Work Plan for:

RCRA FACILITY INVESTIGATION/CORRECTIVE MEASURES STUDY FOR OPERABLE UNIT 5 (LOWER GENESEE RIVER AREA OF CONCERN) OF THE EASTMAN BUSINESS PARK SITE ROCHESTER, NEW YORK

Prepared For:

New York State Department of Environmental Conservation
Division of Environmental Remediation

Albany, New York

Prepared By:

PARSONS
Syracuse, New York

O'BRIEN & GERE

and

LimnoTech

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CERTIFICATION STATEMENT

I, David Babcock, certify that I am currently a New York State-registered Professional Engineer and that this RFI-CMS Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with DER Technical Guidance for Site Investigation and Remediation (DER-10, May 2010).

4/1/2015
Date

David B. Babcock, P.E.
NYS Professional Engineer License No. 065209-1
Parsons Engineering of New York
301 Plainfield Road, Suite 350
Syracuse, NY 13212

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LIST OF ACRONYMS

Acronym	Description / Definition
AOC	Area of concern
AQWS/GV	Ambient Water Quality Standards or Guidance Values
ASTM	American Society of Testing and Materials
cfs	Cubic feet per second
CMA	Corrective measure alternative
CMS	Corrective Measures Study
CP	Citizen participation
CPOI	Chemical parameter of interest
CSO	Combined sewer overflow
DDD	Dichlorodiphenyl dichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DER	Division of Environmental Remediation (within NYSDEC)
EBP	Eastman Business Park
EFDC	Environmental Fluid Dynamics Code
ER-M	Effects range-median (value)
FEMA	Federal Emergency Management Agency
FWRIA	Fish and Wildlife Resources Impact Analysis
GLNPO	Great Lakes National Program Office
HASP	Health and Safety Plan
KLWWTP	Kings Landing Wastewater Treatment Plant
MCDPH	Monroe County Department of Public Health
µg/kg	Microgram(s) per kilogram (equal to one part per billion)
mg/kg	Milligram(s) per kilogram (equal to one part per million)
MNR	Monitored natural recovery
NOAA	National Oceanic and Atmospheric Administration
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSOPRHP	New York State Office of Parks, Recreation, and Historical Properties
OU	Operable Unit
PAH	Polynuclear (or polycyclic) aromatic hydrocarbons

LIST OF ACRONYMS (CONTINUED)

Acronym	Description / Definition
PCB	Polychlorinated biphenyls
PEC	Probable effects concentration
ppm	Part(s) per million
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG&E	Rochester Gas and Electric
RIBS	Rotating intensive basin studies
SCG	Standards, criteria or guidance (value)
SGV	Sediment guidance value
SOP	Standard operating procedure
SPDES	State Permit Discharge Elimination System
SUNY	State University of New York
SVOC	Semi-volatile organic compound
TAL	Target analyte list
TCL	Target compound list
TEC	Threshold effects concentration
TEQ	Toxicity equivalent (applied to dioxins and furans)
TIE	Toxicity identification evaluation
TOC	Total organic carbon
TSS	Total suspended solids
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service (within the US Department of the Interior)
USGS	United States Geological Service
VOC	Volatile organic compounds

EXECUTIVE SUMMARY

This work plan describes sampling, laboratory analyses and scientific and engineering evaluations to be conducted on behalf of the New York State Department of Environmental Conservation's (NYSDEC) Division of Environmental Remediation for the portion of the lower Genesee River downstream of the State Route 104 (Veteran's Memorial) Bridge in Rochester, New York. The portion of the lower Genesee River being addressed is Operable Unit (OU)-5 of the Eastman Business Park (EBP) Resource Conservation and Recovery Act (RCRA) Site.

