel size slag fill and gray to brown silt with poorly sorted gravel were encountered at 18MC-SB10 (southern portion of the property, north of Eighteenmile Creek).

- Suspected slag fill comprised of gray, brown, and black fine to coarse sand; dark brown gravely silt; and native gray and brown soft silty clay were encountered at 18MC-MW10 (northwestern portion of the property).

- Suspected slag fill comprised of dark (gray to dark brown to black) fine to coarse sand; gray-brown clay-matrix material containing mixed-size gravel; and brown to red-brown silty clay with dolostone gravel were observed at 18MC-MW11 (northeastern portion of the property).

- Overburden at 18MC-MW12 (western portion of the property, east of Eighteenmile Creek) consisted of suspected slag fill (dark fine to coarse sand); and brown silty clay.

- Suspected slag fill comprised of dark (gray to brown to black) fine to coarse sand; and black, poorly consolidated mixed sand, silt and clay were encountered at 18MC-MW13 (southern portion of the property, north of Eighteenmile Creek).

A total of 13 soil borings were installed in the Former United Paperboard Company property (see Figure 2-1). Rock coring was conducted in 18MC-MW09 due to refusal prior to encountering groundwater. Geologic conditions observed during the subsurface investigation at the Former United Paperboard Company property are summarized below:

- Suspected slag fill comprised of mixed-size sand to medium gravel; as well as brown clay-matrix material with varying proportions of poorly sorted gravel;

and brown silty clay with fine dolostone gravel were found at 18MC-SB01 (north portion of the property, east of Eighteenmile Creek).

- Suspected fill comprised of brown clay-matrix material with poorly sorted gravel; and fill comprised of dark gray fine sandy slag were encountered at 18MC-SB02 (north portion of the Former United Paperboard property, east of Eighteenmile Creek).

- Suspected fill comprised of poorly sorted sandy gravel of varying colors; sandy black slag fill; and poorly consolidated silty-clay matrix with sand to medium gravel were encountered at 18MC-SB03 (east of Eighteenmile Creek, west of the intersection of Mill Street and Olcott Street).

- Gray clay-rich soil with fine gravel was encountered at 18MC-SB04 (between Eighteenmile Creek and Water Street).

- Black slag fill; red-brown silty clay-matrix fill with unsorted sand and gravel; brown clay; unconsolidated sandy gravel; and dark gray, highly plastic silt with up to 40% fine wood fragments were found at 18MC-SB05 (east of Eighteenmile Creek, west of the building). A very slight metallic or petroleum odor was detected in the silt encountered in the bottom of the borehole.

- Burnt red-brown mixed grain size fill material with fragments of glass and metal; as well as gray-brown silt-matrix material containing poorly sorted sand to medium gravel; gray to brown fine silt with a few fragments of wood and shells; and tight yellow-gray clay were observed at 18MC-SB15 (near fill material visible at the ground surface on the western portion of the property, north of Clinton Street, East of Eighteenmile Creek, outside the fence that surrounds the property).

- Black to dark brown fine sandy soil; loose, orange-brown to gray to red-brown, sandy fill with fine gravel; and dense, brown silty clay were encountered at 18MC-MW01 (northern portion of the property, east of Eighteenmile Creek).

- No obvious fill was observed while drilling 18MC-MW02 (northern portion of the property, east of Eighteenmile Creek). Overburden consisted of gray-brown silt with varying proportions of unsorted dolostone gravel.

- Brown fine silty soil with few fragments of red brick; black sand slag fill; brown sandy, silty soil; black and brown silty, sandy soil; and native material comprised of wet, sandy silt with intermittent poorly to moderately sorted fine dolostone gravel were encountered at 18MC-MW04 (northern portion of the property, east of Eighteenmile Creek).

- Overburden at 18MC-MW05 (northern portion of the property, west of Eighteenmile Creek) consisted of gray sandy soil; red-brown poorly sorted cinder fill; gray, silty clay matrix material with mixed color unsorted sand and gravel; and possible native material comprised of red-brown silt with intermittent coarse sand and fine gravel. This location was moved to target a ridge of suspected red-brown cinder fill adjacent to Eighteenmile Creek.

- Gray-brown well graded sand with gravel; gray-brown and red-brown sandy soil; and native material comprised of tan-brown silt to silty clay were encountered at 18MC-MW06 (eastern portion of the Former United Paperboard Company property, east of Eighteenmile Creek, near the north edge of the Mill Street parking lot).

- Overburden at 18MC-MW08 (western portion of the Former United Paperboard Company property, east of Eighteenmile Creek, in the Clinton Street parking area) consisted of brown sandy soil; mixed black and red-brown poorly sorted sandy fill; and dark gray to black fine silt with fine wood fragments.

- Black sandy fill; light brown clayey silt and gravel were encountered at18MC-MW09 (western portion of the property, west of Eighteenmile Creek). HSA refusal was encountered at 9 feet BGS.

There were no soil borings installed on the Former Flintkote Plant Site during this investigation. More than 10 feet of red-brown poorly sorted cinder ash fill containing fragments of brick, metal, glass, rubber and buttons could be observed in the banks on the Former Flintkote Plant Site near Eighteenmile Creek and on the ground surface on the Former Flintkote Plant Site property.

3.3 Hydrology

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 approximately 245 feet AMSL at the shoreline to approximately 400 feet AMSL at the toe of the escarpment (see Figure 1-1). Within the watershed area the escarpment ranges from 100 to 175 feet. The 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.

The gulf and the main branch of Eighteenmile Creek are both located within a well-incised, steeply sloped channel 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.

The Site is located in an area in which deep, well drained to excessively drained, medium-textured soils formed in glacial outwash deposits composed primarily of sand and gravel.

3.3.1 Surface Water and Runoff

Approximately 75% of the surface area at the Site is covered by grass/vegetation and some areas of exposed soils and fill, with the other 25% of the surface area covered by buildings and asphalt/stone.

Eighteenmile Creek varies from tens of feet wide or less where the creek enters the Site to the south, to over 50 feet wide in the Mill Pond along the Former United Paperboard property. In many areas the creek bed along the center of the channel was comprised mostly of coarse sand and various sizes of gravel, stone, and rubble. A larger proportion of silt was observed along the creek bottom in the West Branch of the creek, as well as between Clinton Street and the Clinton Street Dam. In the East Branch of the creek, as well as downstream of the Clinton Street Dam the creek bottom was comprised largely of gravel and rubble.

Water depth in the creek varied from a few inches in the southern-most point of the West Branch to around 10 feet in the center of the Mill Pond, along the Former United Paperboard Company property (Line 18MC-L08).

Drainage ditches are generally absent on all of the individual properties. Based on historical review, the only underground utility present in the Eighteenmile Creek Corridor Site is a storm sewer located in the creek north of the Clinton Street Dam. Also several sewer manholes were observed on both banks (east and west) of the creek.

Upson Park surface topography dips away from Clinton Street, toward the West Branch of Eighteenmile Creek. Topography of the White Transportation property is terraced, descending from east to west, toward the East Branch of Eighteenmile Creek. Topography of the Former United Paperboard Company property and the Former Flintkote Plant Site dips toward Eighteenmile Creek. It appeared that a substantial amount of rock and concrete debris may be buried beneath the surface on the eastern portion of the Former United Paperboard Company Property site; and the soil on this property and the Former Flintkote Plant Site appeared to be well drained, likely resulting in a significant amount of drainage on these properties percolating directly downward, into the soil.

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 is caused by a topographic high point located in the southeastern portion of the watershed. The East Branch near the Barge Canal and White Transportation property has high flow, with water depth of 1 to 3 feet at mid-channel, and rocky bottom. The West Branch has moderate to high flow velocity in most places and a bottom composed

of cobble, gravel, and sand. The East and West Branches of Eighteenmile Creek merge immediately upstream from Clinton Street and then flow north beneath Clinton Street into Mill Pond on the former United Paperboard Company property. Near the Former Flintkote Plant Site, the creek channel splits and flows around an island with most of the flow following the channel on the west side of the island.

3.3.2 Groundwater

Groundwater elevations were measured at all wells on July 9, 2007, and November 21, 2007. Table 2-7 shows the groundwater elevations and Figures 3-1 and 3-2 show the interpreted groundwater isopleths based on these measurements. Groundwater elevations ranged between less than 465 feet in the NYSDEC wells installed on the Former Flintkote Plant Site prior to this SRI (wells 198-E, 198-F and MCW-1), and nearly 503 feet in 18MC-MW16, in Upson Park, near Clinton Street.

The water level in well 18MC-MW17 decreased nearly 10 feet between the first and second rounds of water level measurements, taken July 9 and November 21, respectively (see Table 2-7), while water levels in all other wells fluctuated less than 1 foot. To verify these measurements, during a site visit on January 24, 2008, to dispose of the IDW, water levels were measured again in the Upson Park wells (18MC-MW14 through 18MC-MW17). The Barge Canal was empty at this time and 18MC-MW17 was dry. Water levels in the remaining wells in Upson Park, however, had risen between approximately a few tenths of a foot and 2 feet.

Groundwater contour patterns depicted in Figures 3-1 and 3-2 show flow generally toward Eighteenmile Creek. The horizontal hydraulic gradient at the Site ranges between 0.08 foot per foot and 0.32 foot per foot as measured from the contours and associated July and November 2007 water levels depicted on Figures 3-1 and 3-2.

4 Quality Assurance/ Quality Control Procedures

This section describes the QA/QC procedures utilized for each environmental medium collected and analyzed for this project. The Quality Assurance Project Plan (QAPP) presented in the work plan was followed for all activities. The procedures described in the QAPP are consistent with the current updates of the United States Environmental Protection Agency (EPA) analysis procedures as described in SW-846.

4.1 Field QC Samples

Field QC samples provide a means to check ways that sample quality can be compromised in the field or through shipping, and also document overall sampling precision. The following sections describe field QC samples collected during the SRI.

Duplicate Samples

Consistency in both sample collection and sample analysis is checked through analysis of duplicate samples. Duplicate samples consist of aliquots of sample media placed in separate sample containers and labeled as separate samples. Duplicate samples were collected at a rate of approximately one per 20 field samples. Table 4-1 lists the duplicate samples and the original samples they duplicated. Duplicate sample analytical data are presented in the Data Usability Summary Reports (DUSR) in Appendix E. Duplicate precision is evaluated based on the relative percent difference (RPD) in the duplicate pair. Solid matrices with RPD values less than 70% are considered to have good precision. Water samples with RPD values less than 40% are considered to have good precision.

Field duplicate results indicated good overall precision. For the sediment samples, the PCBs and metals show good precision for most of the samples with no significant outliers indicating a concern with sampling or analysis precision. SVOCs were measured in one sediment duplicate pair. Most of the results were below the Practical Quantitation Limit (PQL) except for polycyclic (or polynuclear) aromatic hydrocarbons (PAH). The PAH results were much higher in the original than the duplicate. The results indicate potential for sediment samples contaminated with hydrocarbons to be inhomogeneous. The soil samples show good precision for most of the samples with no significant outliers indicating a

concern with sampling or analysis precision. For the one groundwater duplicate, some of the dissolved metals show a potential variability that may be due to differences in the filtering.

Field Blank Samples

Rinsate samples were collected to check the effectiveness of the decontamination process on sampling equipment. Two rinsate samples were collected from decontaminated split-spoons used for the collection of subsurface soil samples during drilling. A trace level of chlorobenzene was reported, but the result was below the reporting limit and difficult to confirm. Metals, including aluminum, barium, calcium, copper, iron, magnesium manganese, and nickel were detected in the rinsate blanks. Qualification of sample results was not necessary because the concentrations of metals detected in the rinsate blank were low level and significantly below soil concentrations. The rinsate blanks do not indicate any concerns with the split-spoon sampling techniques. One rinsate blank was collected for the groundwater samples from the pump, tubing, and bailer combination used for sampling. The sample showed low levels of both total and dissolved metals and bis(2-ethylhexyl)phthalate. The contaminants appear to come from low-level laboratory or field contamination. Most of the sample results were either significantly above the blank levels or were already qualified due to method blank levels. However, several low level zinc values reported in the samples are near the rinsate concentrations and should be considered laboratory background.

Appendix F contains rinsate blank analytical data (see Table F-1).

Trip blanks were prepared and shipped with the water samples for VOCs analysis. No compounds were detected in the trip blanks.

4.2 Laboratory QC Samples

Laboratory QC samples provide mechanisms to evaluate data quality based on sample integrity, holding times, method and calibration blank results, spike recoveries, surrogate recoveries, and duplicate precision. A complete listing of samples analyzed is provided in the associated DUSRs (see Appendix E). The DUSRs include attached outlier reports from data validation. The outlier report lists specific analytes outside control limits and associated samples. QC procedures used during the SRI sample analyses and any potential concerns with sample analysis procedures are detailed below.

Holding Times

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

All samples were analyzed with the method-specified holding times and no qualification was required. One sample, 18MC-SB14-Z2, exceeded the holding time for TCLP mercury because the decision to run the sample for TCLP was not made until after the holding time had expired. Mercury was not found in the sample. Several samples for SVOCs were prepared after the NYSDEC ASP holding times, but within the method holding times. The samples were mostly re-extractions and no data qualification was required. 18MC-TB01 and 18MC-RB01 were analyzed outside the seven-day holding time for VOCs in the QAPP, but the samples were preserved which extended the holding time to 14 days.

Method and Calibration Blanks

Quality checks on the laboratory equipment, instrumentation, and methods reagents are conducted by analysis of method blanks. Method blanks consist of organic-free deionized water subjected to every step of the analytical process to determine possible points of laboratory contaminant introduction. Instrument calibration blanks are pure reagent matrix analyzed compared to set instrument response baselines.

Method and calibration blanks were performed at the required frequency. Low levels of phthalates, pesticides, and several metals were detected in the method blanks at trace levels. Sample results near the blank levels were qualified "U" either at the PQL or at the reported concentration.

Surrogate Spikes

Laboratory performance for individual samples analyzed for organic compounds is established by the use of surrogate spikes. Samples are spiked with surrogate compounds prior to preparation and analysis. Unusually low or high surrogate recoveries may indicate some deficiency in the analytical system or that some matrix effect exists. The surrogate results outside QC limits are presented on Table 3 in the DUSR.

Surrogate recoveries for several samples had recoveries outside of QC limits. Positive results associated with low or high recoveries were qualified "J" as estimated. Non-detect results were qualified "UJ" only for results with low recoveries. Non-detect results associated with high surrogate results were not qualified. The variation in the surrogate recoveries appear to be associated with sample matrix effects. The samples for SVOCs were reanalyzed to substantiate these matrix effects.

Most of the PCBs results showed high recoveries due to interferences from the matrix and PCBs. Many of the sediment and soil samples for PCB analysis and a few samples for SVOCs were analyzed at high dilutions and the surrogate compounds were diluted out and gave no recovery.

Spike Samples

Spike samples simulate the background effect and interferences found in the actual samples, and the calculated percent recovery of the spike is used as a measure of the accuracy of the total analytical method. Spike samples were prepared by adding to an environmental sample (before extraction or digestion) a known amount of pure analyte to be assayed. The percent recovery of the spike analyte measures the accuracy of the method. Spikes were added at a concentration approximately midpoint on the calibration curve. Spikes (e.g., laboratory control samples) added to a matrix blank were analyzed with each sample batch to assess analytical performance not affected by sample matrix. If matrix spike samples indicated a potential matrix effect, the matrix spike blanks were evaluated to verify the problems were not due to an analytical concern. If the concentration of the compound in the sample is greater than four times the spike amount, the results are not qualified. Recoveries outside QC limits are presented on Table 4 in the DUSR (if applicable).

All laboratory control sample (LCS) analyses were performed at the required frequency and were generally within control limits.

All matrix spike (MS) analyses were performed at the required frequency. MS recoveries indicate potential matrix problems for select metals and SVOCs in soil samples. The associated results are flagged "J" as estimated or "UJ" as estimated reporting limit. The recoveries do not indicate an analytical concern and are clearly associated with matrix effects.

Laboratory Duplicate or Matrix Spike Duplicates

In addition to analytical error introduced by machinery and sample handling, error can also occasionally result from analytical process interference by a sample matrix. This can result in the reporting of analytes at concentrations higher or lower than the true concentrations. Laboratory or matrix spike duplicates are aliquots of the same sample that are split prior to analysis and are treated exactly the same throughout the analytical method. The RPD between the values of the MS and matrix spike duplicate (MSD) or between the original and the matrix duplicate was taken as a measure of the precision of the analytical method. RPDs outside QC limits are presented in Table 5 in the DUSR (if applicable).

MS/MSD analysis was performed at the required frequency. RPD values for the select metals and SVOCs indicate potential soil matrix problems. The associated results are flagged "J" as estimated or "UJ" as estimated reporting limit.

Compound Identification and Reporting

For soil and sediment samples reported by STL, benzo(b)fluoranthene and benzo(k)fluoranthene peaks could not be resolved due to matrix effects. Positive results for these compounds were qualified "J." In addition, both STL and Mitkem reported tentatively identified compounds (TICs) for SVOCs. The TICs are qualified J as estimated and "N" as not confirmed. For soil and sediment samples,

the TICs represented potential hydrocarbon contamination as well as confirm high levels of PCB contamination. For the groundwater samples, the TICs indicate the potential for glycol contamination.

Pesticide analysis by EPA Method 8081 employs gas chromatography with electron capture as means of detection. Retention time is used as the method of compound identification. The analysis is ran using two dissimilar analytical columns to provide reliability in identification. However, in the presence of PCBs or in a complicated sample matrix, EPA Method 8081 can result in false positives or high biases of pesticide compounds.