The objectives of the activities described in this work plan are to improve the understanding of the nature and extent of contamination and the loadings of contaminants (if any) continuing to enter the lower reach of the Genesee River, to assess whether remedial action is warranted, and to develop and evaluate corrective measure alternatives as warranted. Field and laboratory activities include the following:

- Sampling and chemical analyses of sediment, surface water, and suspended sediment in the lower river, wetland-floodplain soils adjoining the lower river, benthic macroinvertebrates and fish
- Physical characterizations of the river channel, river flows and potential cultural resources in the river
- Further assessing sediment toxicity
- Updating groundwater conditions at the Kings Landing Wastewater Treatment Plant
- Assessing sediment bed mobility
- Assessing upstream sites potentially impacting the lower river
- Further assessing types and diversity of benthic macroinvertebrates and fish in the lower river
- Sampling and chemical analyses of benthic macroinvertebrates and fish

Field data, laboratory data from analyses of samples collected during the field effort, and results generated through use of various technical tools that incorporate data from this field effort and from past field efforts will be synthesized into a report of findings called a RCRA Facility Investigation Report. If information in the RCRA Facility Investigation Report indicates one or more corrective measures may be warranted in the lower reach of the Genesee River, then a Corrective Measures Study (CMS) will also be completed. The CMS will include development of corrective action objectives and evaluations of potentially applicable corrective measures.

Field efforts described in this work plan are anticipated to be completed in 2015, and the CMS, if needed, is anticipated to be completed in 2016. Additional investigation work outside the scope of work included in this work plan may be identified at a later time that could warrant extending the field efforts into 2016.

SECTION 1

INTRODUCTION

1.1 OBJECTIVES

This work plan presents the elements of a RCRA facility investigation (RFI) and corrective measures study (CMS) to be conducted for a segment of the Lower Genesee River located in Rochester, New York. The lower reach of the Genesee River is operable unit (OU)-5 of the Eastman Business Park (EBP) RCRA Site (Figure 1) and is defined as the Genesee River sediments and adjoining wetlands and floodplain areas extending downstream (i.e., north) approximately four miles from the State Route 104 (Veteran's Memorial) Bridge to the mouth of the river at Lake Ontario (Figure 1).

The objectives of the RFI and CMS work outlined in this work plan are to:

- Identify and/or confirm concentrations of chemical parameters of interest (CPOIs) in lower Genesee River sediment, wetland-floodplain soils, surface water, benthic macroinvertebrates and fish
- Characterize physical aspects of the lower river including sediment properties, morphology and potential cultural resources
- Identify and assess significant remaining upstream sources of sediment contamination if present
- Determine if significant chemical loadings are impacting the lower reach of the Genesee River from upstream sites and, if so, quantify the impacts
- Assess whether there are impacts to the lower reach of the Genesee River that warrant corrective measure and, if so, identify and evaluate relevant corrective measure alternatives

1.2 REGULATORY BACKGROUND

Elements of the RFI and CMS described in this work plan are based on a RCRA permit jointly held by Eastman Kodak Company and Recycled Energy Development (RED)-Rochester LLC (which is currently requesting a RCRA permit renewal). As a consequence of the bankruptcy of the Eastman Kodak Company and subsequent related settlement agreements, the Eastman Business Park Environmental Trust has been established to fund environmental response actions in relation to pre-existing contamination associated with historic releases from the EBP. The work outlined in this plan is being funded through this Trust. NYSDEC has been designated the primary beneficiary of the Environmental Trust, and is responsible for administering these trust obligations, including the development and implementation of this work plan. The NYSDEC site number for the EBP is 828177 (USEPA[1] RCRA ID#NYD980592497).

The lower reach of the Genesee River is located within the 35 square miles Rochester Embayment (Figure 2). The Rochester Embayment has been designated an area of concern

[1] USEPA – United States Environmental Protection Agency

(AOC) in the Great Lakes basin under the United States-Canada Great Lakes Water Quality Agreement. This agreement defines AOCs as areas where environmental degradation has impaired the area's ability to support aquatic life. Remedial action plans have been developed to address use impairments in AOCs. For the Rochester Embayment, currently identified impairments include: restrictions on fish and wildlife consumption, tainting of fish and wildlife flavor, degradation of fish and wildlife populations, fish tumors or other deformities, bird/animal deformities or reproductive problems, degradation of aquatic bottom communities (benthos), restrictions on dredging activities in the lower Genesee River, eutrophication or undesirable algae, beach closings, degradation of aesthetics, degradation of plankton populations, and loss of fish and wildlife habitat (NYSDEC, 2014a). The effort to assess impairments in the Rochester Embayment AOC is being by led by the Monroe County Department of Public Health (MCDPH) and the NYSDEC Division of Water in consultation with Region 2 of the USEPA. In 2008, specific criteria were defined for determining conditions in the Rochester Embayment AOC for which particular uses of the embayment would no longer be impaired. Work is ongoing to eliminate aquatic impairments by implementing remedial action plans for the watershed.

1.3 WORK SCOPE

The RFI work scope presented in this work plan includes the following elements:

- Sampling and analysis of river sediment, wetland and floodplain soils, river surface water, suspended sediment, benthic macroinvertebrates and fish to further assess the nature and extent of contamination
- Using analytical techniques to further assess environmental impacts from river sediment including sediment toxicity testing
- Analyzing hydrodynamics and bed sediment transport to assess potential future movement of sediment within the river and floodplain
- Assessing potential impacts from upstream sites to the river
- Assessing potential impacts on fish and wildlife in the river and adjacent wetland/floodplain habitat
- Assessing potential impacts to human health from exposure to contaminated media
- Assessing potential impacts to existing cultural resources (including archaeological and historical resources)

A report describing RFI results and related analyses will be prepared following completion of RFI activities.

If warranted based on the results from the RFI, a CMS will be conducted following agency review of the RFI report. The primary objective of the CMS would be to identify, screen and evaluate potential remedial alternatives (including a no action alternative) for addressing contamination identified in the RFI report. A CMS report would be prepared following completion of the evaluation of remedial alternatives.

1.4 COMMUNITY RELATIONS

The NYSDEC is developing a Citizens Participation (CP) Plan for environmental activities associated with the Eastman Business Park. The CP plan will describe actions that will be taken to keep the community informed and involved. DEC will establish a public repository for lower

Genesee River documents, such as this work plan and other documents and reports that will be generated. At key milestones and periodically via electronic means (via ListServe) and/or through web postings, DEC will issue updates regarding the status of the work and projected schedules.

1.5 WORK PLAN ORGANIZATION

This work plan is organized into eight sections and four appendices. Following this introduction, Section 2 describes OU-5, including adjoining wetland-floodplain areas, and summarizes the most relevant past investigations in the area encompassing the lower Genesee River. Section 3 presents a preliminary conceptual model of the site that will be updated as the RFI is conducted. Section 4 presents the rationale for the work plan elements. Sections 5 through 8 present the work elements for the RFI (Section 5), data evaluation-reporting (Section 6), the CMS and reporting (Section 7), and references cited in the text (Section 8). The four appendices are standard operating procedures [SOPs] for sampling) (Appendix A), a site-specific Health and Safety Plan (HASP) including activity hazard analyses (Appendix B), a Quality Assurance Project Plan (QAPP) for sample handling and laboratory analyses (Appendix C), and a summary of previous sample results (Appendix D).

1.6 SCHEDULE

The proposed schedule for implementing the tasks specified in this work plan is provided below. The schedule assumes no significant delays due to uncontrollable circumstances:

- Conduct RFI Field Activities — May – November 2015*
- Prepare and submit a Draft RFI Report to NYSDEC — Early 2016*
- Conduct CMS and prepare Draft CMS Report — 2016*

*Assuming additional investigation work outside the scope of work specified in this work plan is not determined at a later time to be warranted prior to conducting the CMS.

SECTION 2

SITE BACKGROUND AND PHYSICAL SETTING

2.1 SITE LOCATION AND DESCRIPTION

OU-5 consists of a five-mile-long section of the Genesee River in Rochester, New York, that extends from the State Route 104 (Veteran's Memorial) Bridge north to the mouth of the river at Lake Ontario (Figure 1). The underwater footprint of OU-5 (hereafter called the lower reach of the Genesee River) covers approximately 280 acres. The EBP (formerly Kodak Park) and the associated Kings Landing Wastewater Treatment Plant (KLWWTP) are located downstream of the State Route 104 (Veteran's Memorial) Bridge on the western bank of the river. Industrial operations at the EBP have been ongoing for over 100 years. Many of these operations involved intensive use of various chemicals and occasional inadvertent releases from storage tanks, pipelines, and manufacturing units. Other past and ongoing industrial operations are located in the vicinity of the river upstream of the lower reach of the Genesee River, primarily within the City of Rochester.