The laboratory documented matrix interferences encountered in the EPA Method 8081 analysis. In those cases, the samples were analyzed at a dilution. Low levels of pesticides (e.g., 4,4′-DDE, 4,′-DDT, delta-BHC, Endosulfan II) were reported as positive detections, based on second column confirmation. The EPA Method 8081 chromatogram exhibited a "noisy" baseline pattern with multiple peaks. Based on the retention time and pattern recognition, the laboratory reported positive hits for PCBS in the EPA Method 8082 analysis of the same samples. The EPA Method 8270 chromatogram displayed the matrix interferences as the hydrocarbon "envelope."

During EPA Method 8081 and 8070C screening, the laboratory reported instrument shut-down for several samples. Analysis could only be performed with additional sample preparation steps and dilutions, resulting in elevated detection limits. Moreover, EPA Method 8081 analysis was eliminated for several samples based on the elevated detection limits and increased probability of false positive attributed to matrix interferences.

4.3 Data Review

The samples were grouped by STL and Mitkem into sample delivery groups (SDGs) based on batches of no more than 20 samples, daily delivery, or requested turnaround time. The SDGs are listed with their associated samples in Appendix E. A DUSR was generated for each SDG and they are included in Appendix E. Data for IDW soil and water disposal were not reviewed. The data reviews (both hard copy and electronic) followed the NYSDEC Guidance for the Development of DUSRs, June 1999.

Table 4-2 provides a summary of analytical methods and samples collected. Analytical data reports generated by the laboratory were checked to verify that data reported are consistent with the work plan and QAPP. The data review included an evaluation of the field and laboratory QC samples noted in Section 4.2 using the following procedure:

- **Completeness.** EEEPC performed a completeness check on all EDDs and compared the data to the hard copy deliverable to verify the data were reported consistently.

- **Compliance.** EEEPC processed EDDs using the internal software to verify the data reported are compliant with the QAPP requirements. EEEPC performed electronic data validation of EDDs and generated reports of qualified data. EEEPC reviewed the electronic reports, checked the hard copy reports and case narratives, assigned qualifiers to any outliers, review calibration information, and developed a DUSR for each SDG.

- **Reporting.** EEEPC assigned data qualifiers and flagged all reportable data. EEEPC generated summary tables of final qualified data included in Section 5.

- **Data Management.** EEEPC developed a project-specific database with all validated data stored in Microsoft Access format. A copy of the complete electronic data is provided in Appendix E.

Any deviations from acceptable QC specifications are discussed in the DUSRs (see Appendix E). The EEEPC data validators added appropriate qualifiers to the data to indicate potential concerns with data usability. These qualifiers were transferred to the data presented on summary tables in Section 5. For the SRI data, the following qualifiers were added:

J – The qualifier indicates an estimated value because the associated QC data indicated a potential laboratory or matrix problem or interference.

U – The result is considered non-detect. The laboratory assigned this flag to analytes not present at detectable concentrations (above the instrument detection limit or method detection limit). The data validator assigned this flag when an analyte was considered non-detect due to blank contamination. If the result is above the PQL, the PQL is considered elevated.

UJ – The result is considered non-detect at an estimated PQL.

Overall, the data quality was acceptable and the laboratory analysis and reporting procedures were representative of appropriate methodology for the samples collected. Table 4-3 summarizes the qualified data records for the sample reports. No sample results were rejected for an overall completeness of 100%. Laboratory QC concerns did not have a significant impact on the overall completeness and representativeness of the dataset. Copies of the laboratory reports are provided electronically as part of Appendix E.

5 Nature and Extent of Contamination

5.1 Introduction

This section presents the analytical results of the SRI field activities in order to develop an understanding of the nature and extent of contamination at the Site. This information was used to assess the fate and transport of chemicals (see Section 6) and identify chemicals of potential concern for risk evaluation (see Section 7) that pose a potential threat to human health and/or the environment. A summary of the total number of samples organized by property and sample media is presented in Table 5-1.

Screening

The analytical results (see Tables 5-2 through 5-7) were screened against existing NYS regulatory criteria to identify samples containing analyte levels that may represent a possible threat to human health and/or the environment. Groundwater analytical data were compared to standards and guidance values contained in NYSDEC, *Technical and Operational Guidance Series (TOGS 1.1.1: Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (NYSDEC 1998, with updates). Soil (surface and subsurface) data were compared to soil cleanup objectives contained in NYSDEC, 6 New York Codes, Rules, and Regulations (NYCRR) Subpart 375-6.8, *Remedial Program Soil Cleanup Objectives*. Sediment data were compared to the sediment criteria contained in the NYSDEC Division of Fish, Wildlife, and Marine Resources Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999, with updates).

Under the Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999), the screening levels for organic compounds are calculated based on the site-specific/sample-specific TOC. Site-specific corrected screening values were calculated based on an average TOC in order to compare the sample data to the same screening value. The TOC was determined by averaging the TOC results from all samples and calculated the 95% confidence interval. The lowest confidence interval of the TOC average was used for the calculation of the screening levels for the sediment samples, because this generated the most conservative estimate. Under this guidance the screening levels are calculated for: human health bioaccumulation, wildlife bioaccumulation, and benthic aquatic life acute and

chronic toxicity. The most stringent of the four levels was used in the comparisons. NYSDEC is in the process of revising the screening levels for sediments. The sediment data are also compared against the draft (not published) Sediment Guidance Values for Use in Assessing Contaminated Sediment in New York State. The draft criteria are based on development of national consensus based sediment quality guidelines (MacDonald et al. 2000a and b).

Under 6 NYCRR Subpart 375-6.8, NYSDEC presents various soil cleanup objectives (SCOs) for protection of public health based on land use criteria which include:

- **Unrestricted Use**, which is a use without imposed restrictions, such as environmental easements or other land use controls; or

- **Restricted Use,** which is a use with imposed restrictions, such as environmental easements, which as part of the remedy selected for the site require a site management plan that relies on institutional controls or engineering controls to manage exposure to contamination remaining at a site. Restricted use is separated into four different categories:

    1. **Residential Use** is a land use category that allows a site to be used for any use other than raising livestock or producing animal products for human consumption. Restrictions on the use of groundwater are allowed, but no other institutional or engineering control relative to the residential soil cleanup objectives, such as a site management plan, would be allowed. This land use category will be considered for single family housing;

    2. **Restricted-Residential Use** is a land use category that shall only be considered when there is common ownership or a single owner/managing entity of the site. Restricted-residential use shall, at a minimum, include restrictions which prohibit any vegetable gardens on a site, although community vegetable gardens may be considered with NYSDEC approval and single-family housing. Active recreational uses, which are public uses with a reasonable potential for soil contact, such as parks, are also included under this category;

    3. **Restricted-Commercial Use** is a land use for the primary purpose of buying, selling, or trading of merchandise or services. Commercial use includes passive recreational uses, which are public uses with limited potential for soil contact; and

    4. **Restricted-Industrial Use** is a land use for the primary purpose of manufacturing, production, fabrication, or assembly process and ancillary services. Industrial uses do not include any recreational component.

In addition, SCOs are presented in 6 NYCRR Subpart 375-6.8 for the protection of groundwater and ecological resources, which should be considered where applicable. The SCOs for protection of groundwater were not included in the screening process because groundwater data are screened independently against NYSDEC TOGS 1.1.1 values. If groundwater contamination is determined to be of concern based on this screening process, the FS will consider these soil cleanup objectives in selection of cleanup goals for soils. Similarly, protection of ecological resources is evaluated in the Site-specific ERA. If the ERA for this Site identifies a serious risk for one or more receptor groups, the SCOs for protection of ecological resources can be considered at that time as part of the risk-management process for the Site. Since this is a Superfund project, the soil data must be compared to prerelease conditions; therefore, the 6 NYCRR Part 375-6.8 Unrestricted Use SCOs are used for the Site. Additionally, the Restricted-Commercial Use SCOs are included in the tables for comparison purposes only.

The list of inorganic analytes (i.e., metals) found in the 6 NYCRR Part 375-6.8 regulation is limited to 15 metals because the intention of NYSDEC was to develop cleanup objectives for a priority list of contaminants commonly found at NYS waste sites. NYS background values (95th percentile), obtained from Appendix D of the *New York State Brownfield Cleanup Program, Development of Soil Cleanup Objectives, Technical Support Document* (NYSDEC 2006c), were used as screening criteria for those metals that were detected in site soils but not listed in 6 NYCRR Part 375-6.8. For metals with no Part 375-6.8 cleanup objectives and no NYS background values, eastern United States background values (95th percentile) from Shacklette and Boerngen (1984) were used as screening values.

The concentrations of metals in the TCLP analysis of high-level lead samples were compared to NYSDEC, Division of Solid and Hazardous Materials, Identification and Listing of Hazardous Wastes (6 NYCRR 371) for D008 hazardous waste values (hereafter called “NYSDEC hazardous waste values”).

Additionally, guidance values and standards apply to total PCB concentrations rather than individual Aroclor concentrations. Aroclors 1242, 1248, 1254, 1260, 1262, and 1268 were found in the various samples collected during the SRI. Aroclors 1248 and 1254 were the predominant Aroclors. Aroclor 1260 also was found in several soil and sediment samples. Aroclor 1242 was only detected in six shallow sediment samples; Aroclor 1262 was only detected in four downstream off-bank soil samples; and Aroclor 1268 was not found in the sediment samples. PCBs were not detected in groundwater samples collected at this Site.

5.2 Sediment Investigation Sampling and Analysis Results

Ninety-three sediment samples were collected from the center and banks of Eighteenmile Creek, as well as from the Barge Canal, and one upstream location. A

summary of the collected samples and the analyses is presented in Tables 2-1 and 2-3. The results for the sediment samples are presented in Figures 5-1a through 5-1h and 5-2a through 5-2h and on Tables 5-2a through 5-2f and 5-3a. A discussion of these results is presented below.

Upgradient

Two sediment samples were collected and submitted for TCL PCB, select metals, TCL SVOC, and pesticide analysis. A summary of the analytical data is provided in Table 5-2a. The upgradient location is south of the Barge Canal (see Figure 2-1).

PCBs. There were no PCBs detected in the upgradient sediment samples.

Pesticides. A total of six pesticides were detected in the upgradient sediment samples including five pesticides in the upgradient shallow sediment sample and one in the deep sample. Three pesticides, endrin, lindane and heptachlor, were detected in the shallow sample at concentrations exceeding the respective draft Sediment Guidance Values.

SVOCs. There were several SVOCs detected in the upgradient sediment samples including a phthalate, 16 PAHs, and three PAH-like SVOCs (i.e., similar chemical composition). Six PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene) were detected above the current screening levels. Six more PAHs (anthracene, dibenzo(a,h)anthracene, fluoranthene, fluorene, phenanthrene, and pyrene) were detected above the draft Sediment Guidance Values. Total PAH concentrations exceeded the draft Sediment Guidance Value in both samples. PAHs are ubiquitous products of incomplete combustion of fuels or elevated temperature processes that involve compounds containing carbon and hydrogen and as such they are commonly found in urban areas.

Metals. All five metals were detected in the two samples. Copper was detected at a concentration above the current screening level in the shallow sample (18MC-UP-S01-Z1). Lead was found at a concentration exceeding the current screening level of 31 mg/kg in the shallow sample only (33.5 mg/kg).

New York State Barge Canal

Six sediment samples were collected from the Barge Canal. All samples were submitted to the laboratory for TCL PCB and select metal list (arsenic, chromium, copper, lead, and zinc) analysis. Two samples were also submitted for SVOC analysis, and one sample was also submitted for pesticide analysis. A summary of the analytical data is provided in Table 5-2a. At location 18MC-BC03, a duplicate sample was also collected (18MC-BC03-Z1/D). The collected sediment was mixed prior to filling the sample jars; however, the high gravel content made it difficult to homogenize. The analytical results for the organic compounds (SVOCs, pesticides, and PCBs) show high variability between the two samples,

indicating that the sediment at the 18MC-BC03 area (dry dock) is very heterogeneous. Therefore, the two sets of data are discussed below as individual samples.

PCBs. PCBs were detected in six of the seven sediment samples at concentrations of total PCBs ranging from 0.0066 mg/kg (18MC-BC01-Z1) to 2.63 mg/kg (18MC-BC04-Z1). Two Aroclors were detected, including 1248 (six samples) and 1260 (18MC-BC04). All detections exceeded the current screening level of 0.000023 mg/kg (see Figure 5-1a).

Pesticides. Nine pesticides were detected in the two samples, 18MC-BC03-Z1 and 18MC-BC03-Z1/D, that were analyzed for pesticides. There were three pesticides detected in the original sample (18MC-BC03-Z1) and eight pesticides detected in the duplicate (18MC-BC03-Z1/D). One pesticide, gamma-chlordane, was detected at a concentration above the current screening level (0.000043 mg/kg) in both samples. Dieldrin and beta-BHC were also detected above the current screening levels in the original sample only. Endrin was detected above the draft Sediment Guidance Value only in the duplicate sample. All the pesticide detections were below laboratory reporting limits in the original sample.

SVOCs. There were 24 SVOCs detected in the upgradient sediment samples including phenols, phthalates, and several PAHs and PAH-like compounds. Eight PAHs were detected above the current screening levels and 10 were detected above the draft Sediment Guidance Values. Six of these PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene) were detected above the current screening level in all three samples analyzed. Additionally, total PAH concentrations exceeded the draft Sediment Guidance Value in both samples.

Metals. All five metals were detected in the Barge Canal samples. Lead was detected in all Barge Canal samples at concentrations ranging from 33.1 mg/kg (18MC-BC01-Z1) to 190 mg/kg (18MC-BC06-Z1), which exceed the current screening level (31 mg/kg). Furthermore, lead concentrations exceed the draft guidance value (36 mg/kg) in all but one (18MC-BC01-Z1) Barge Canal samples (see Figure 5-2a). Arsenic, copper, and zinc were also detected above the current screening levels and the draft guidance value in Barge Canal sediments.

Upson Park

Five transects (18MC-L01W, 18MC-L02W, 18MC-L03W, 18MC-L04, and 18MC-L05) were established and 24 (and one duplicate) sediment samples were collected from the West Branch of Eighteenmile Creek adjacent to the Upson Park property. All samples were submitted for TCL PCB and select metals list. Eight samples were also submitted for TCL SVOC analysis and one sample was analyzed for TCLP Metals. A summary of the analytical results is provided in Table 5-2b for sediment samples and Table 5-3a for TCLP metals.

PCBs. PCBs were detected in 14 sediment samples, all at concentrations exceeding the current screening level for total PCBs. Ten samples did not contain any PCBs. The Aroclors detected in the Upson Park sediment samples include 1248 (10 samples), 1254 (10 samples), and 1260 (two samples). The PCB results are shown on Figures 5-1b and 5-1c. All PCB concentrations in the Upson Park area were less than 1 parts per million (ppm).

Pesticides. Fifteen pesticides were detected in the Upson Park sediment samples. Thirteen of these pesticides were detected above the current screening levels in a number of samples. The most frequent exceedances were for 4,4'-dichlorodiphenyltrichloroethane (DDT) and aldrin.

SVOCs. There were 21 SVOCs detected in the Upson Park samples including phenols, phthalates, 19 PAHs, and PAH-like compounds. SVOCs detected above the current screening levels include six PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene). Six more PAHs (anthracene, dibenzo(a,h)anthracene, fluoranthene, fluorene, phenanthrene, and pyrene) were detected above the draft Sediment Guidance Values. Additionally, total PAH concentrations exceeded the draft Sediment Guidance Value in four samples.

Metals. TAL metals analysis revealed the presence of all five metals in the Upson Park samples at concentrations exceeding the screening levels. Lead was detected in all of the 24 sediment samples at concentrations ranging from 28.9 mg/kg (18MC-L02W-S03-Z2) to 1,660 mg/kg (18MC-L01W-S02-Z2). All but one sediment sample collected from Upson Park were found to exceed the current screening level and the draft guidance value (see Figure 5-2b and 5-2c).

Sample 18MC-L01W-S02-Z2 that contained the highest lead concentration did not have lead detected during TCLP analysis. Barium and cadmium were found in the TCLP extract but at concentrations below the NYSDEC hazardous waste values (see Table 5-3a).

The White Transportation Property

Three transects (18MC-L01E, 18MC-L02E, and 18MC-L03E) were established across the East Branch of Eighteenmile Creek adjacent to the White Transportation property and 11 sediment samples were collected. All sediment samples were submitted to the laboratory for TCL PCB analysis. Nine samples were submitted for select metals and two for Total Metals analysis. Six samples were also submitted for TCL SVOC and pesticide analysis. One sample was also analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-2c and 5-3a.

PCBs. PCBs were detected in all of the sediment samples at concentrations ranging from 0.012 mg/kg Aroclor 1248 (18MC-AS01-S01-Z2) to 3.8 mg/kg total PCBs (18MC-L02E-S01-Z1). Principle Aroclors detected were 1248 (seven sam-

ples), 1254 (nine samples), and 1260 (four samples). PCBs were found to exceed the current screening level in all 11 sediment samples (see Figure 5-1d). The highest PCB concentrations were found in 18MC-L02E-S01-Z1. All the other PCB concentrations were less than 1 ppm.

Pesticides. Fifteen pesticides were detected in the White Transportation sediment samples. Thirteen of these pesticides were detected above their current screening levels in a number of samples. The most frequent exceedances were for 4,4'-DDE and aldrin. Samples 18MC-L02E-S02-Z1 and 18MC-L03E-S02-Z1 contained the most pesticides at concentrations above the screening levels.

SVOCs. There were 22 SVOCs detected in the White Transportation sediment samples. Twelve SVOCs were detected above the current screening levels, the draft Sediment Guidance Values, or both. Additionally, total PAH concentrations exceeded the draft Sediment Guidance Value in all samples. The highest concentration of PAHs was found in sample 18MC-L03E-S02-Z1.

Metals. Twenty-two metals were detected in the White Transportation samples. The five main metals (arsenic, chromium, copper, lead, and zinc) were detected in all the samples and at least once above the current screening level. Lead concentrations in all 11 sediment samples exceeded the current screening level and in 10 samples they also exceeded the higher draft guidance values. Other metals found at concentrations exceeding the current screening level include manganese and nickel. Lead, copper, and zinc exhibited the most exceedances over the screening levels (see Figure 5-2d).

TCLP metals analysis of sample 18MC-L02E-S01-Z1 that contained the highest lead concentration revealed lead in the TCLP extract at concentrations below the NYSDEC hazardous waste values (see Table 5-3a). Only trace low levels of barium, cadmium, and lead were found in the TCLP extract of this sample.

The Former United Paperboard Company Property

Six transects (18MC-L06 through 18MC-L11) were established across Eighteenmile Creek adjacent to the Former United Paperboard Company property and 20 sediment samples were collected. All sediment samples were submitted to the laboratory for TCL PCB and select metals analysis. Seven samples were also submitted for TCL SVOC and pesticide analysis. Four samples were analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-2d and 5-3a.

PCBs. PCBs were detected in 17 of the 20 United Paperboard Company sediment samples at concentrations ranging from 0.04 mg/kg total PCBs (18MC-L08-S02-Z1) to 61 mg/kg total PCBs (18MC-L09-S03-Z1). Principle Aroclors detected were 1242 (three samples), 1248 (17 samples), 1254 (16 samples), and 1260 (two samples). In all 17 samples where PCBs were detected the current screening level was exceeded and in 13 samples the higher draft guidance value was exceeded as

well. PCBs were not detected in samples 18MC-L06-S01-Z1, 18MC-L08-S01-Z1, and 18MC-L09-S02-Z2 (see Figures 5-1e and 5-1f).

Pesticides. Thirteen pesticides were detected in the United Paperboard sediment samples, all of them found in at least one sample at a concentration above the screening values. Thirteen of these pesticides were detected above their current screening levels in a number of samples. The most frequent exceedances were for 4,4'-Dichlorodiphenyldichloroethylene (DDE) and aldrin. Samples 18MC-L02E-S02-Z1 and 18MC-L03E-S02-Z1 contained the most pesticides at concentrations above the screening levels. The majority of the pesticides were detected at concentrations below the laboratory reporting limit.

SVOCs. There were 22 SVOCs detected in the United Paperboard sediment samples. Thirteen PAHs were detected above the current screening levels, the draft Sediment Guidance Values, or both. Additionally, total PAH concentrations exceeded the draft Sediment Guidance Value in four samples. The highest PAH concentrations were detected in sample 18MC-L11-S02-Z1.

Metals. All five metals were detected in the United Paperboard samples at concentrations exceeding the screening levels. Lead was detected in all sediment samples at concentrations ranging from 31.9 mg/kg (18MC-L06-S02-Z1) to 15,000 mg/kg (18MC-L09-S03-Z1), all exceeding the current screening level of 31 mg/kg. The highest metals concentrations were found in 18MC-L09-S03-Z1 (see Figures 5-2e and 5-2f).

Four samples with lead concentrations above 1,000 ppm (18MC-L09-S01-Z1, 18MC-L09-S03-Z1, 18MC-L10-S01-Z1, and 18MC-L11-S02-Z1) were selected for TCLP analysis. All four metals (barium, cadmium, chromium, and lead) were detected during TCLP metals analysis in a least one sample extract. Sample 18MC-L09-S01-Z1 contained lead in the extract at a concentration exceeding the NYSDEC hazardous waste value (see Table 5-3a). All the other concentrations were below NYSDEC hazardous waste values.

The Former Flintkote Plant Site

Seven transects (18MC-L12, 18MC-L13, 18MC-L14W, 18MC-L14E, 18MC-L15W, 18MC-L15E, and 18MC-L16E) were established across Eighteenmile Creek adjacent to the Former Flintkote Plant Site and 22 sediment samples (and one duplicate) were collected. All sediment samples were analyzed for TCL PCB and select metals. Seven samples were also submitted for TCL SVOC and Pesticide analysis. Eleven samples were analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-2e and 5-3a.

PCBs. PCBs were detected in 17 of the 22 sediment samples at concentrations ranging from 0.006 mg/kg Aroclor 1248 (18MC-L14W-S02-Z1) to 180 mg/kg Aroclor 1248 (18MC-L14E-S02-Z1). Principle Aroclors detected were 1242 (two samples), 1248 (16 samples), and 1254 (16 samples). In all 18 samples where

PCBs were detected the current screening level was exceeded and in 16 samples the higher draft guidance value was exceeded as well (see Figure 5-1g).

Pesticides. Fifteen pesticides were detected in the Former Flintkote Plant Site sediment samples. Twelve of these pesticides were detected above the current or draft proposed screening levels in a number of samples. The most frequent exceedances were for endosulfan I, alpha BHC, and lindane. The majority of the pesticides were found at levels below the laboratory reporting limits.

SVOCs. There were 27 SVOCs detected in the Former Flintkote Plant Site sediment samples. Fourteen PAHs, one phthalate, and one PAH-like compound were detected above the current screening levels, the draft Sediment Guidance Values, or both. Additionally, total PAH concentrations exceeded the draft Sediment Guidance Value in five samples. The highest PAH concentrations were detected in sample 18MC-L15E-S02-Z1.

Metals. All five of the selected metals were detected in all the Former Flintkote Plant Site samples. The concentrations of every metal exceeded the screening levels in 14 of the 22 samples and some metals exceeded screening levels in every sample. Lead was detected in all 22 sediment samples at concentrations ranging from 11.3 mg/kg (18MC-L14W-S02-Z1) to 3,990 mg/kg (18MC-L13-S03-Z1). Lead concentrations exceeded the current and draft proposed screening levels in 21 Former Flintkote Plant Site sediment samples (see Figure 5-2g). Copper concentrations exceeded the current screening level in all samples.

TCLP metals analysis was performed on 11 samples with concentrations of lead greater than 1,000 ppm. Barium, cadmium, and lead were detected in all of the sample extracts. Extracts for samples 18MC-L13-S03-Z1, 18MC-L14W-S03-Z1, 18MC-L14W-S03-Z2, and 18MC-L15E-S03-Z1 contained lead at concentrations exceeding the NYSDEC hazardous waste value (see Table 5-3a).

Area Downstream of the Former Flintkote Plant Site

Three transects (18MC-L16W, 18MC-L17, and 18MC-L18) were established across Eighteenmile Creek adjacent to and downstream of the Former Flintkote Plant Site and eight sediment samples were collected. All sediment samples were analyzed for TCL PCB and select metals. Three samples were also submitted for TCL SVOC and Pesticide analysis. A summary of the analytical data is provided in Tables 5-2f and 5-3e.

PCBs. PCBs were detected in six of the eight sediment samples. Total PCB concentrations ranged from 0.02 (18MC-L18-S02-Z2) to 10.3 mg/kg (18MC-L16W-S01-Z1). Principle Aroclors detected were 1242 (two samples), 1248 (four samples), 1254 (five samples), and 1260 (one sample). In all six samples where PCBs were detected the current screening level was exceeded and in four samples the higher draft guidance value was exceeded as well.

Pesticides. Eight pesticides were detected in the downstream sediment samples at low concentrations below the laboratory reporting limit. The concentrations did exceed at least one screening level. Sample 18MC-L18-S02-Z1 contained the most pesticides with all concentrations exceeding the higher draft screening level.

SVOCs. There were 18 SVOCs detected in the downstream sediment samples. Nine PAHs were detected above the current screening level, the draft Sediment Guidance Value, or both. Additionally, total PAH concentrations exceeded the draft Sediment Guidance Value in two samples. The highest PAH concentrations were detected in sample 18MC-L18-S02-Z1.

Metals. All five selected metals were detected in the downstream samples. The concentrations of every metal exceeded the screening levels in only two of the seven samples. Lead was detected in all sediment samples at concentrations ranging from 32.6 mg/kg (18MC-L18-S02-Z2) to 576 mg/kg (18MC-L18-S02-Z1), which all exceeded the current screening level. Copper concentrations exceeded the current screening level in all downstream samples as well. None of the lead concentrations were above 1,000 ppm, therefore, no TCLP analysis was performed.

5.3 Soil Investigation Sampling and Analysis Results

Fifty-nine surface soil and 95 subsurface soil samples were collected during the SRI, including off bank surface and subsurface soil samples collected during the sediment coring and surface and subsurface soil samples collected during borehole drilling and monitoring well installation. The results for the soil samples are presented on Figures 5-1 through 5-5, Table 5-3b, and table series 5-4 through 5-6. A discussion of these results is presented below.

5.3.1 Surface Soil Samples

A combined total of 59 surface soil samples (generally less than 2 inches below grade) were collected from the Upson Park, White Transportation, Former United Paperboard Company, and downstream of the Former Flintkote Plant Site properties. These samples were collected from off bank creek transect locations and from soil boring locations where monitoring wells were installed with the following exceptions: 18MC-SS02 (MW-02 was moved south of originally intended location due to shallow refusal and because MW03 would not be installed), 18MC-SS03 (MW03 was not installed), 18MC-SS05 (MW05 was moved due to an overhead obstruction and to target a suspected area of contamination), 18MC-SS07 (MW07 was not installed), and 18MC-SS18 through -SS20 were collected form locations where no monitoring wells were planned.

Upson Park

Sixteen surface soil samples were collected from Upson Park including 12 collected along the creek transects (Z1 samples of S04, S05, and S06 locations) and four collected from other portions of the property. All surface soil samples were submitted to the laboratory for TCL PCB and TAL Metals analysis. Ten samples

were submitted for TCL SVOC analysis and nine of them were also submitted for TCL Pesticide analysis. One sample was analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-3b, 5-4a, and 5-5a.

PCBs. Four PCBs were detected in 10 of the 16 surface soil samples at total PCB concentrations ranging from 0.0097 mg/kg to 0.66 mg/kg (18MC-SS15). The Aroclors detected were 1248 (five samples), 1254 (eight samples), 1260 (three samples), and 1268 (two samples). PCBs were found at concentrations exceeding the unrestricted use SCO of 0.1 mg/kg in six samples. There were no exceedances of the restricted commercial use SCO of 1.0 (see Figures 5-1b and 5-1c). All PCB concentrations in the Upson Park area were less than 1 ppm.

Pesticides. Fourteen pesticides were detected in the Upson Park surface soil samples. Four pesticides were detected at least once at a concentration above the unrestricted use SCO. 4,4'-DDE and 4,4'-DDT exhibited the most exceedances.

SVOCs. There were 20 SVOCs, mostly PAHs, detected in the Upson Park surface soil samples. Seven PAHs were detected above the unrestricted use SCO. The highest concentrations and most exceedances of PAH were found in sample 18MC-L04W-S04-Z1. No PAH were detected about the higher commercial use SCO except benzo(a)pyrene in this sample. Note that the commercial use and restricted use SCOs are the same for benzo(a)pyrene.

Metals. Twenty-two metals were detected in the Upson Park samples. Sixteen metals concentrations exceeded the unrestricted use SCO and 11 metals concentrations exceeded also the higher commercial use SCO. The five main metals (arsenic, chromium, copper, lead, and zinc) were detected in all the samples and at least once above the unrestricted use SCO. Chromium concentrations exceed the unrestricted use SCO in every sample. Lead was present in all the samples at concentrations ranging from 18.8 mg/kg (18MC-L01W-S04-Z1) to 3,480 mg/kg (18MC-L03W-S05-Z1). Lead concentrations exceeded the unrestricted use SCO in all but four samples and the restricted commercial use (1,000 mg/kg) SCO in one sample (18MC-L03W-S05-Z1) (see Figures 5-2b and 5-2c).

TCLP metals analysis was performed on the one sample 18MC-L03W-S05-Z1 with lead concentrations above 1,000 ppm. Trace levels of lead and barium were found in the extract at concentrations below the NYSDEC hazardous waste values (see Table 5-3b).

The White Transportation Property

Eight surface soil samples were collected from the White Transportation property including four that are located on transects established across the creek and four collected at various locations in the property. All were submitted to the laboratory for TCL PCB and TAL metals analysis. Six samples were also submitted for TCL SVOC and TCL Pesticide analysis. All surface soil samples were archived and

one sample was analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-3b, 5-4b, and 5-5b.

PCBs. PCBs were detected in six of the eight surface soil samples at total PCB concentrations ranging from 0.0078 mg/kg (18MC-L03E-S04-Z1) to 0.67 mg/kg (18MC-SS13). Principle Aroclors detected were 1248 (one sample), 1254 (one sample), and 1260 (five samples). PCBs were found to exceed the unrestricted use SCO in three samples (all for Aroclor 1260); however there were no exceedances noted over the higher SCO for restricted commercial use (see Figure 5-1d).

Pesticides. Fourteen pesticides were detected in the White Transportation surface soil samples. Four pesticides were detected at least twice at a concentration above the unrestricted use SCO. 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT exhibited the most exceedances.

SVOCs. There were 23 SVOCs, including 16 PAHs, detected in the White Transportation surface soil samples. Only sample 18MC-SS10 contained SVOCs (five PAHs) at concentrations above the unrestricted use SCOs. One PAH, benzo(a)pyrene, was also detected above the commercial use SCO. Note that the commercial use and restricted use SCOs are the same for benzo(a)pyrene.

Metals. Twenty-two metals were detected in the White Transportation samples. Thirteen metals concentrations exceeded the unrestricted use SCO and eight metals concentrations exceeded also the higher commercial use SCO. The five main metals (arsenic, chromium, copper, lead, and zinc) were detected in all the samples and at least in three samples at concentrations above the unrestricted use SCO. Chromium concentrations exceeded the unrestricted use SCO in every sample. Lead was detected in all White Transportation surface soil samples at concentrations ranging from 9.7 mg/kg to 3,750 mg/kg (see Figure 5-2d). Lead concentrations exceeded the unrestricted use SCO in six samples and the restricted commercial use SCO in one sample (18MC-L02E-S05-Z1).

TCLP metals analysis was performed on sample 18MC-L02E-S05-Z1 that contained lead at a concentration greater than 1,000 ppm. Trace levels of barium, cadmium, chromium, and lead were found in the TCLP extract at concentrations below the NYSDEC hazardous waste values (see Table 5-3b).

The Former United Paperboard Company Property

Twenty-one surface soil samples were collected from the United Paperboard Company property. These samples include 12 surface soil samples collected during sediment coring (off-bank samples) and nine surface soil samples collected at locations where monitoring wells were planned. Additionally the surface soil off-bank sample collected adjacent to the Former Flintkote Plant Site (18MC-L13-S04-Z1) is discussed herein with the United Paperboard surface soil samples. Three additional samples (18MC-SS18 through SS-20) were collected from the

property across the United Paperboard at the Site of the dilapidated former power plant building located on the east side of Mill Street. These samples are included in this section with the United Paperboard samples as well. A total of 25 samples was submitted to the laboratory for TCL PCB and TAL metals analysis. Nineteen samples were submitted for TCL SVOC analysis and 16 samples were submitted for TCL Pesticide analysis. All surface soil samples were archived and two samples were analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-3b, 5-4c, and 5-5c.

PCBs. PCBs were detected in 17 of the 25 surface soil samples with total PCB concentrations ranging from 0.014 mg/kg to 4.3 mg/kg. Principle Aroclors detected were 1248 (seven samples), 1254 (11 samples), 1260 (two samples), and 1268 (only in the two samples collected inside the dilapidated former power plant building). Seventeen soil samples contained PCBs at concentrations exceeding the unrestricted use SCO. PCB concentrations (Aroclor 1248) in one sample (18MC-L07-S05-Z1) also exceeded the higher commercial use SCO (see Figures 5-1e to 5-1g). The sample is located on the east bank under the United Paperboard facility.

Pesticides. Eighteen pesticides were detected in the samples. Seven pesticides were detected at least twice at a concentration above the unrestricted use SCO. 4,4'-DDE and 4,4'-DDT concentrations exceeded the SCO in all the samples and were the most common pesticides found.

SVOCs. There were 24 SVOCs, including 16 PAHs, detected in the surface soil samples discussed here. Ten SVOCs, including nine PAHs and dibenzofuran (a PAH-like compound) were detected at concentrations exceeding the unrestricted use SCO. Additionally, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene concentrations exceeded the higher commercial use SCO in at least three samples. PAH levels in the two samples (i.e., SS18 and SS19) collected inside the dilapidated former power plant building were several times higher than those detected in the other Former United Paperboard Company samples.

Metals. Twenty-three metals were detected in the samples discussed here. Eighteen metals concentrations exceeded the unrestricted use SCO and 12 metals concentrations exceeded also the higher commercial use SCO. Lead was detected in all of the 25 surface soil samples at concentrations ranging from 32.0 mg/kg (18MC-L10-S04-Z1) to 3,600 mg/kg (18MC-L09-S04-Z1). Lead concentrations exceeded the unrestricted use SCO in all but four samples and the commercial use SCO in three samples (see Figures 5-2e through 5-2g).