2.2 LOWER GENESEE RIVER AND EASTMAN BUSINESS PARK

Construction and manufacturing processes at the EBP, began in 1891. The facility encompasses an area of approximately four square miles within the City of Rochester and the Town of Greece. Primary operations at the EBP included manufacturing of various photographic materials and products and production of synthetic organic chemicals, dyes and couplers (NYSDEC, 2002). The reorganization of the EBP manufacturing space is the result of Kodak's recovery from bankruptcy, which was filed in 2012.

Kodak Park East (Figure 1) is the easternmost section of the EBP, and the northeast portion of Kodak Park East is the only section of the EBP that included industrial operations directly adjacent to OU-5. Development of Kodak Park East began in 1891. Kodak Park East is listed on the New York State registry of inactive hazardous waste sites. Numerous investigations have been completed at Kodak Park East. Tunnels from the combined sewer overflow (CSO) abatement program operated by Monroe County surround Kodak Park East on three sides. The CSO tunnels provide storm surge storage capacity and are encased in bedrock at depths ranging from 60 to 100 feet below ground surface at the EBP.

The KLWWTP is the other portion of Kodak operations that abuts the Genesee River at OU-5. The KLWWTP has been in operation since 1957, and is located directly adjacent to and at nearly the same elevation as the Lower Genesee River. Upgrades to KLWWTP were completed in the 1970s in response to the Federal Clean Water Act. The KLWWTP treated on average 17 million gallons of water daily from EBP manufacturing operations (ARCADIS, 2009) and still actively treats wastewater and a large portion of the stormwater from EBP. Through its existence, the KLWWTP has treated wastewater generated from photographic film and papermaking operations, which use several heavy metals, most notably silver. Treated water is then discharged to the Genesee River adjacent to the KLWWTP.

2.3 LAND USE AND TOPOGRAPHY

As shown on Figure 1, current land use along the lower reach of the Genesee River is primarily park land and cemeteries. Turning Point Park parallels the west bank of the Lower Genesee River and is adjoined on its south end by Riverside Cemetery, which is in turn adjoined by St. Bernard's Park and King's Landing Cemetery north of the KLWWTP. Land along the east bank of the river is undeveloped in the vicinity of the Turning Basin and Seneca Park proceeding upstream to the State Route 104 Bridge. Steep topography near the river bank limits development along both river banks upstream of the Turning Basin.

The section of the lower reach of the Genesee River immediately downstream of the Route 104 Bridge includes several point sources: CSO outfalls, the KLWWTP discharge, and the Merrill Street stormwater outfall. The river downstream of the EBP area to the Turning Basin (approximately 3.1 miles) receives relatively few point source discharges.

From the Turning Basin downstream to its mouth, the river is characterized by reinforced banks and bulkheads, boat docks, and small embayments. Several recent civic improvement projects have been conducted along the river downstream of the Turning Basin; some of these are ongoing. In 2004, the Colonel Patrick O'Rourke drawbridge was installed. The drawbridge crosses the river upstream of the Port of Rochester. Concurrently, a terminal building was built at the Port of Rochester, which is currently being upgraded. A 1.5-mile-long public recreational path placed along the water line between the Turning Basin and the Port of Rochester in 2008 is used for hiking, bicycling, and fishing.

The Port of Rochester includes a navigation channel that extends upstream from the mouth of the river to approximately 0.5 miles upstream of the turning basin (Figure 1). The navigation channel is dredged as necessary to accommodate commercial shipping traffic. Several marinas located between the Turning Basin and the river mouth have recently completed dredging to maintain access to their facilities. Sediment that is dredged from the navigation channel and adjoining boat slips is deposited in Lake Ontario in accordance with permits issued by the US Army Corps of Engineers.