Similar to the other surface soil samples, chromium concentrations exceeded the unrestricted use SCO in all samples. Copper and zinc concentrations exceeded the unrestricted use SCO in 18 samples (one of which also exceeded the commercial use SCO for copper). The commercial use SCO was exceeded in several

samples including 12 samples for antimony and eight for arsenic. Twelve samples contained mercury at concentrations exceeding the unrestricted use SCO. Ubiquitous metals such as magnesium, calcium, and iron were found at concentrations exceeding at least the unrestricted use SCO in several samples. Metals concentrations in the two samples collected inside the dilapidated former power plant building were similar to those found in the other United Paperboard samples with the exception of barium and zinc that were found at concentrations several orders of magnitude higher in the two samples than in the United Paperboard samples. Barium concentrations exceeded the commercial use SCO.

TCLP metals analysis was performed on samples 18MC-L09-S04-Z, 18MC-L09-S05-Z1, 18MC-SS18, and 18MC-SS19. Barium, cadmium, and chromium concentrations in the TCLP extract were below the NYSDEC hazardous waste values. Lead was detected in extract from 18MC-L09-S04-Z1 at a concentration exceeding the NYSDEC hazardous waste value (see Table 5-3b).

Area Downstream of the Former Flintkote Plant Site

Ten surface soil samples were collected from the area downstream of the Former Flintkote Plant Site and. All the samples were analyzed for TCL PCB and TAL metals. Three samples were also submitted for TCL SVOCs and pesticide analysis. A summary of the analytical data is provided in Tables 5-3b and 5-5d.

PCBs. PCBs were detected in three of the 10 samples with total PCB concentrations ranging from 0.1 to 0.83 mg/kg. Principle Aroclors detected were 1254 (one samples), 1260 (one sample), and 1262 (two samples). PCB concentrations in samples 18MC-L16W-S04-Z1 and 18MC-L18-S07-Z1 exceeded the unrestricted use SCO but were below the higher commercial use SCO (see Figure 5-1h).

Pesticides. Eleven pesticides were detected in the downstream samples. Concentrations of three pesticides (4,4'-DDE, 4,4'-DDT, and dieldrin) exceeded the unrestricted use SCO in sample 18MC-L16W-S04-Z1.

SVOCs. There were 24 SVOCs detected in the downstream samples. PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were found at concentrations exceeding the unrestricted use SCO in two sample each. Benzo(a)pyrene concentrations also exceeded the commercial use SCO in the two samples, because this SCO is the same as the unrestricted use SCO.

Metals. Twenty-three metals were detected in the downstream samples. Sixteen metals concentrations exceeded the unrestricted use SCO and nine metals concentrations exceeded also the higher commercial use SCO. Lead was detected in all downstream surface soil samples at concentrations ranging from 20.9 mg/kg (18MC-L16W-S05-Z1) to 603 mg/kg (18MC-L18-S05-Z1). Lead concentrations exceeded the unrestricted use SCO in all but two samples (see Figure 5-2h).

Similar to the other surface soil samples, chromium concentrations exceeded the unrestricted use SCO in all downstream surface soil samples. Copper and zinc concentrations exceeded the unrestricted use SCO in five and eight samples, respectively (two of which also exceeded the commercial use SCO for copper). The commercial use SCO was exceeded for several metals including antimony (two samples), cobalt, arsenic, potassium, and nickel (one sample each). Five samples contained mercury at concentrations exceeding the unrestricted use SCO. Ubiquitous metals, such as magnesium, calcium, and iron, were found at concentrations exceeding at least the unrestricted use SCO in several samples and the commercial use SCO in at least two samples each. Lead concentrations did not exceed 1,000 ppm and no TCLP analysis was performed.

5.3.2 Subsurface Soil Samples

A combined total of 95 subsurface soil samples were collected from the study area. Subsurface soil samples were collected from off bank locations and soil boring locations.

Upson Park

A total of 28 subsurface soil samples were collected, including 17 off-bank subsurface soil samples collected along the transects established across the West Branch of Eighteenmile Creek adjacent to the Upson Park property and 11 subsurface soil samples collected during drilling operations in the property. These samples were submitted for TCL PCB and TAL metals analysis. Four samples were also submitted for TCL SVOC analysis. Six samples were analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-3b, 5-5a, and 5-6a.

PCBs. PCBs were detected in 14 of the 28 subsurface soil samples at total PCB concentrations ranging from 0.0093 mg/kg to 4.0 mg/kg total PCBs. Aroclors detected included 1248 (two samples), 1254 (eight samples), 1260 (four samples), 1268 (five samples). PCBs concentrations exceeded the unrestricted use SCO in four subsurface soil samples (18MC-L02W-S04-Z2, 18MC-L02W-S04-Z3, 18MC-L02W-S05-Z2, and 18MC-L02W-S06-Z2), while the concentration exceeded the higher restricted commercial use SCO in only one sample (18MC-L02W-S04-Z3). This sample was collected on the west side of the Site at a depth of 2.5 to 3 feet. Nearby subsurface soils did not show any PCB concentrations above 1 ppm (see Figures 5-1b and 5-1c).

SVOCs. There were seven SVOCs detected in the Upson Park samples, all at concentrations below the SCOs.

Metals. Twenty-three metals were detected in the Upson Park subsurface soil samples, with most of them found at concentrations exceeding the SCOs in several samples. Metals found above the higher commercial use SCOs include: antimony, arsenic, barium, cadmium, calcium, cobalt, copper, iron, lead, magnesium, mercury, nickel, potassium, sodium, and vanadium. Lead was detected in

all of the subsurface soil samples at concentrations ranging from 7.9 mg/kg to 77,300 mg/kg. Lead concentrations exceeded both SCOs in four samples and only the unrestricted use SCO in 15 samples (see Figures 5-2b and 5-2c). Similar to the surface soil samples, chromium levels exceeded the unrestricted use SCO in all the Upson Park subsurface soil samples.

TCLP metals analysis was performed on six samples with total lead concentrations close to or over 1,000 ppm. Barium, cadmium, chromium, and lead were detected at low levels in the sample extracts except for sample 18MC-SB14-Z2. This sample extract contained lead at a concentration exceeding the NYSDEC hazardous waste value (see Table 5-3b). The other sample from this boring, 18MC-SB14-Z1, contained lead close to the NYSDEC hazardous waste value for lead.

The White Transportation Property

Twenty-one subsurface soil samples were collected from the White Transportation property. These samples include 16 off-bank subsurface soil samples collected during sediment coring and five subsurface soil samples collected during drilling operations. The 21subsurface soil samples were submitted for TCL PCB and TAL metals analysis. Six samples were also submitted for TCL SVOC analysis. Two samples were analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-3b, 5-5b, and 5-6b.

PCBs. PCBs were detected in five subsurface soil samples at total PCB concentrations ranging from 0.012 mg/kg to 0.48 mg/kg. Principle Aroclors detected included 1254 (two samples) and 1260 (four samples). PCB concentrations were found to exceed the unrestricted use SCO in two White Transportation subsurface soil samples (18MC-SB09-Z1 and 18MC-L02E-S04-Z2); however they did not exceed the higher commercial use SCO (see Figure 5-1d).

SVOCs. Thirty-two SVOCs were detected in the White Transportation subsurface soil. Three SVOCs (1,4-dioxane, 4-methylphenol, and phenol) were detected at concentrations exceeding the unrestricted use SCOs. Chlorophenol compounds also were detected at trace levels in these borings. This level of phenol compounds was not observed in any other samples. The concentrations appear to be unique to White Transportation.

Metals. Twenty-two metals were detected in the White Transportation subsurface soil samples, 16 of which were found at concentrations exceeding the SCOs. Metals found above the higher commercial use SCOs include: antimony, barium, calcium, iron, lead, magnesium, potassium, and sodium. Lead was detected in all of the subsurface soil samples at concentrations ranging from 1.7 mg/kg to 2,590 mg/kg. Lead concentrations exceeded both SCOs in one sample (18MC-L02E-S05-Z2) and only the unrestricted use SCO in seven samples (see Figure 5-2d). Similar to the surface soil samples, chromium levels exceeded the unrestricted use SCO in all the White Transportation subsurface soil samples.

TCLP metals analysis was performed on samples 18MC-L02E-S05-Z2 and 18MC-MW13-Z1 that contained high levels of total lead. Barium, cadmium, lead, and chromium were detected in the TCLP extracts at concentrations below the NYSDEC hazardous waste values (see Table 5-3b).

The Former United Paperboard Company Property

Thirty-seven subsurface soil samples were collected from the United Paperboard property. These samples include 12 off-bank samples subsurface soil samples collected during coring and 25 subsurface soil samples collected during drilling operations. Additionally, the off-bank subsurface soil sample collected from transect line 18MC-L13 (18MC-L13-S04-Z2) located at the boundary of the Flintkote property is discussed herein with the United Paperboard subsurface soil samples. The 38 samples were submitted for TCL PCB and TAL metals analysis. Thirteen samples were also submitted for TCL SVOC analysis. Four samples were analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-3b, 5-5c, and 5-6c.

PCBs. PCBs were detected in 11 subsurface soil samples at total PCB concentrations ranging from 0.0047 mg/kg to 626 mg/kg. Principle Aroclors detected included 1248 (10 samples), 1254 (five samples), and 1260 (two samples). PCBs were found to exceed only the unrestricted use SCO in six subsurface soil samples, and both SCOs in three samples (18MC-SB15-Z1, 18MC-L08-S05-Z2, and 18MC-L09-S05-Z2). Sample 18MC-SB15-Z1 had the highest concentration of PCBs of any of the samples at the Site (see Figures 5-1e through 5-1g).

SVOCs. Thirty-three SVOCs were detected in the United Paperboard Company subsurface soil. Four SVOCs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene) were detected at concentrations exceeding the unrestricted use SCOs and one (benzo(a)pyrene) was detected at concentrations exceeding both SCOs. Sample 18MC-MW05-Z1 contained the highest levels of SVOCs.

Metals. Twenty-two metals were detected in the United Paperboard Company subsurface soil samples, 19 of which were found at concentrations exceeding the SCOs. Metals found above both SCOs include: antimony, arsenic, calcium, cobalt, copper, iron, lead, magnesium, mercury, potassium, sodium, and vanadium. Lead was detected in all the property subsurface soil samples at concentrations ranging from 1.7 mg/kg to 7,430 mg/kg. Lead concentrations in nineteen samples were found to exceed the unrestricted use SCO, and in four samples (18MC-MW05-Z1, 18MC-SB15-Z1, 18MC-L09-S04-Z2, and 18MC-L09-S05-Z2) exceeded both SCOs (see Figures 5-2e through 5-2g). Similar to the surface soil samples, chromium levels exceeded the unrestricted use SCO in all the United Paperboard subsurface soil samples.

TCLP metals analysis was performed on four samples with concentrations of total lead above 1,000 ppm. Barium, cadmium, and chromium were detected in the sample extracts at concentrations below the NYSDEC hazardous waste values. Lead concentrations in the extracts of samples 18MC-MW05-Z1 and 18MC-SB15 were significantly above the NYSDEC hazardous waste value (see Table 5-3b). Lead was not detected in the extracts of 18MC-L09-S04-Z2 and 18MC-L09-S05-Z2.

Area Downstream of the Former Flintkote Plant Site

Eight subsurface soil samples were collected from the area downstream of the Former Flintkote Plant Site. All the samples were analyzed for TCL PCB and TAL Metals. One sample was analyzed for TCLP Metals. A summary of the analytical data is provided in Tables 5-3b and 5-5d.

PCBs. PCBs were detected in three samples with total PCB concentrations ranging from 0.31 to 0.53 mg/kg. Principle Aroclors detected were 1254 (18MC-L18-S07-Z2) and 1262 (18MC-L16W-S04-Z2 and 18MC-L18-S06-Z2). PCB concentrations in samples 18MC-L18-S06-Z2 exceeded the unrestricted use SCO (see Figure 5-1h).

Metals. Twenty-two metals were detected in the downstream samples. Fourteen metals concentrations exceeded the unrestricted use SCO and nine metals concentrations exceeded also the higher commercial use SCO. Lead was detected in all downstream subsurface soil samples at concentrations ranging from 8.5 mg/kg (18MC-L16W-S05-Z1) to 1,240 mg/kg (18MC-L18-S05-Z1). Lead concentrations exceeded the restricted commercial use SCO in one sample (18MC-L16W-S04-Z2) and the unrestricted use SCO in 12 samples (see Figure 5-2h).

Similar to the other soil samples, chromium concentrations exceeded the unrestricted use SCO in all downstream subsurface soil samples. The commercial use SCO was exceeded for several metals including antimony (two samples), calcium and magnesium (four samples), cobalt, arsenic, sodium, mercury, and nickel (one sample each). Copper, mercury, nickel, and zinc concentrations exceeded the unrestricted use SCO in four samples.

TCLP metals analysis was performed on sample 18MC-L16W-S04-Z2 that contained total lead at a concentration above 1,000 ppm. Barium and cadmium were detected in the TCLP sample extracts at concentrations below the NYSDEC hazardous waste values. Lead and chromium were not detected in the TCLP extract.

5.4 Groundwater Investigation

A combined total of 14 groundwater samples were collected from the wells installed at 15 soil borings on the Upson Park, White Transportation, and Former United Paperboard properties. Well 18MC-MW09 did not produce sufficient water for sample collection.

Upson Park

Four groundwater samples were collected from Upson Park. All samples were submitted to the laboratory for TCL VOC, TCL SVOC, TCL PCB, TCL Pesticide, and TAL Metals (Total and Dissolved) analysis. A summary of the analytical data is provided in Table 5-7a.

PCBs. PCBs were not detected in any of the groundwater samples collected from Upson Park.

VOCs. Groundwater samples from the two southern Upson Park wells (18MC-MW16 and -MW17) did not contain any VOCs. Seven VOCs (chloroform and six chlorinated hydrocarbons) were detected in the sample collected from the 18MC-MW14 well installed at the northern portion of the Site, near the property line at the shoulder of Clinton Street. Trichloroethene (TCE) and cis-1,2-dichloroethene (cis-1,2-DCE) in 18MC-MW14 were found at concentrations above the NYS groundwater quality standards. Three chlorinated hydrocarbons were detected in the groundwater sample collected from well 18MC-MW15 (located approximately 50 feet from the lower of the two Park service roads), all at concentrations below the NYS groundwater quality standards.

SVOCs. No SVOCs were detected in the Upson Park groundwater samples.

Metals. Twenty metals were found in the Upson Park groundwater samples. Total antimony, and total and dissolved iron, magnesium, and sodium were detected at concentrations exceeding the NYS groundwater quality standards in at least three of the four samples. Lead was only detected in sample 18MC-MW17 at a concentration of 11.4 micrograms per liter (µg/L), which is below the NYS groundwater quality standard.

The White Transportation Property

Four groundwater samples were collected from the White Transportation property. All samples were submitted to the laboratory for TCL VOC, TCL SVOC, TCL PCB, TCL Pesticide, and TAL Metals (total and dissolved) analysis. A summary of the analytical data is provided in Table 5-7b.

PCBs. PCBs were not detected in any of the groundwater samples collected from the White Transportation property.

VOCs. The groundwater sample collected from White Transportation well 18MC-MW11 located near the northeast corner of the building contained TCE and toluene at concentrations well below the NYS groundwater quality standards. No other VOCs were detected in the White Transportation groundwater samples.

SVOCs. Three SVOCs (two PAHs and caprolactam) were found in the White Transportation groundwater samples at concentrations well below the NYS groundwater quality standards. No phenolic compounds were detected in the

groundwater even though these compounds were found in the associated subsurface soil samples.

Metals. Sixteen metals were found in the White Transportation groundwater samples. Total antimony, and total and dissolved iron, manganese, and sodium were detected at concentrations exceeding the NYS groundwater quality standards in at least one of the four samples. Lead was not detected in any of the White Transportation groundwater samples.

The Former United Paperboard Company Property

Six groundwater samples were collected from the United Paperboard property. All samples were submitted to the laboratory for TCL VOC, TCL SVOC, TCL PCB, TCL Pesticide, and TAL Metals (total and dissolved) analysis. A summary of the analytical data is provided in Table 5-7c.

PCBs. PCBs were not detected in any of the groundwater samples collected.

VOCs. Groundwater samples from the two United Paperboard wells (18MC-MW06 and -MW08) located in the east portion of the southern parcel did not contain any VOCs. Five VOCs (chloroform and four chlorinated hydrocarbons) were detected at least once in the remaining four United Paperboard wells. One VOC, cis-1,2-DCE, was detected above the NYS groundwater quality standard (5 µg/L) at 7.1 µg/L in well 18MC-MW05 located at the northeast corner of the southern United Paperboard parcel. The remaining VOCs were detected at concentrations well below the NYS groundwater quality standard.

SVOCs. Six SVOCs (three PAHs, phenols, caprolactam, and acetophenone) were found in the United Paperboard groundwater samples. The PAH compounds also were detected in the soil samples from the monitoring well borings. Phenols were detected in groundwater sample 18MC-MW08 at a concentration exceeding the NYS groundwater quality standard. Phenols were not detected in the soil samples collected from the well, but phenols were detected from soils in the monitoring well borings of White Transportation. The remaining SVOCs were found at concentrations well below the NYS groundwater quality standards

Metals. Twenty metals were found in the United Paperboard groundwater samples. Antimony, iron, magnesium, manganese, and sodium were detected at concentrations exceeding the groundwater NYS groundwater quality standards in at least two samples. Lead was detected in two groundwater samples at concentrations below the groundwater standard.