2.4 GEOLOGIC SETTING

Regionally, the area was affected by glaciations. Surficial geological deposits in the area tend to be of glacial origin, and typically provide a relatively thin (less than 30 foot thick) layer over bedrock. The section of the lower Genesee River from Rochester to Lake Ontario is unique because it was subject to both flooded conditions (the gorge was fully submerged) as well as incisions during different glacial periods. The Rochester Gorge section of the Genesee River downstream of the Upper Falls has been heavily altered by anthropogenic activities, including bank erosion controls and urban development.

Bedrock in the Rochester Gorge in the vicinity of the EBP is sedimentary rock, generally consisting of shales, siltstones and sandstone. The bedrock below the riverbed and exposed on the lower walls of the gorge is the Queenston Shale. This relatively soft bedrock was readily eroded, creating the Rochester Gorge. A cross section of the river gorge adjacent to the EBP at Kings Landing (NYSDEC, 2003) has been included as Figure 3.

2.5 HYDROLOGY

The Genesee River watershed covers approximately 2,500 square miles within Western New York and Northern Pennsylvania (US Army Corps of Engineers [USACE], 2004). The river originates in Northern Pennsylvania and is 157 miles long. The watershed is broken into two major basins, bound centrally by the Mount Morris Dam located in Mt. Morris, New York (Figure 2). The Upper Basin is characterized by geologically immature steeply sided ridges and valleys. Riverbed elevation changes in the Upper Basin average 8.9 feet per mile or river length. The Lower Basin lies north of Mount Morris and is characterized by a geologically mature, gently-sloping landscape.

The Barge Canal intersects the Genesee River at grade approximately 12 miles upstream (south) of the river's mouth. Water levels in the Barge Canal during navigation season (typically April through October) are regulated by a gated dam operated by the New York State Canal Corporation.

The United States Geological Survey (USGS) maintains a stream gage on the Genesee River at the Ford Street Bridge near downtown Rochester, New York, upstream of the falls area. The stream gage at the Ford Street Bridge is located approximately 3.2 river miles upstream of the Lower Falls. The gage at the Ford Street Bridge has been collecting daily river discharge data continuously since 2005 (USGS, 2014). From 1904 to 2005, river discharge data were collected from the Lower Falls area. Mean daily discharge from 1919 to 1951, prior to the construction of the Mt. Morris Dam, was approximately 2800 cubic feet per second (cfs) in the Lower Falls area, while mean daily discharge from 1951 to 2014 was approximately 2,850 cfs. The maximum river flow observed at the Lower Falls area or at the Ford Street Bridge during the record keeping period was 29,600 cfs on June 25, 1972.

The river has three controlled ponds and diversions for power generation in the waterfalls area downstream of the Ford Street gauging station and upstream of lower Genesee River (OU-5).

The Genesee River immediately downstream of the Lower Falls is a high-energy environment characterized by high water velocities. In the vicinity of the State Route 104 Bridge, the Genesee River is more quiescent, as evidenced by increasing sediment thickness (GEI Consultants, 2014), lower percentages of sand and gravel sediments, and reduced water velocities. The river remains relatively quiescent for the remainder of its path to Lake Ontario. Sediment throughout the area below the Route 104 Bridge is dominated by fine sand, silt, and clay (USGS, no date). River channel width in the lower Genesee River averages approximately 260 feet, while water depths in the deepest part of its channel average 14.5 feet (USEPA. 2012). Riverbed elevation changes in much of the lower Genesee River Basin have been observed to be as low as 0.2 foot per mile of river length compared to an average of 0.8 foot per mile of river length downstream of the Mount Morris Dam (CRA, 2011). The Lower Genesee River is classified by NYSDEC as a Class B waterbody. The Class B designation indicates that the river's most suitable uses are for primary (bathing) and secondary (incidental) contact recreation and fishing as well as for fish, shellfish, and wildlife propagation and survival.