5.5 Tentatively Identified Compounds

TICs are compounds that can be detected by the analytical methods but the identity and concentration cannot be confirmed without further testing. The TICs reported herein (see Appendix F) are compounds that the instrumentation detected but the SVOC and VOC analytical methods did not specifically target.

TICs were included in this SRI to investigate their occurrence in the sediment, soil, and water and perhaps to definitively identify and quantify a subset of them. Since these compounds are tentatively identified and are not part of the Target Compound List, specific screening criteria do not exist for them.

A total of 65 TICs were detected in the sediment samples and are provided in Table F-2 (see Appendix F). Fifty-three TICs were detected in the surface and 36 were found in the subsurface soil samples (see Appendix F Tables F-3 and F-4, respectively). TICs detected during SVOC analysis of the sediment and soil samples include PAH-like compounds, napthalenes, and other hydrocarbons. No TICs were detected in the soil samples at concentrations exceeding 100 mg/kg (the maximum value of SCOs for unrestricted use).

A summary of the TICs detected in the groundwater samples is provided in Table F-4 (see Appendix F). One VOC (dimethyl sulfide) and 14 SVOC TICs were detected in the groundwater samples. TICs detected during SVOC analysis of the groundwater samples include hydrocarbons and glycols. Several of these TICs were detected at concentrations higher than 5 µg/L (principal organic contaminant standard).

6 Fate and Transport

6.1 Introduction

This section discusses the natural mechanisms that may result in and affect migration of chemical compounds at the Eighteenmile Creek Corridor Site and the chemical persistence and behavioral characteristics of those compounds. This information is combined with Site-specific data and observations to assess the extent of migration that has occurred.

PCBs and lead were previously identified as the compounds of concern based on historical investigations conducted at the Site and surrounding areas. VOCs, SVOCs, pesticides, and other metals were also detected in sediment and soil samples collected during this SRI.

VOCs were detected in groundwater above screening criteria at the Upson Park and United Paperboard properties. PID screening during this SRI did not reveal the presence of VOCs in Site soils/fill and VOCs have historically not been a COC throughout the Corridor Site. Moreover, flow patterns in the vicinity of the wells with VOC exceedances in the groundwater suggest an off-site source for the VOCs.

SVOCs (primarily PAHs) were detected above screening criteria in sediment and soil samples; however, concentrations of these compounds were consistent with concentrations typical of urban areas. Furthermore, the presence of PAHs in soils throughout the site appears to be associated with the fill on these properties, which was also where metals and PCB contamination was found. Therefore, SVOCs will not be considered as primary COPCs at these sites because alternatives to address metals and PCBs will also address soil and soil-like material contaminated with PAHs.

Pesticides were also reported above screening criteria throughout the Corridor Site. However, these pesticide detections are considered laboratory artifacts due to matrix interferences during analysis and their presence in the samples is considered suspect. Moreover, over half of these pesticide exceedances coincide with PCB exceedances and, as such, their presence will be addressed as PCB contamination is addressed.

In addition to lead, some sediment and subsurface samples also exhibited elevated antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, vanadium and zinc concentrations. However, 73% of these exceedances were co-located with PCB and lead exceedances and will, therefore, be addressed as PCB and lead contamination is addressed. The samples where other metals exceedances do not coincide with PCB and lead exceedances involved, at a minimum, chromium exceedances and they will be considered during the FS.

Below is a summary of the SRI findings:

- PCBs were not detected in the on-Site groundwater samples;
- PCBs were detected at concentrations exceeding the NYSDEC SCO in several samples throughout the Site;
- The highest Aroclor 1260 concentration was found in soil boring 18MC-SB15 installed near an area of fill found in the southeast corner of the property near Clinton Street. Low levels of Aroclor 1260 was found in the Barge Canal sediments, White Transportation sediments and soils, Upson Park sediments and soils, in the Mill Pond, and downstream of the corridor. RI samples from the Former United Paperboard Company parcels also contained Aroclor 1260;
- The highest Aroclor 1254 concentration found at the Site was in RI sample SED-22 collected south of the Olcott Street Bridge. During this SRI, the highest Aroclor 1254 concentrations were found in the Former Flintkote Plant Site (east side of millrace). Aroclor 1254 was not found in the Barge Canal samples;
- The highest Aroclor 1248 concentrations were found in the Former Flintkote Plant Site (L14E-S02) and in the Former United Paperboard Company property (SB15). Aroclor 1248 was detected above 1 ppm in sediment samples from all the areas sampled except the Upson Park property;
- Aroclor 1242 was only detected downstream of the Clinton Street Dam;
- Aroclor 1262 was only detected in two samples collected downstream of the study area at concentrations below 1 ppm;
- Aroclor 1268 was only found in the samples collected from the former coal power plant located east the Former United Paperboard Company property at the corner of Mill and Olcott streets and at four off-bank coring locations installed west of the creek in the Upson Park property;
- Although lead was present in most soil samples collected from the Eighteen-mile Creek Corridor Site, the highest lead concentrations were located in the

west bank of the Upson Park property, south of the Olcott Street Bridge, and in the creek along the Former United Paperboard Company and Former Flintkote Plant Site properties; and

- Antimony, iron, manganese, and sodium were detected above the screening levels in the monitoring wells around the Site. However, iron, magnesium, manganese, and sodium are ubiquitously found in the natural formations in the area and are not considered COPCs. Antimony detections are suspect due to spectral interference and should be confirmed by inductively coupled plasma/mass spectroscopy (ICP/MS) analysis. There were no other metals found in the groundwater above screening criteria in any of the sites.

An additional field investigation was performed at the Corridor Site in late 2008/early 2009 (EEEPC 2009) to fill in gaps in the RI and SRI data and to facilitate the FS. The findings of the Additional Investigation were submitted as an addendum to the Final SRI report (EEEPC 2009). Below is a summary of the Additional Investigation findings:

- Solids detected in the water column are in the dissolved phase as evidenced by the absence of suspended solids detections in both Barge Canal and creek samples;

- Limited means of contaminant transport in the dissolved phase changing to the suspended phase and ultimately to be deposited at the Site; and

- Passive In Situ Chemical Extraction Sampler (PISCES) samples indicate little to no impact to fish from PCBs.

Based on the finding above, the Additional Investigation concluded that Barge Canal sediments do not appear to be currently a significant contributor of PCBs and metals to Eighteenmile Creek sediments in the Project Area. Therefore, the likelihood of re-contamination from the Barge Canal after creek sediments have been remediated is small.

6.2 Potential Sources of Contamination

The properties associated with the Eighteenmile Creek Corridor Site include the Barge Canal, Upson Park, the White Transportation property, the Former United Paperboard Company property, and the Former Flintkote Plant Site. Many of these properties have had manufacturing operations (e.g., paper mill, box factory, boat building, pulp mill) conducted on-Site starting as early as the mid 1880s. Each of these properties was previously identified as potential source areas that may have contributed contaminants to Eighteenmile Creek. Below is a summary of the RI and SRI findings as they related to potential source of contamination in the creek.

Upstream of the Site

There were no PCBs found in the two upstream creek sediment samples (upstream of the culverted portion of the creek). The metals concentrations were in the low end of the range of metals concentrations found in the Site creek sediments. PAH concentrations in the upstream samples were relatively high consistent with urban runoff. These findings indicate that the metals and PCB contamination in the creek does not originate upstream of the Barge Canal.

New York State Barge Canal

In addition to the seven Barge Canal samples collected during the SRI (six locations near the Corridor), nine Barge Canal samples (five locations) were collected in April 2005 by the URS Corporation. These samples were collected as part of the Remedial Investigation of the New York State Electric and Gas Substation at South Transit Street and State Road in the city of Lockport, Niagara County, New York.

PCBs. PCBs were detected in all nine URS upstream Barge Canal samples and in six of the seven SRI Barge Canal samples. Aroclor 1248 was the only congener detected consistently in both sets of samples. The highest SRI concentration (2.5 ppm) was found in the sample collected opposite of the Canal Corporation property between the East and West Branches of the creek. The highest upstream concentration from the URS investigation was 310 ppm. PCB concentrations in the canal sediments exceed the screening criteria and in some cases they also exceeded the hazardous waste level.

The relatively low Aroclor 1260 levels are consistent with levels found in Site sediments and soils. The SRI Aroclor 1248 concentration is in the low end of concentrations found in the creek sediments and the Site soils. It is however comparable to the levels found south of Clinton Street (White Transportation samples and Upson Park). These data suggest that the Barge Canal could be a chronic source of PCBs to the creek. However, the elevated PCB concentrations found further downstream indicate that the canal is not the only source. The variability of the PCB concentrations between the SRI and URS samples suggests that migration of PCB contamination in the Barge Canal is complicated and fluctuating.

Metals. Lead was detected in all canal samples. The SRI samples contained lead at concentrations comparable to the URS samples. Barge Canal lead concentrations were similar to the concentrations of lead found in many of the Eighteenmile Creek sediment samples and fall in the lower range of lead detected during the SRI. Lead concentrations exceeded the screening level in several samples. The lower lead levels found in the canal indicate that the canal is not likely the main source of lead contamination in the creek but could be contributing to the lead contamination in the creek.

Concentrations of the other metals exhibited the same patterns as the lead concentrations. Similar to lead, concentrations of the other metals found in the Barge

Canal were comparable to the low end of the concentration range found in the creek sediments.

SVOCs. SVOCs, primarily PAHs, were detected in the Barge Canal samples. Total PAH concentrations exceeded 10 ppm. PAH concentrations in the canal sediments were at the higher end of the concentration range found in the Site sediments. The relatively elevated levels of PAHs detected in the canal sediments indicate that the canal may be a contributing source of PAHs in the creek.

Upson Park

As further discussed in Section 8, the water in the West Branch of the creek in the vicinity of Upson Park, originates from a dry dock on the north side of the Barge Canal. Both gray-black slag fill and red-brown cinder fill (containing glass, metal fragments, brick fragments, rubber, and buttons) were observed in Upson Park. The reddish-brown ash-like fill was observed in the embankment along Eighteenmile Creek.

PCBs. PCBs were not present in the samples collected from the fringes of the property. The concentrations of PCBs in the vicinity of the creek were generally less than 1 ppm. The highest concentrations of total PCBs in the area were found in the two NYSDEC RI soil samples collected near the west bank of the creek (80 ppm in the subsurface and 1.6 ppm at the surface), and in a SRI off bank subsurface soil sample (4 ppm) collected at 2.5 to 3 feet BGS from a layer of fill material. These results indicate historical presence of PCBs in the property and the creek embankments. The source of these PCB concentrations is likely a combination of the Barge Canal that is feeding the creek and the fill present throughout the property.

Metals. Lead was present in all the Upson Park soil and sediment samples and in the groundwater sample from 18MC-MW17 installed in the southern portion of the property closest to the canal. Lead was not detected above the screening level in the groundwater. It was present at high concentrations (greater than 1,000 ppm) in the east bank of the creek in the deeper sediment that was mixed with fill as well as in the west side of the creek in the deeper off bank samples on transect L02 (18MC-L02W-S04-Z3 and 18MC-L02W-S05-Z2) and the subsurface sample from the fill in boring SB14. The elevated concentrations of lead in the Upson Park samples appear to be associated with the fill. The other metals appear to be associated with fill as well. TCLP analysis revealed sample 18MC-SB14-Z2 contained lead at a concentration above the hazardous waste level. Lead concentrations in the surface sediments are comparable to the concentrations found in Upson Park and several of the other sediment samples in the creek.

SVOCs. The concentration of PAHs in the surface samples only (soils and sediments) is consistent with the theory that they are the result of urban activities and runoff. Glycols were found as TICs in the groundwater at wells 18MC-MW14, -MW15, and -MW17. Glycols are often associated with de-icing activities of air-

crafts and antifreeze mixtures used for automobiles. Further investigation is required in order to identify the potential source of the glycols in the groundwater.

VOCs. VOC analyses were not performed on the soil and sediment samples due to the absence of PID readings. Chlorinated organic compounds were detected in the groundwater samples from 18MC-MW14 and -MW15. TCE and cis-1,2-DCE concentrations in well 18MC-MW14 exceeded the groundwater standard.

White Transportation

As mentioned earlier, East Branch waters originate at the spillway in the Barge Canal near the Mill Street bridge where canal waters join with water from the culverted section of Eighteenmile Creek south of the Barge Canal. During the winter months, water also originates directly from the bottom of the Canal from a bottom plug that when removed drains into the culvert that crosses beneath the Canal. Extensive slag and cinder fill was observed throughout the White Transportation property.

PCBs. Low concentrations of PCBs were found in the subsurface and off bank soils at the White Transportation property. The majority of the samples contained PCBs at concentrations below 1 ppm. The only sample with a concentration of PCBs above 1 ppm was sediment sample 18MC-L02E-S01 collected from the west bank of Eighteenmile Creek. The data suggests that this property is not a source of PCB contamination in the creek. Possible source of the low level PCBs found in the East Branch sediments is the Barge Canal, where similar levels of PCBs were found since there is a direct pathway from the Canal to the East Branch via the spillway and the plug. However, the presence of Aroclor 1254 in the White Transportation sediment samples and its absence from the SRI Barge Canal samples indicates that the Canal is not the only source of PCB contamination.

Metals. Lead was present in all the White Transportation soil and sediment samples but it was not present in the groundwater. Lead concentrations were generally lower than the concentrations found in the Upson Park samples. The only sample containing lead at a concentration greater than 1,000 ppm was a fill sample from an off bank core (18MC-L02E-S05) located east of the creek. Based on the lateral distribution of lead and the other metals concentrations at White Transportation, the presence and nature of the manmade cover (fill and slag) appears to vary around the property, with fill containing higher levels of metals near the banks of the creek and in the creek sediments where slag fragments were also present. TCLP analysis of the samples did not indicate the presence of metals at hazardous waste levels. The other metals in the soil and sediment exhibit a distribution similar to the lead.

SVOCs. The highest concentrations of PAHs in the soil and sediment were found in the samples collected in the vicinity of the trailers observed at the west end of the property. Most of the PAH contamination is present in the surface soil and

sediments. The source of PAHs at this property is suspected to be a combination of urban activities/runoff and Site-specific activities. PAHs in the groundwater were found in wells 18MC-MW10 and -MW12. The associated subsurface soils contained low levels of PAHs, indicating that the source of PAHs in the groundwater may be further upgradient. Phenols were found in the subsurface soil at concentrations exceeding the screening levels in 18MC-MW11, -MW12, and -MW13, but they were not detected in the groundwater. Similar to Upson Park, glycols were present in one well (18MC-MW12).

VOCs. VOC analyses were not performed on the soil and sediment samples due to the absence of PID readings. Trace levels of VOCs were found in one well (18MC-MW11).

Former United Paperboard Company Property

Ash fill was observed throughout the Former United Paperboard Company property on both sides of the creek.

PCBs. PCBs were found throughout the property and the creek, with concentrations increasing closer to the creek banks. The highest PCB concentration (630 ppm) detected at the Site during the SRI was found in the near surface sample from 18MC-SB15 collected from a layer of ash fill. The primary congener in the SB15 sample was Aroclor 1248. The presence of PCBs in the creek downstream of SB15 at concentrations higher than those found in the upstream sediments (Upson Park, White Transportation, and Barge Canal samples), suggests that the ash fill is a likely source of PCB contamination (especially for Aroclor 1248).

Water from the Mill Pond formed behind the dam leaks around the west side of the dam and flows adjacent to or over the top (during high flow conditions) of the abandoned transformer pad. Also at times of high flow, water from the Mill Pond has been observed to flow through the dam via a partly open gate. That would suggest a direct pathway for the contaminants. However, PCB concentrations appear to generally increase downstream of the Clinton Street Dam. Downstream United Paperboard RI sample SED-22 also contained elevated levels of PCBs (201 and 1,400 ppm). The elevated levels of PCBs found below the dam (especially Aroclors 1242 and 1254), indicate a potential source present downstream of the dam or at the vicinity of the dam.

Metals. Lead was detected in most of the soil and sediment samples in both sides of the creek, with concentrations increasing downstream of 18MC-SB15 and the Clinton Street Dam, similar to the PCBs. The SB15 sample contained lead above the hazardous waste level. All the samples collected along transect 18MC-L09 established downstream of the Mill Pond and the Dam where red cinder fill was observed, exhibit some of the highest lead concentrations found at the Site. Elevated lead concentrations were also found at 18MC-MW05 that was also established at a ridge of suspected red-brown cinder fill. This indicates that the cinder fill is a potential chronic source of lead contamination in the fill. However, PCBs

were not found in the off bank soils with elevated lead concentrations, which suggests a different source or transportation mechanism for the lead and PCBs. Most of the metals concentrations exhibited the same general distribution as lead with some exceptions where elevated zinc concentrations did not coincide with elevated lead concentrations. Lead was detected in the groundwater at two wells at levels below the groundwater standard.

Elevated lead and zinc were also found in the surface soil collected from the abandoned former coal plant building to the east of the Former United Paperboard Company property.

SVOCs. PAHs were found throughout the property in the soil and sediments, with the highest levels found along line 18MC-L09, similar to the PCBs and lead. PAHs found at this property are consistent with urban levels. PAHs were also found in the groundwater. The elevated levels of PAHs found in 18MC-MW05 are consistent with the PAH levels found in the subsurface soils. Phenols were detected in the groundwater in 18MC-MW08 but they were not found in the associated subsurface soil samples. This well is in proximity to the White Transportation property where phenols were detected in the subsurface soil but not in the groundwater. Glycols were detected in three groundwater samples (18MC-MW02, -MW06, and -MW08).

Elevated PAHs were found in the surface soil samples collected from the abandoned building across the United Paperboard property, possibly associated with historical activities at this property.

VOCs. VOC analyses were not performed on the soil and sediment samples due to the absence of PID readings. Concentration of cis-1,2-DCE exceeded the groundwater standard in well 18MC-MW05. There is not enough information at this point to identify the source of VOCs in the groundwater.

Former Flintkote Plant Site and Downstream

More than ten feet of red-brown poorly sorted cinder ash fill are present in the banks on the Former Flintkote Plant Site near Eighteenmile Creek and on the ground surface on the Former Flintkote Plant Site property.

PCBs. PCBs were found in the creek and along the banks in the vicinity of the Former Flintkote Plant Site and downstream. The highest concentrations (above 50 ppm) were found in the east side of the millrace during both the RI (SED-34 and SED-37) and the SRI (18MC-L14E-S02) sampling. This is an area of deposition with very little flow most of the year.

PCBs were detected at concentrations above the hazardous waste criterion in sediment collected from a deep basement at the Former Flintkote Plant Site. However, the PCB congeners in that sample (1242 and 1260) are different from

the congeners (1248 and 1254) detected in the creek sediments samples SED-34, SED-37, and 18MC-L14E-S02.

Downstream of the Flintkote Plant Site, PCBs were absent in the off bank samples and their presence appears to be limited in the wet creek sediments. This is consistent with PCBs found downstream of the corridor during the PCBs track-down study performed by the Niagara County. Levels detected downstream of the study area range between non-detect and 69 ppm.

Metals. Lead was detected in all the sediment and soil samples in both sides of the creek and the millrace, with concentrations exceeding the hazardous waste level at several locations. High lead concentrations that correspond with high PCB concentrations are found in the east side of the creek (L13-S03) and the east side of the millrace. Lead concentrations on the west side of the millrace coincide with areas of suspected fill but do not coincide with elevated PCBs. Lead concentrations appear to decrease downstream but remain at levels exceeding 400 ppm.

SVOCs. PAHs were present in the sediments and surface soils. The highest concentration was detected in the L15E-S02 sample. The results appear to be consistent with the rest of the samples collected during the SRI.

6.3 Potential Routes of Migration

Natural and other man-made mechanisms that can result in the migration of contaminants from their source areas include: surface water flow, infiltration, groundwater flow, subsurface utilities, volatilization, excavation, grading, and vehicular traffic. Because PCBs and lead are not readily volatilized, only surface water flow, infiltration, groundwater flow, subsurface utilities, and man-made mechanisms are discussed. The impacts of these mechanisms vary by source area and specific Site conditions.

Surface Water Flow

Surface water flow can be a mechanism that allows migration of contaminants if those contaminants are present in surface soils. Surface water flow at the Eighteenmile Creek Corridor Site is a mechanism that potentially allows lateral migration of contaminants from surficial soil into various property drainage ways that discharge into Eighteenmile Creek and could potentially discharge to Lake Ontario in Olcott, New York.

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. 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 is caused by a topographic high point located in the southeastern portion of the watershed. Surficial topography across the Site is predominantly low-lying with an approximately 35-foot

drop-off in elevation along the creek from the Barge Canal to the northern end of the Flintkote property.

Surface water flow at the Eighteenmile Creek Corridor Site occurs primarily during heavy precipitation events and spring snowmelts as surface runoff. Some areas are covered with vegetation (grassy and wooded areas) and some are covered by impervious surfaces. Within the grassy and wooded areas there are some exposed soils and fill. Erosion of these exposed soils and fill adjacent to the creek provides a direct route for soils/fill to migrate to the creek.

Infiltration

Infiltration of precipitation would be expected in areas not covered by relatively impermeable barriers (i.e., concrete or asphalt). Infiltration causes water-soluble compounds present in the unsaturated zone to migrate vertically downward to the groundwater table in areas where infiltration can occur. In addition, infiltration recharges the groundwater, which may increase groundwater gradients, potentially enhancing migration via groundwater flow. PCBs and lead are relatively insoluble in water and are not expected to appreciably leach into groundwater. Other contaminants detected including phenols are more soluble in water and may be subject to infiltration. Twenty-five percent of the corridor is covered by paved areas or buildings that would reduce direct infiltration and facilitate overland flow/runoff.

Groundwater Flow

Overburden groundwater flow would be expected to allow both vertical and lateral migration of contaminants located within the saturated zone. Groundwater flow is considered a significant transport mechanism for contaminants that are water-soluble. Migration via groundwater flow can allow contaminants to travel significant distances from their source area. PCBs and lead are not readily soluble in groundwater and there were no PCB detections and very few lead detections in the groundwater samples. Therefore, PCBs and lead found in Site soils do not appear to be impacting the groundwater at the Site.

Utility Corridors

Utility corridors can provide a transport mechanism for contaminants in water and loose particles that may enter/settle in the pipe bedding used to install these utilities. As the water passes around the pipe and through the pipe bedding, soil particles can be suspended and transported through the void spaces found in the bedding as these spaces provide a path of least resistance for the water. Based on historical review, the only ground utility present in the Eighteenmile Creek Corridor Site is a storm sewer crossing the creek approximately 25 to 50 feet downstream of the dam. Several sewer manholes were observed on both banks (east and west) of the creek. Although PCBs are not readily soluble in water, water flowing through pipe bedding containing PCB-laden particles can provide a means of transport for these particles into or from the creek and potentially beyond the Eighteenmile Creek Corridor Site.

Man-made Mechanisms

Considering that there were multiple surface and subsurface soil PCB detections above the SCO, it is possible PCB-laden Site soils could be transported to other areas on and off Site during daily activities in non-paved areas or if an excavation were to occur. If there are no land restrictions to prevent excavations at this Site; then exposing the contaminated material would also facilitate soil transport via surface water flow.

6.4 Contaminant Persistence and Behavioral Characteristics

In general, chemical compounds of a given chemical type behave similarly in the environment. However, significant differences in behavior of chemical compounds may be observed. Their behavior is dependent on their physical and chemical properties as well as environmental conditions, such as the presence of bacteria, pH variations, and oxidation-reduction conditions. Water solubility is a critical property affecting the environmental transport of a chemical: chemicals with low water-solubility can be rapidly leached from soil and are generally mobile in groundwater. A compound's volatilization rate from water depends on its vapor pressure and water solubility: highly water-soluble compounds generally have lower volatilization rates from water than compounds with low water solubility. Vapor pressure and Henry's Law constants are measures of volatilization behavior.

PCBs

PCBs are man-made mixtures of up to 209 individual chlorinated compounds called congeners. The compounds contain one to 10 chlorine atoms attached to biphenyl (two benzene rings consisting of hydrogen and carbon atoms) and have a general chemical formula of $C_{12}H_{10-x}Cl_x$. Most PCB congeners are colorless to light yellow oily liquids or waxy solids. The commercial mixtures are clear viscous liquids (the more highly chlorinated mixtures are more viscous). The chemicals have no known smell or taste. Many commercial PCB mixtures are known in the United States by the trade name Aroclor.

Although the physical and chemical properties vary widely across the class, PCBs have low water solubilities and low vapor pressures. They are soluble in most organic solvents, oils, and fats. PCBs are very stable compounds and do not degrade easily. Most PCBs do not mix with water and settle into riverbeds, lake bottoms, and coastal sediments. Some PCBs can exist as a vapor in air that can travel long distances and be deposited in areas far away from the point of release. In water, a small amount of PCBs might remain dissolved, but most adhere to organic particles and bottom sediments. PCBs also bind strongly to soil.

Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial

applications including dielectric fluids for capacitors and transformers, heat transfer fluids, hydraulic fluids, lubricating and cutting oils, and as additives in pesticides, paints, carbonless copy "NCR" paper, adhesives, sealants, plastics, reactive flame retardants, and as a fixative for microscopy. More than 1.5 billion pounds of PCBs were manufactured in the United States before production was banned in 1977.

Their chemical and physical stability has also been responsible for their continuing low-level persistence in the environment. PCBs are generally unalterable by microorganisms or by chemical reaction (they do not readily degrade). The stable nature of PCBs also lends to accumulation in the fatty tissues of animals once the PCBs are released into the environment. These accumulations increase as the tissue from contaminated animals moves through the food web. Because of bioaccumulation, the concentration of PCBs found in fish tissues is expected to be considerably higher that the average concentration of PCBs in the water from which the fish were taken.

Acute toxic effects in the environment include death of animals, birds, or fish, and death or low growth rate in plants. Chronic effects from PCBs may include shortened lifespan, reproductive problems, lower fertility, and changes in appearance or behavior. The primary concern of PCBs in surface water is the chronic effect of bioaccumulation.

Under specific conditions PCBs may be destroyed by chemical, thermal, and biochemical processes. Because of their high thermodynamic stability, all degradation mechanisms are difficult. Intentional degradation as a treatment of unwanted PCBs generally requires high heat or catalysis. Environmental and metabolic degradation generally proceeds quite slowly relative to most other compounds.

Incineration is the conventional destruction technology for these extremely recalcitrant compounds, but other technologies, such as solvent extraction and thermal desorption, also are being applied

The predominant Aroclors detected in the Eighteenmile Creek Corridor Site soil samples were Aroclors 1242, 1248, 1254, 1260, 1262, and 1268. PCBs were not detected in the groundwater samples.

These Aroclors are generally used in electrical capacitors, electrical transformers, vacuum pumps, and gas-transmission turbines (formerly used as heat transfer fluid, hydraulic fluids, rubber plasticizer, adhesives, carbonless paper, and wax extenders). The environmental fate of Aroclors generally depends on the degree of chlorination. The Aroclors are tightly adsorbed in soil with adsorption generally increasing as the degree of chlorination of the individual congeners increase. They should not leach significantly in most aqueous soil systems although the most water soluble PCBs will be leached preferentially. In the presence of organic solvents, which may be possible at waste sites, PCBs may have a tendency

to leach through soil. Although the volatilization rate of the Aroclors may not be rapid from soil surfaces due to the tight adsorption, the total loss by volatilization over time may be significant because of the persistence and stability of them.

Metals

The polar nature of metals results in their tendency to bind to clay particles. Solubility increases with decreasing water pH. Once dissolved, they can migrate with the groundwater. They tend to accumulate, rather than degrade and they tend to form metal complexes in the presence of high heat. Oxidation of many metals will occur in groundwater, depending on the dissolved oxygen content of the water. Presence of elevated lead concentrations throughout the Site is consistent with the behavior of lead, as it accumulates in ash during the incineration process.

Comparison of TCLP data to their respective total lead concentrations gathered during this SRI showed inconsistent results. Several samples with relatively low concentrations of lead yield high TCLP results. On the other hand some samples with elevated concentrations of lead did not yield elevated TCLP concentrations. It appears that the leachability of the lead may vary with the type of source material.

SVOCs

SVOCs are persistent compounds in the environment, degrading very slowly due to their low vapor pressure, viscous texture, and extremely low water solubility. They can be mobilized by the presence of solvents (mostly VOCs), but the minimal solvent presence detected in the landfill indicates these compounds would rely primarily on infiltrating meteoric water to be mobilized from the soil into the aquifer. Their low water solubilities indicate the leaching mechanism can only serve as a very minor PAH source to groundwater. SVOCs are only minimally susceptible to biodegradation unless under controlled conditions. Thus they tend to be persistent, being most frequently susceptible to evaporation; a process that only affects most of them when the ambient temperature is warmest; usually during summer only. PAHs are products of incomplete combustion of fossil fuels and are often found in urban areas.

7 Human Health Risk Evaluation

7.1 Introduction

Section 6 summarizes the contaminants that were detected in surface and subsurface soil, stream sediment, and groundwater at the Site, possible sources of the contaminants, their migration pathways, and their potential fate. The data summary tables in Section 5 show that some chemicals are present in these media at concentrations exceeding NYS SCOs, regulatory standards, or guidance values. Although those regulatory criteria were developed to be health-protective, the mere presence of environmental contamination at higher concentrations does not necessarily pose an actual risk to human health.

For contamination to pose a human health risk, both of the following conditions must be true:

- There must be a complete pathway of exposure from the contamination to human receptors; and
- The magnitude of the receptors' exposure to contamination must be sufficient to cause an adverse health effect.

If there is no complete pathway of exposure, there will be no risk associated with the contamination. If a complete pathway exists, but the magnitude of the receptor's exposure is low, the associated risk may not be significant. Both factors need to be considered when evaluating potential human health risks posed by Site contamination.

COPCs for human health in the Eighteenmile Creek Corridor were identified by comparing the maximum concentration of a chemical detected in the samples with the SCOs described in detail in Section 5.

Soil and sediment COPCs include arsenic, chromium, cobalt, lead, manganese, and PCBs. NYSDEC does not publish health-based screening criteria for the other metals detected in soil and sediment at concentrations exceeding the alternative screening criteria (iron, calcium, potassium, magnesium, and sodium). The only metal detected in groundwater at concentrations exceeding standards prom-

ulgated for protection of human health was sodium. The levels of these essential elements (iron, calcium, potassium, magnesium, and sodium) are substantially below concentrations associated with adverse health effects and are not evaluated in this assessment.

7.2 Conceptual Site Model

7.2.1 Site Description

The Eighteenmile Creek Corridor Site is located between the Barge Canal and Harwood Street in the city of Lockport, Niagara County, New York (see Figure 1-1). It includes Eighteenmile Creek and adjacent properties in that area. The properties associated with the Eighteenmile Creek Corridor Site include Upson Park, White Transportation, United Paperboard, and the Former Flintkote Plant Site (see Figure 2-1). There is also a residential area on Water Street that borders the creek between William and Olcott Streets that may be impacted by Site-related contamination.

Upson Park is a town park owned by the City of Lockport and contains picnic areas and a walking trail along the canal. There is a parking area on the Site but no standing buildings. The White Transportation property and the Former Flintkote Plant Site are former industrial properties that are currently unused. Both properties are accessible to visitors and trespassers. The Former United Paperboard property is currently an active industrial facility occupied by Duraline Abrasives, Inc. The banks of the creek are accessible to residents of the properties along Water Street as well as visitors, anglers, and other recreational users of the stream at many locations in the Eighteenmile Creek Corridor. NYSDOH has issued an advisory against consuming fish caught from Eighteenmile Creek because of PCB contamination; however there is evidence from the Site visit (see Section 8) that fishing in the creek is common throughout the area despite the advisory.

A conceptual model of potential pathways of human exposure to contaminants in the Eighteenmile Creek Corridor is presented in Figure 7-1. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: (1) a contaminant source; (2) contaminant release and transport mechanisms; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population. An exposure pathway is considered complete when all five elements are present; a potential exposure pathway is considered incomplete when any one or more of the five elements comprising an exposure pathway is not present or does not exist. Four groups of receptors with distinctly different potentials for exposure were identified (see Figure 7-1) and are summarized below:

- Residents of the homes along Water Street with back yards abutting the creek. Eighteenmile Creek floods periodically and has deposited contaminated sediment in the backyards of some of these residences. Residents of these homes could be exposed to Site-related contaminants as a result of direct contact (dermal contact with and incidental ingestion of soil) with contaminated soils

in their yards and stream bank sediments and creek water, and through consumption of fish caught from the creek.

- Visitors to the Eighteenmile Creek Corridor. This group of receptors includes recreational users of Upson Park and visitors to the banks of the creek and the active and inactive industrial parcels along the creek. These receptors are assumed to visit these areas but not fish in the creek or consume fish from the creek. Exposure of these receptors to Site-related contaminants could occur as a result of direct contact with soils, sediment and creek water in the Corridor.

- Eighteenmile Creek Anglers. This group of receptors is similar to Site visitors but members are assumed to fish in the creek and eat their catch in addition to coming in contact with Site soils, sediment and creek water. Since PCBs are important COPCs in the Eighteenmile Creek Corridor, and because they tend to accumulate and concentrate in fish and other biota, consumption of fish from the creek could pose substantially greater health risks than simply contacting contaminated environmental media in the area.

- Site workers at the Former United Paperboard Property. This group consists of individuals working at the Former United Paperboard property. They would be exposed to Site-related contaminants mainly through direct contact with soils on the United Paperboard site.

This completes the requirements of a qualitative Human Health Risk Evaluation as described in Appendix 3B of NYSDEC's Draft DER 10 – Technical Guidance for Site Investigation and Remediation (NYSDEC 2002). Since a number of chemicals exceeded human health screening levels in each of the environmental media investigated, there appears to be reason to believe that contaminants at the Eighteenmile Creek Corridor Site could pose potentially significant risks to human health. A quantitative human health risk assessment was not conducted because NYSDOH has documented public health risks to residents living on Water Street (NYSDEC 2009) and fish advisories have been established for the creek.