In the vicinity of the EBP, the river sits in the bottom of a gorge more than 150 feet below surrounding lands. Groundwater in this area discharges to the river. However, based on a number of tunnel construction projects within the bedrock in the vicinity of the gorge and the EBP, and

numerous groundwater investigations, the bedrock does not readily transmit groundwater. The volume of groundwater discharging to the river through the bedrock is very low, especially in comparison to the river's discharge rate.

2.6 BIOLOGICAL RESOURCES

Migratory spawning runs of various types of fish take place at different times of the year in the lower Genesee River from September through May. Fishing activity can be high during spawning runs. A lake sturgeon restoration program is ongoing in the lower Genesee River as well.

The New York State Department of Health (NYSDOH) issues fish consumption advisories based on contaminant concentrations measured in edible fish tissue. These advisories recommend that people limit or avoid consumption of certain fish, in order to reduce their exposure to contaminants. Since the Genesee River is a tributary of Lake Ontario, the Lake Ontario advisories apply to the lower reach of the Genesee River up to the first barrier that stops fish from moving upstream. The current Lake Ontario fish consumption advice is due to PCBs, dioxin, and mirex, and is provided in the table below, and online[1].

Lake Ontario and Lower Genesee River Fish Consumption Advisories

Fish Species	Men over 15 and Women over 50	Women under 50 and Children under 15	Chemicals of concern
Carp Channel Catfish White Perch west of Point Breeze	Don't Eat	Don't Eat	PCBs Mirex Dioxin
Brown trout greater than 20 inches Lake trout greater than 25 inches White perch east of Point Breeze White sucker	Up to 1 meal a month		
Brown trout less than 20 inches Lake trout less than 25 inches All other fish	Up to 4 meals a month		

Benthic macroinvertebrate community information for the lower reach of the Genesee River is available from work completed by NYSDEC in the early 1990's and in 2002. Results from a 2014 benthic macroinvertebrate community assessment are not yet available.

2.7 CULTURAL RESOURCES

The New York State Office of Parks, Recreation and Historical Properties (NYSOPRHP) has designated the entire lower Genesee River area as an archaeologically sensitive area based on

information obtained from the NYSOPRHP Geographic Information System database. Exact locations of archaeological resources are not available because the locations are protected from disclosure by federal and state regulations. NYSOPRHP can provide recommendations to state and federal agencies regarding the need for archaeological surveys.

Seneca Park directly adjacent to the lower reach of the Genesee River (Figure 1) is listed on the National Register of Historic Places. Registration for placement on the list was prepared in 2003 and includes the entire historic and current area of the park.

Two other resources near OU-5 that are listed in the National Register of Historic Places are St. Bernard's Seminary, which is located on top of the gorge along the west bank downstream of Merrill Street and the EBP, and the Maplewood Historic District, which is located on top of the gorge near the west bank upstream of EBP and the State Route 104 (Veteran's Memorial) Bridge.

2.8 PREVIOUS ENVIRONMENTAL INVESTIGATIONS AND ONGOING ACTIVITIES

Results from prior investigations conducted in the lower reach of the Genesee River that are particularly relevant to this work plan are provided in the documents cited below.

- Arcadis 2009. Summary Report Lower Genesee River Data Evaluation Eastman Business Park, Rochester, NY
- Battelle 2012. Task 6: Final Summary Report for Site Characterization at the Genesee River Sediment Site, Rochester Embayment AOC, Rochester, NY. Prepared for USEPA-Great Lakes National Program Office, Chicago, IL
- NYSDEC 1995. Lower Genesee River Project Phase II Report – Summary of 1992, 1993, and 1994 Results
- NYSDEC 2007. Contaminant Analysis in the Rochester Embayment Area of Concern. Prepared for USEPA- Great Lakes National Program Office, Chicago, IL
- NYSDEC and USACE 2004. The Genesee River Basin Action Strategy. Prepared for Genesee/Finger Lakes Regional Planning Council
- USACE 2001. Sediment Sampling for Biological, Chemical, and Physical Analysis at Rochester Harbor, New York. Volumes I and II
- USACE 2008. Benthic Bioaccumulation and Bioavailability of Polychlorinated Dibenzo-p-Dioxins/Dibenzofurans from Surficial Lake Ontario Sediments
- USEPA 1991. Genesee River Watershed Summary. Volumes 1 through 4
- USEPA 2013. Technical Report: Genesee River Sediment Sampling under the Great Lakes Legacy Act Rochester Embayment Area of Concern Rochester, NY
- USFWS 2010. Genesee River Emergent Contaminants Pilot Study 2010. Great Lakes Restoration Institute. Rochester Embayment Area of Concern.
- USFWS 2011. Contaminants of Emerging Concern Study Within the Rochester Embayment Area of Concern. Spring 2011 Sampling Summary.
- United States Geological Survey (no date). Assessment of Habitat Use by Experimentally Stocked Juvenile Lake Sturgeon. Prepared for USEPA- Great Lakes National Program Office, Chicago, IL

- United States Geological Survey 2010. Chemicals of Emerging Concern in Water and Bottom Sediment in Great Lakes Areas of Concern, 2010 to 2011 – Collection Methods, Analyses Methods, Quality Assurance, and Data
- United States Geological Survey 2014. Monitoring of Wild Fish Health at Selected Sites in the Great Lakes Basin: Methods and Preliminary Results

2.8.1 Completed Investigations

Several environmental investigations have been conducted for the lower Genesee River and some have included work in Rochester Harbor. Table 1 provides a timeline of these investigations and summarizes data collected. These reports were used as the primary source of information to assess site conditions summarized in Section 4 and to identify data gaps.

2.8.2 Ongoing Investigations

The following are identified as ongoing and/or planned investigation efforts that include the lower reach of the Genesee River. Applicable results from this work will be included in the analysis of information described in Section 6 of this work plan.

- Invertebrate bioassays (based on NYSDEC and USGS, 2013a)
- Plankton bioassays (based on NYSDEC and USGS, 2013b)

SECTION 3

PRELIMINARY CONCEPTUAL SITE MODEL

A preliminary conceptual site model has been developed to illustrate potential pathways through which impacts from chemical parameters of interest (CPOIs) can be transmitted and the potential receptors of those impacts (Figure 4). Natural systems are inherently complex, so any illustration of natural system dynamics is simplified but useful nonetheless. While multiple conceptual models could be developed for the lower reach of the Genesee River (e.g., separate aquatic pathways from terrestrial pathways), natural systems are interconnected. The focus of this site model is the aquatic system given the river itself is the primary focus of this investigation. The conceptual site model may be revised following the RFI.

3.1 CHEMICAL PARAMETERS OF INTEREST

CPOIs have been identified for OU-5 based on past sampling and laboratory analyses of sediment and water samples within the river and based on industrial operations at the EBP and upstream along the river. These CPOIs include the following:

- Metals, particularly, arsenic, copper, cadmium, lead, mercury, nickel, silver and zinc
- Semi-volatile organic compounds (SVOCs), in particular polynuclear aromatic hydrocarbons (PAHs) associated with past petroleum releases and other sources
- Polychlorinated biphenyl (PCB) concentrations of which have been quantified in past work efforts as Aroclors
- Pesticides and herbicides, particularly toxaphene, chlordane, and dichlorodiphenyl dichloroethane (DDD)
- Dioxins and furans
- Ammonia

3.2 CONTAMINANT FATE AND TRANSPORT

Pathways for contaminants to move within OU-5 are presented in Figure 4 as arrows. Contaminants in solid and aqueous forms can migrate from upland sources to OU-5 through surface runoff and groundwater infiltration. Surface runoff reaches the river through combined sewer and storm sewer discharges and direct overland flow. Groundwater can reach river water directly through infiltration into the river, particularly given the larger elevation differences between the EBP and the lower reach of the Genesee River. However, movement of contaminants through groundwater is many times slower than movement through surface runoff. Other contaminants, such as mercury, can reach an aquatic system through atmospheric deposition of airborne particulates from sources such as energy-generating plants.