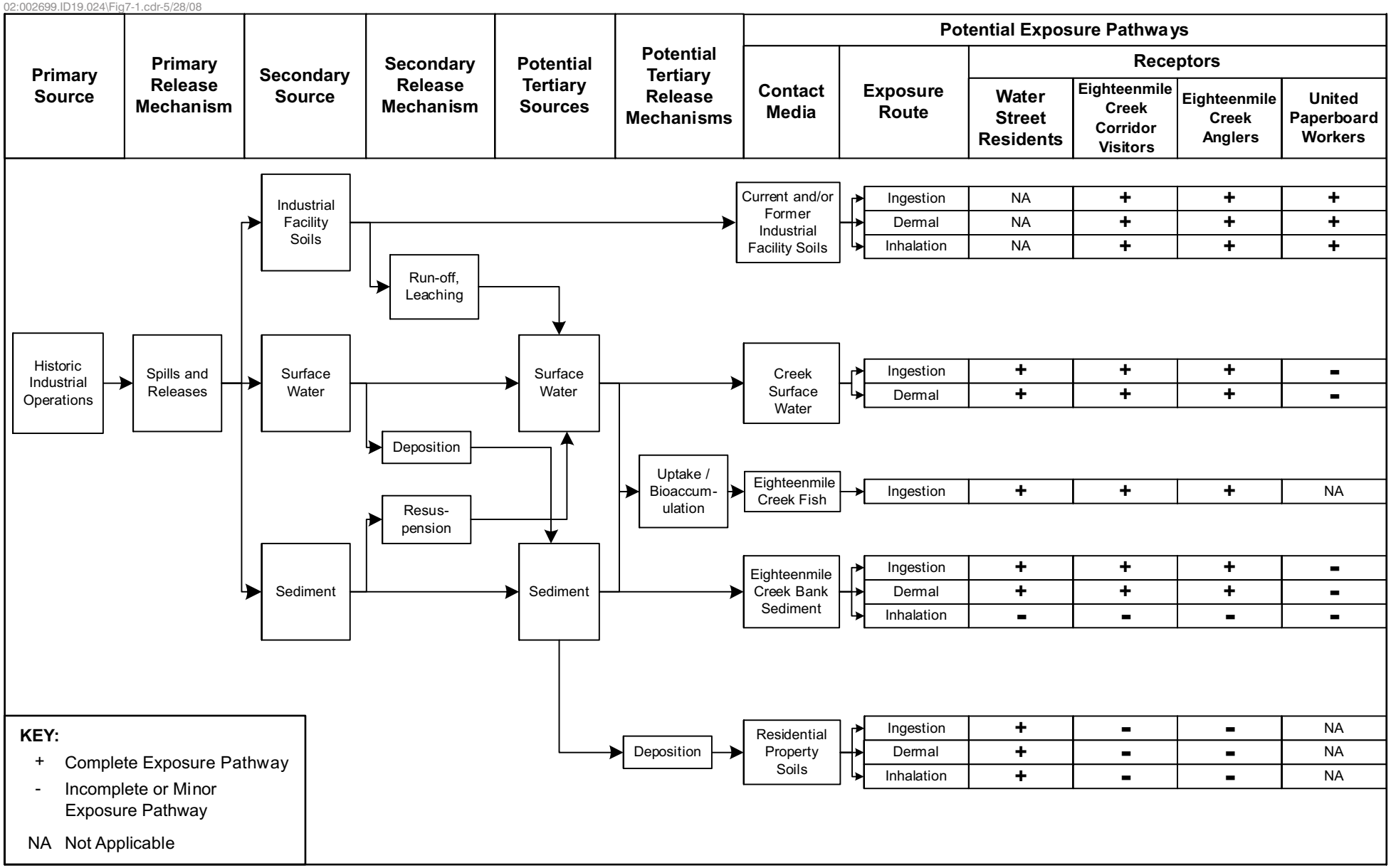

Figure 7-1 Conceptual Model of Potential Human Exposures to Contaminants in the Eighteenmile Mile Creek Corridor Site, Supplemental Remedial Investigation

8 Fish and Wildlife Impact Analysis

8.1 Introduction

This section evaluates potential impacts of Site-related contaminants on the ecological resources at the Eighteenmile Creek Corridor Site, Lockport, New York (Site No. 932121). This evaluation was conducted consistent with NYSDEC guidance for characterizing threats to fish and wildlife at inactive hazardous waste sites (NYSDEC 1994). Specifically, this evaluation satisfies Steps 1 and 2A of NYSDEC (1994), which call for a site description and exposure pathway analysis. This evaluation also is consistent with ERA guidance issued by the EPA, including:

- *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA 1997); and
- *Guidelines for Ecological Risk Assessment* (EPA 1998).

The principal goal of this evaluation is to determine if complete exposure pathways exist between Site-related contaminants and ecological receptors at the Site. If so, further evaluation, such as a criteria specific analysis and/or toxic effect analysis (Steps 2B and 2C in NYSDEC 1994), may be warranted.

8.2 Site Location and Description

As described in Section 3, the Eighteenmile Creek Corridor Site is located in the city of Lockport, Niagara County, New York (see Figure 8-1). The Site includes the channel and riparian zone of the creek for the first 3,000 feet downstream of the Barge Canal, and four former commercial/industrial properties adjacent to the creek. This section describes only the ecological characteristics of the Site.

8.2.1 Site Maps

Figure 8-1 shows the topography of the Eighteenmile Creek Corridor Site and surrounding area. The Site lies at the border of two relatively flat plains (the Ontario and Huron Plains) that are separated by the Niagara Escarpment, which runs generally east-to-west along the northern portion of the city of Lockport (see Figure 8-1). Eighteenmile Creek flows northward through the study area and eventually into Lake Ontario. Primarily urban, commercial, and residential land uses are

within 2 miles of the Site. Ecological community types on and near the Site are shown on Figure 8-2 and described below. Wetlands and surface water features on and near the Site are shown on Figures 8-3 and 8-4.

8.2.2 Description of Fish and Wildlife Resources

8.2.2.1 Ecological Community Types

Figure 8-2 shows community types based on Edinger et al. (2002) that occur at the Site. The community types were identified during a field reconnaissance conducted by EEEPC on October 18, 2007. Three principal community types were identified on the Site: headwater stream, successional southern hardwoods, and floodplain forest/successional southern hardwoods (see Figure 8-2). No significant or unique habitats were among them. These community types are described below.

Headwater Stream. Eighteenmile Creek has the characteristics of a headwater stream in the study area. The East Branch near the Barge Canal and White Transportation property has high flow, water depth of 1 to 3 feet at mid-channel, and rocky bottom. Building ruins are present near the headwaters of the East Branch and the initial section of the creek in this area is channelized. The source of water to this branch is a mixture of Eighteenmile Creek water from upstream of the Barge Canal and Barge Canal water (via a spillway during high-water conditions and a plug during low-water conditions in the canal). The banks of the East Branch are forested and steeply sloped, making access to the creek channel difficult in most places.

The West Branch of Eighteenmile Creek also has the characteristics of a headwater stream, including moderate to high flow velocity in most places and a bottom composed of cobble, gravel, and sand. Water depth ranged from 0.5 to 2 feet at the time of the Site visit. The channel of the West Branch is 15 to 20 feet wide in most places. The water in the West Branch originates from a dry dock on the north side of the Barge Canal. The gate between the dry dock and Barge Canal was observed to be leaking during the Site visit in October 2007; thus, water from the Barge Canal is able to enter the West Branch through the dry dock. Similar to the East Branch, the banks of the West Branch are forested and steep, making access to the creek channel difficult in most places.

The East and West Branches of Eighteenmile Creek merge immediately upstream from Clinton Street and then flow north beneath Clinton Street into a Mill Pond on the Former United Paperboard Company property (see Figure 8-2). At the time of the Site visit, the pool behind the dam was full and water was flowing through the dam via a partly open gate. Downstream of the dam, the creek channel is a series of rapidly flowing riffles and runs with a section of slower flow near the Former Flintkote Plant Site. Near the Former Flintkote Plant Site, the creek channel splits and flows around an island. Most of the flow (about 95%) follows the channel on the west side of the island. Most of the riparian zone of the creek downstream of Clinton Street is forested.

Successional Southern Hardwoods. The wooded area situated between Clinton Street and the Barge Canal at the southwest end of the Site is best described as southern successional hardwoods (SSH; see Figure 8-2). This cover type is a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed. According to Edinger et al. (2002), this is a broadly defined cover type and several regional variants are known. The dominant tree species present at the Site in this cover type include box elder (*Acer negundo*), black locust (*Robinia pseudoacacia*), tree-of-heaven (*Ailanthus altissima*), and Norway maple (*Acer negra*).

Floodplain Forest/Successional Southern Hardwood. The riparian zone of the creek is best described as a combination of floodplain forest and successional southern hardwoods (FF/SSH), depending on slope and elevation (see Figure 8-2). Low lying areas near the creek channel are best characterized as floodplain forest, whereas areas further from the channel at a somewhat higher elevation are best characterized as successional southern hardwoods. According to Edinger et al. (2002), the floodplain forest cover type occurs on mineral soils on low terraces of river floodplains and deltas. This cover type is characterized by its flooding regime (low areas are annually flooded in spring and high areas are flooded irregularly) and is quite variable and may be diverse. Dominant tree species present at the Site in the FF/SSH cover type include cottonwood (*Populus deltoides*), willow (*Salix spp.*), silver maple (*Acer saccharinum*), boxelder, black locust, tree-of-heaven, and Norway maple. Common understory species in the FF/SSH cover type include poison ivy *(Toxicodendron radicans*), grapevines (*Vitis spp*.), raspberry (*Rubus spp*.), and white snakeroot (*Ageratina altissima*). Burdock (*Arctium spp.*), sumac (*Rhus spp.*), and goldenrod (*Solidago spp.*) were observed in areas where the canopy of the riparian zone was incomplete or lacking. Near the downstream end of the study area, Japanese knotweed *(Polygonum cuspidatum*) was observed next to the creek channel in places.

8.2.2.2 Wetlands

Figures 8-3 and 8-4 show federal- and state-designated wetlands in the vicinity of the Eighteenmile Creek Corridor Site. According to the NWI, two reaches of Eighteenmile Creek within the study area are considered palustrine, permanently flooded, diked/impounded wetlands (PUBHh; see Figure 8-3). These two reaches are: (1) the Mill Street Pond that lies upstream of the Clinton Street Dam and (2) a portion of Eighteenmile Creek near the Former Flintkote Plant Site, where the flow becomes slower and the channel widens before the creek flows through conduits under Williams Street. No state-designated wetlands lie within the Eighteenmile Creek study area (see Figure 8-4). Figures 8-3 and 8-4 show that several federal- and state-designated wetlands are located beyond the Site boundary but within 2 miles of the Site. In particular, several large wetlands are located along the channel of Eighteenmile Creek downstream of the study area (see Figures 8-3 and 8-4). These wetlands could potentially be affected by downstream transport of Site-related contaminants.

8.2.2.3 Species of Special Concern

In October 2007, the NYS Natural Heritage Program (NHP) was contacted for information on species and habitats of concern in the Site vicinity. The NHP indicated that they have no records of known occurrences of rare or state-listed animals or plants, significant natural communities, or other significant habitats, on or in the immediate vicinity of the Site (see Appendix G).

Information on federally listed species in Niagara County was obtained from the United States Fish and Wildlife Service (USFWS) Web site (www.fws.gov/northeast /nyfo/es/section7.htm). The USFWS indicated that the bald eagle (*Haliaeetus leucocephalus*) and federally listed threatened eastern prairie fringed orchid (*Platanthera leucophea*) have been observed in Niagara County. The record for the eastern prairie fringed orchid is historic, not current.

The bald eagle was de-listed on August 7, 2007. While there are no Endangered Species Act requirements for the Bald Eagle after this date, the eagles continue to receive protection under the Bald and Golden Eagle Protection Act. Bald Eagles occupy riparian corridors with large diameter trees along major water bodies, feeding on fish, waterfowl, and carrion. They prefer areas with limited human activity. Given that the Eighteenmile Creek Corridor Site is located within the city of Lockport, is seems highly unlikely that eagles would use the riparian zone of the creek within the study area.

The eastern prairie fringed orchid occurs in a wide variety of habitats, from mesic prairie to wetlands such as sedge meadows, marsh edges, and bogs (USFWS 2005). It requires full sunlight for optimum growth and flowering and a grassy habitat with little or no woody encroachment. Given that most of the riparian zone of the Eighteenmile Creek Corridor Site is forested, it seems unlikely that the eastern prairie fringed orchid would occur at the Site, and none were observed during the Site reconnaissance in October 2007. Furthermore, the USFWS (2005) reports that the eastern prairie fringed orchid is not known to occur in NYS currently, although it did occur here historically (see Appendix G).

8.2.2.4 Observations of Stress

No signs of stressed vegetation or wildlife were observed at the Site during Site visits or sampling conducted there by EEEPC personnel.

8.2.3 Description of Fish and Wildlife Resource Values

8.2.3.1 Value to Associated Fauna

Eighteenmile Creek provides habitat for fish, benthic invertebrates, and other aquatic life. The riparian zone of the creek provides habitat for small- to medium-sized mammals, songbirds, and other wildlife. Wildlife and evidence of wildlife observed at the Site by EEEPC personnel include a Blue Heron (*Ardea herodias*), Black-capped Chickadee (*Poecilie atricapilla*), other songbirds, and tracks of white-tail deer (*Odocoileus virginianus*).

8.2.3.2 Value to Humans

The Eighteenmile Creek Corridor Site is used for fishing and perhaps other recreational activities. Evidence of fishing was observed on both banks of the creek between Clinton Street and the Clinton Street Dam. Along Water Street, the back yards of most residences extend right up to the creek shoreline. One residence had a small wooden dock (about 5 by 10 feet in size) on the creek on which a bench was placed, suggesting that the creek and its riparian zone is valued for aesthetic reasons.

8.2.4 Identification of Fish and Wildlife Regulatory Criteria

The following regulatory criteria and acts potentially are relevant to any RI and FS activities that may be undertaken at the Site for the purpose of assessing or reducing ecological impacts:

- Clean Water Act, 233 U.S.C. 1261 et seq. Sec 404;
- The Freshwater Wetlands Act (Article 24 Environmental Conservation Law, 6 NYCRR, Parts 663 and 664);
- Significant habitats and species of the NHP;
- NYSDEC Ambient Water Quality Standards and Guidance Values (1998); and,
- NYSDEC Technical Guidance for Screening Contaminated Sediments (1999).

In addition, ERA guidance from NYSDEC and EPA also are applicable (see Section 8.1).

8.3 Pathway Analysis

Pathway analysis is Step 2A in the Fish and Wildlife Impact Analysis (FWIA) process (NYSDEC 1994) and the first element of a contaminant-specific impact assessment. Pathway analysis is similar to the problem-formulation step in the EPA ERA process (EPA 1997, 1998). Pathways analysis identifies potential Site-related contaminants, ecological receptors, and exposure pathways. A Site conceptual model is then developed to summarize the relationship between contaminant sources, transport pathways, routes of exposure, and potential ecological receptors. The pathway analysis step for the Eighteenmile Creek Corridor Site is based on a review of existing reports and information, as described below.

8.3.1 Contaminant Sources and Migration Pathways

NYSDEC (2006a) found high concentrations of PCBs and metals in sediment of Eighteenmile Creek and the millrace adjacent to the Former Flintkote Plant; and metals-contaminated fill at Upson Park, the White Transportation property, the Former United Paperboard Company property, and the Former Flintkote Plant

Site. PCB-contaminated sediment in the Barge Canal immediately upstream of Eighteenmile Creek was identified during another investigation (URS 2004). Sediment and floodplain soil samples collected by EEEPC for this investigation (see Section 5) generally corroborate NYSDEC's findings. Based on the available data, it appears that inputs of water and suspended sediment from the Barge Canal are a source of PCBs to the creek, and that erosion and runoff from Upson Park, the White Transportation property, the Former United Paperboard property, and the Former Flintkote Plant Site are ongoing sources of metals contamination to the creek. The ultimate sources of the PCBs and metals probably are historic industrial and commercial activities on and near the Site.

8.3.2 Site-Related Contaminants

The principal contaminants found in Eighteenmile Creek sediment by NYSDEC (2006a) were PCBs, copper, lead, and zinc. Greater than 50% of the sediment samples collected from the creek by NYSDEC exceeded sediment quality benchmarks for these contaminants (see Figures 5-9, 5-12, 5-13, and 5-14 in NYSDEC 2006a). PCBs, copper, lead, and zinc also were found at elevated levels in sediment and floodplain soil samples collected by EEEPC for the current investigation (see Section 5 in this report). In addition, samples collected by EEEPC also contained PAHs and organochlorine pesticides; however, these contaminants may be from non-point sources in the creek's drainage basin, such as stormwater runoff from city streets and/or historic pesticide use, and may not have their ultimate source at the Site.

8.3.3 Ecological Receptors

Based on EEEPC's understanding of the Site, the following groups of ecological receptors have the potential be exposed to chemical contamination at the Eighteenmile Creek Corridor Site:

- Plants and soil invertebrates living in the riparian zone of the creek;
- Mammals, birds, and reptiles that use the creek and its riparian zone to satisfy their food and habitat needs; and
- Aquatic life (fish, amphibians, and benthic invertebrates) in the creek.

8.3.4 Preliminary Conceptual Site Model

Potential receptors and exposure pathways are summarized in the Site conceptual model shown in Figure 8-5. Plants and soil invertebrates may be exposed to Site-related chemicals by direct contact with contaminated soil and uptake of chemicals from soil. Birds, mammals, and reptiles that use the Site may be exposed to Site-related chemicals by incidental ingestion of contaminated soil and sediment, consumption of contaminated prey, and consumption of contaminated water. However, for wildlife, consumption of contaminated surface water typically accounts for only a minor fraction of total exposure. Direct contact with contaminated soil, sediment, and water also is considered a minor route of exposure for

birds, mammals, and reptiles due to the protection provided by their external coverings (i.e., fur, feathers, and scales). Fish, amphibians, and benthic invertebrates using the creek may be affected by direct contact with contaminated water and sediment, ingestion of contaminated water and sediment, and through the food chain.

8.4 Conclusions

The Eighteenmile Creek Corridor Site contains aquatic and terrestrial habitats capable of supporting a wide variety of aquatic organisms and wildlife. Both the current investigation and NYSDEC (2006a) found elevated levels of PCBs, copper, lead, and zinc in floodplain soil, sediment, and/or surface water to which these ecological receptors could be exposed. Given that exposure pathways exist between Site-related contaminants and ecological receptors at the Site, if Site soils and sediments are not remediated, or exposure pathways are not modified during site remediation to ameliorate the ecological risks, further evaluation, specifically a criteria-specific analysis and toxic effect analysis (Steps 2B and 2C in NYSDEC 1994), may be necessary to quantify these risks.

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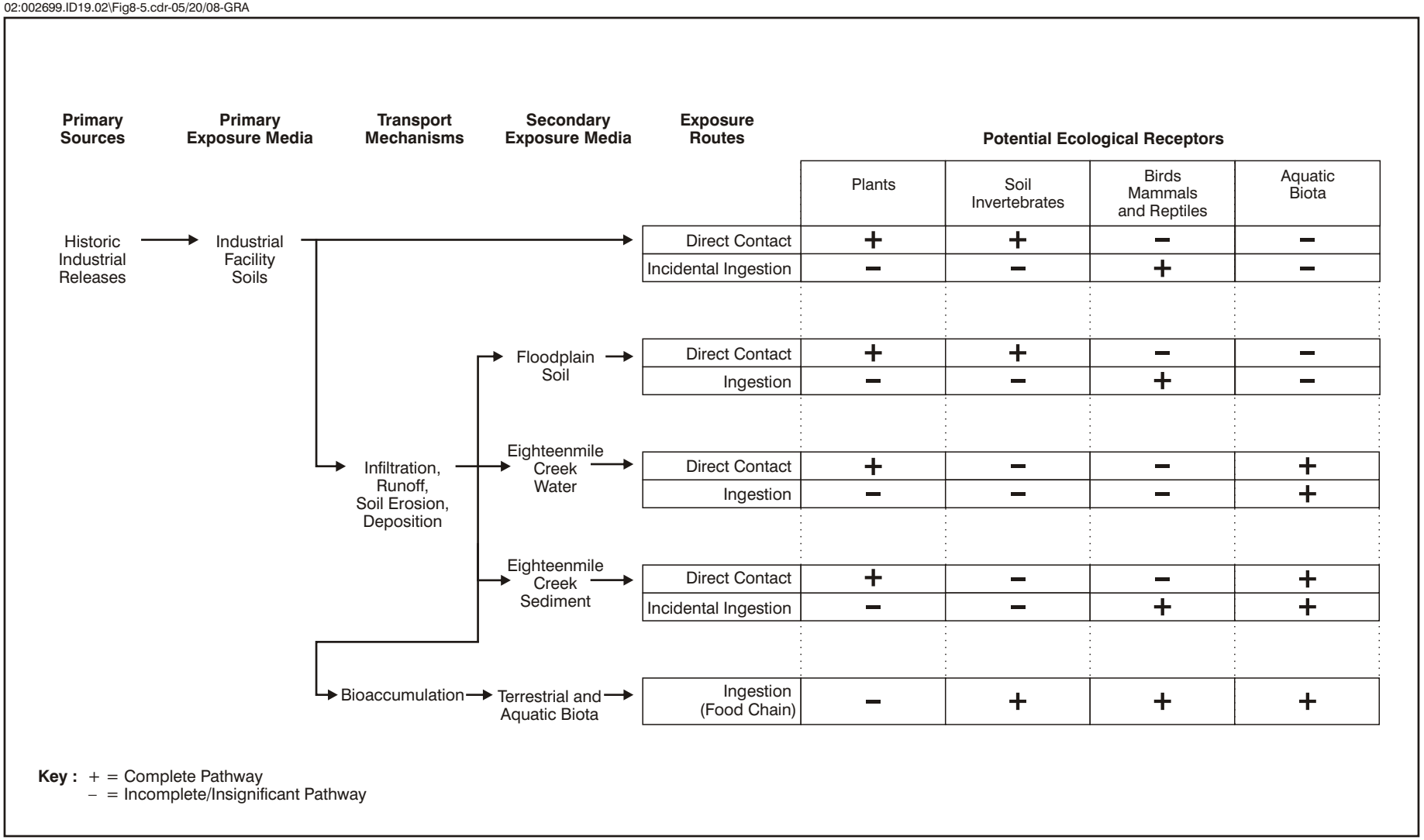

SOURCE: Ecology and Environment, Inc., 2008

Figure 8-5 Preliminary Ecological Conceptual Site Model, Eighteenmile Creek Corridor Site, Supplemental Remedial Investigation

9 Conclusions and Recommendations

The SRI focused on better defining the nature and extent of contamination in the sediment as well as other media in properties adjacent to Eighteenmile Creek. The potential sources of PCBs, PAH, lead, and other related metals to Eighteenmile Creek also were assessed. The NYSDEC RI (2006a) found high concentrations of PCBs and metals in sediment in the creek and the millrace adjacent to the Former Flintkote Plant Site; and metals-contaminated fill at locations along the banks of Eighteenmile Creek. The SRI sediment and floodplain (off-bank) soil samples collected for this investigation (see Section 5) corroborate NYSDEC's findings. PCB-contaminated sediment in the Barge Canal immediately upstream (to the west) of Eighteenmile Creek was identified by another investigation performed by URS in 2004. The SRI investigation found much lower concentrations of PCBs in the Barge Canal sediment samples collected adjacent to the properties.

The headwaters of Eighteenmile Creek are generated from upstream of the Barge Canal on the East Branch. The East Branch also receives water directly from a spillway on the south wall of the canal that leads to the Eighteenmile Creek tunnel that crosses beneath the canal. Water flows over the spillway mainly during spring, summer, and fall months. In late fall, when the canal is drained, the Canal Authority removes a plug from the center of the canal and allows water to flow directly from the bottom of the canal to the Eighteenmile Creek tunnel that crosses under the Barge Canal. This provides a direct pathway for contamination from the Barge Canal to the East Branch of Eighteenmile Creek. The upstream Eighteenmile Creek SRI sample did not have PCBs or significant concentrations of metals. The upstream samples did have levels of total PAHs that were comparable to many of the samples collected farther downstream. PCBs, PAHs, lead, and other related metals were detected in SRI sediment samples collected from the Barge Canal. The concentrations were comparable to many of the other samples collected from the Eighteenmile Creek Corridor Site.

The nearby lock and the fluctuations of the water level in the Barge Canal result in complex sediment and flow dynamics and thus irregular and inconsistent contribution of contaminants from the Barge Canal to the creek. However, based on the available data, including the Additional Investigation findings (EEEPC 2009), Barge Canal sediments do not appear to be currently a significant contributor of PCBs to Eighteenmile Creek sediments. Additionally, the levels of PAHs and

metals in the Barge Canal and upstream sediment indicate they are not a source of significant contamination.

The remaining properties along the Eighteenmile Creek Corridor were characterized by areas of high contamination that appear to be related to areas of fill. The type of fill does not appear to be consistent. High levels of lead contamination are found in all fill areas, but PCB contamination was not found in all fill areas. The transport of fill material via erosion and runoff appears to be the primary mechanism for transport of PCBs and lead contamination farther downstream.

Significant areas of subsurface fill contaminated with lead were identified in Upson Park; however, the SRI data did not confirm the high levels of PCBs found during the RI. Therefore, the fill from Upson Park appears to contribute lead contamination to the creek, but does not appear to be a significant source of PCBs. PCB contamination in the East Branch appears to be from the Barge Canal since only low concentrations of PCBs were found in the subsurface and off bank soils at the White Transportation property.

On the west side of the Eighteenmile Creek Corridor, the potential fill areas show high levels of lead contamination. A high lead concentration fill area was identified on the west side of the Site near 18MC-MW05 and near line 18MC-L09. Significant levels of PCBs were not found in the samples with elevated lead levels collected from suspected fill areas on the west side of the creek. Thus the presence of PCBs in the residential area on the west side of Eighteenmile Creek is most likely due to periodic flooding that has deposited contaminated sediment and not related to the fill used at these properties.

On the east side of the Eighteenmile Creek Corridor, the potential fill areas show both high levels of PCBs and lead contamination. These fill areas with elevated contaminants coincide with elevated levels of PCBs in the sediment on the east side of the creek. An area with high concentration PCB fill was identified at the southeast corner of the Former United Paperboard Company property on the east side of the creek near Clinton Street. High concentrations of PCBs and lead were also found in the millrace adjacent to the Former Flintkote Plant Site. Based on Site hydrology, this area is clearly a depositional area with intermittent flow. However, the potential for contaminant contribution from fill at this location could not be eliminated based on the data collected.

Surface soils were collected from a building on the east side of Mill Street across from the Former United Paperboard Company property. Although contamination was found in these samples, there is no apparent transport mechanism for these soils inside the building to reach the creek. Moreover, the only Aroclor detected at this property was Aroclor 1268 in the two samples collected inside the building. Aroclor 1268 was historically used as a plasticizer in rubbers and synthetic resins and as wax extenders. Aroclor 1268, unlike the other Aroclors that are in liquid

or resin form, is a crystalline white powder. Further investigation of this former coal power plant property as a limited source of fill may be warranted.

Comparison of TCLP data to their respective total lead concentrations gathered during this SRI showed inconsistent results. It appears that the leachability of the lead may vary with the type of source material.

PAHs were detected in many sediment samples and surface soils and some groundwater samples. There were no significant levels of PAHs detected in subsurface samples. In general, the source of PAH contamination appears to be related to anthropogenic sources typical of urban and industrial areas. PAHs were found in samples associated with the fill area near 18MC-MW05 and in surface soils collected in the old building on property across Mill Street.

Chlorinated volatile organics were found in the groundwater in several wells on the west side of the creek. However, the sediment or surface soils were not analyzed for VOCs. Insufficient data exist to identify the potential source of VOC contamination in the groundwater. The impacts of groundwater contamination on the creek cannot be assessed with the data available, but groundwater clearly flows toward Eighteenmile Creek.

Antimony was detected above groundwater quality standards in most of the groundwater samples, but the levels should be confirmed by further analysis of the potential interference from high levels of iron.

Phenolic compounds were detected in several groundwater and subsurface soil samples primarily on the west side of the creek near the White Transportation property. Glycol-related compounds were detected as TICs in the groundwater samples in the same areas. The concentrations of these compounds were not very high, but their presence could be related to another potential source of contamination.

Human Health Exposure and Ecological Risk Assessments

A qualitative human health exposure risk assessment identified four groups of receptors with distinctly different potentials for human exposure to contaminants in the Eighteenmile Creek Corridor. These receptors include: residents of the homes along Water Street with back yards abutting the creek (direct contact with contaminated soils in their yards and stream bank sediments and creek water, and through consumption of fish caught from the creek); visitors to the Eighteenmile Creek Corridor (direct contact with soils, sediment, and creek water in the Corridor); Eighteenmile Creek anglers (direct contact with soils, sediment and creek water in the Corridor and through consumption of fish from the creek); and site workers at the Former United Paperboard Property (through direct contact with soils on the United Paperboard site).

The ERA determined that the Eighteenmile Creek Corridor Site contains aquatic and terrestrial habitats capable of supporting a wide variety of aquatic organisms and wildlife. These ecological receptors could be exposed to the elevated levels of PCBs, copper, lead, and zinc found in floodplain soil, sediment, and/or surface water. Given this situation, if Site soils and sediments are not remediated, or exposure pathways are not modified during site remediation to ameliorate the ecological risks, further evaluation, specifically a criteria-specific analysis and toxic effect analysis (Steps 2B and 2C in NYSDEC 1994), may be necessary to quantify these risks.

Recommendations

Additional data necessary to identify potential remedial alternatives to mitigate contamination problems may be necessary. A more detailed examination of the physical properties of the fill material and related contamination, along with a refined delineation of these fill areas may be necessary to characterize the transport and erosion of the material downstream and the extent of potential source material. Analysis of the contamination related to particle size may help predict whether the fill will deposit contamination or transport the contamination. PCB contamination has been found throughout the creek bed all the way to Lake Ontario. The presence of VOCs in the groundwater indicates a potential presence of VOCs in the soils. Testing for VOCs may be necessary for the FS. An Additional Investigation to address some of these data gaps and to complete the FS was performed at the Corridor Site in late 2008/early 2009 (EEEPC 2009). The findings of the Additional Investigation are submitted under separate cover.

10 References

Brett, C.E., D.H. Tepper, W.M. Goodman, S.T. LoDuca and B. Eckert, 1995, *Revised Stratigraphy and Correlations of the Niagaran Provincial Series (Medina, Clinton and Lockport Groups) in the Type Area of Western New York,* U.S. Geological Survey Bulletin 2086.

Ecology and Environment Engineering, P.C. (EEEPC), 2009, *Final Additional Investigation Addendum to the Supplemental Remedial Investigation Report for the Eighteenmile Creek Corridor Site (Site No. 932121), City of Lockport, New York.* Prepared for the New York State Department of Environmental Conservation by EEEPC, Lancaster, New York.

_____, 2007a, *Phase 1 Environmental Site Assessments, Eighteenmile Creek Corridor Sites: Upson Park, United Paperboard Company, and White Transportation. City of Lockport, New York*, Lancaster, New York.

_____, 2007b, Project Management Work Plan for the Supplemental Remedial Investigation and Feasibility Study at the Eighteenmile Creek Corridor Site (Site No. 932121), *City of Lockport, New York,* Prepared for the New York State Department of Environmental Conservation by EEEPC, Lancaster, New York.

Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero (editors), 2002, *Ecological Communities of New York State. Second Edition, A revised and expanded edition of Carol Reschke's Ecological Communities of New York State* (Draft for review), New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, New York.

LaSala, A.M., Jr., 1968, *Groundwater Resources of the Erie-Niagara Basin, New York,* State of New York Conservation Department of Water Resources Commission, Basin Planning Report ENB-3.

MacDonald, D. D., L. M. Dipinto, J. Field, C. G. Ingersoll, and E. R. Long, 2000a, *Development and evaluation of consensus-based sediment effect concentrations for polychlorinated biphenyls*. Environ. Toxicol. Chem. 19:1403-1413.

MacDonald, D. D., C. G. Ingersoll, and T. A. Berger, 2000b, *Development and evaluation of consensus based sediment quality guidelines for freshwater ecosystems*. Arch. Environ. Contam. Toxicol. 39:20-31.

New York State Department of Environmental Conservation (NYSDEC) 2009, personal communication, letter from Glenn May, NYSDEC DER Region 9, April 3, 2009, re Comments on the Supplemental Remedial Investigation Report, Eighteenmile Creek Corridor Site; Site No. 932121,Lockport (C), Niagara County to Ecology and Environment Engineering, P.C.

_____, 2006a, *Remedial Investigation Report, Eighteenmile Creek Corridor, Lockport, Niagara County, New York, Site Number 932121*. Prepared by NYSDEC, Division of Environmental Remediation, 270 Michigan Avenue, Buffalo, New York.

_____, 2006b, *Record of Decision for the Former Flintkote Plant Site.*

_____, 2006c, *Remedial Program Soil Cleanup Objectives*, 6 NYCRR Subpart 375-6.8, December 14, 2006.

_____, 2003, *Sampling Report, Water Street Properties, City of Lockport, Niagara County, New York.* Division of Environmental Remediation.

_____, 2002, *Sampling Report, Former Flintkote Plant Site, 143 Water Street, City of Lockport, Niagara County, New York.* Division of Environmental Remediation.

_____, 2000, *Site Investigation Report, Former Flintkote Plant Site*.

_____, 1999, *Technical Guidance for Screening Contaminated Sediments*, NYSDEC Division of Fish, Wildlife and Marine Resources, Albany, New York.

_____, 1998, Division of Water Technical and Operational Guidance Series (1.1.1): Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, Division of Water, Albany, New York.

_____, 1996, *Trackdown of Chemical Contaminants to Lake Ontario from New York State Tributaries*.

_____, 1994, *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (FWIA)*, NYSDEC Division of Fish and Wildlife, Albany, New York.

New York State Museum, 2004, *NYS Surficial Geology* web page (http://www.nysm.nysed.gov/data/surficial_alpha.html), downloaded 29 March 2004.

_____, 1991, *Geology of New York: a Short Account*, the University of the State of New York, The State Education Department, Educational Leaflet No. 28.

Shacklette, H. T. and J. G. Boerngen, 1984, Element Concentrations in Soils and Other Surficial Materials of the Continuous United States.

United States Environmental Protection Agency (USEPA), 1998, *Guidelines for Ecological Risk Assessment*, Risk Assessment Forum, USEPA, Washington, D.C., EPA/630/R-95/002F.

_____, 1997, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final*, Environmental Response Team, Edison, N.J.

United States Fish and Wildlife Service (USFWS), 2005, *Eastern Prairie Fringed Orchid Fact Sheet.* Available at www.fws.gov/midwest/endangered/plants/epfo.html.

TVGA Consultants, 2005, *Final Remedial Alternatives Report, former Flintkote Site, Site Investigation/Remedial Alternatives Report (SI/RAR), Former Flintkote Site, 198 and 300 Mill Street, City of Lockport, Niagara county, New York*, Niagara County Department of Planning and Tourism, Sanborn, New York.

_____, 2002, *Phase I Environmental Site Assessment Report For White Transportation 30-40 Mill Street, Lockport. Niagara Country, New York.*

URS Corporation, 2006, *Summary Report for PCBs Detected in NYS Barge Canal Sediments During the Investigation of NYSEG's Transit Street and State road Former MGP Sites, Sites #9-32-098 and #9-32-109, Lockport, NY,* New York State Electric And Gas, Binghamton, New York.