Contaminants can reach the river via sewer discharges and surface runoff, while contaminants in groundwater can reach river water directly through infiltration, as illustrated in Figure 4. Within river water, contaminants can be taken up first by small aquatic life forms such as plankton and aquatic vegetation. Additionally, invertebrates and bottom feeding fish filter water for food and simultaneously consume contaminants. Aquatic vegetation, plankton, and

invertebrates are consumed for food by forage fish such as minnows and by larger fish such as pumpkinseed. Contaminants can subsequently continue to move through predator fish via consumption of the forage and bottom feeding fish. Some contaminants (e.g., PCBs) bioaccumulate and thereby increase in concentration as they move through the food web when smaller organisms are consumed by larger, predatory organisms.

Contaminants in river sediments are also redistributed physically as sediment is transported through the lower reach of the Genesee River by erosion and subsequent deposition.

Contaminants can also periodically reach wetland and floodplain areas adjoining the river during high river flow events. Wetland and floodplain soils and life forms can be impacted depending on elevations relative to water levels during high flow events such as large storms and possibly heavy snowmelt periods. Bird of prey and predatory animals at the wetlands and floodplains can also be impacted as they consume impacted fish or impacted terrestrial life forms.

3.3 HUMAN AND ECOLOGICAL RECEPTORS OF IMPACTS (EXPOSURES)

Fish consumption, incidental consumption of river water, and incidental dermal contact with river sediment and water are potential exposure pathways for humans. Fish consumption is currently discouraged by a fish consumption advisory for Lake Ontario that includes the lower reach of the Genesee River. The Genesee River is listed by NYSDEC as a Class B waterbody under Title 6 of the New York Code of Rules and Regulations (NYCRR), Part 701 - Classifications for Surface Waters and Groundwaters. Class B best uses include public swimming and contact through recreational activities.

Ecological receptors include fish and other biota inhabiting the lower river and its adjoining wetlands and floodplains. Some of the contaminants of concern, most notably PCBs and dioxins-furans, can bioaccumulate as they move through the food web. As a result of bioaccumulation, concentrations of these contaminants in predatory fish may be higher than concentrations of the same contaminant in other biota in the river.

SECTION 4

WORK PLAN RATIONALE

4.1 DATA QUALITY OBJECTIVES

Field measurements and analytical testing will be conducted in the lower reach of the Genesee River to characterize the physical and chemical characteristics of the site, determine the nature and extent of contamination, and provide other information to help assess the need for future remediation within the lower river. Data developed as part of this work effort need to be scientifically sound, representative, comparable, and defensible.

A site-specific QAPP has been prepared for this project and is included as Appendix C. The purpose of this QAPP is to provide a standard for control and review of measurements and laboratory analyses completed as part of this work effort.

Analytical services for sediment, water, and other types of samples to be collected as part of this work effort will be provided by laboratories accredited under the NYSDOH Environmental Laboratory Accreditation Program or equivalent. Data validation will be provided for data collected as a result of this work plan. Data validation is the review and evaluation of analytical environmental sample data in accordance to USEPA and NYSDEC protocols, and is to determine data usability and defensibility. As described in Section 9.0 of the QAPP, a USEPA Level IV data validation (i.e., full data validation) will be conducted on 10 percent of the chemical samples, and a USEPA Level III data validation (i.e., sample plus quality control summary data only, no raw data review) will be conducted on the remaining 90 percent of the samples.

4.2 NATURE AND EXTENT OF CONTAMINATION IDENTIFIED TO DATE

This section summarizes the nature and extent of contamination within the lower reach of the Genesee River based on prior investigation efforts. In addition, two investigation efforts (under the auspices of the United States Fish and Wildlife Service [USFWS]) are ongoing through other agencies that have not been included in the below summary.

4.2.1 Bathymetric Data

A review of available documents indicates limited bathymetric data are available for the Lower Genesee River.

Bathymetric survey data were collected upstream of the lower reach of the Genesee River in 2008 and 2009 as part of the Rochester Gas and Electric (RG&E) investigation of manufactured gas plant non-aqueous phase liquid residuals (GEI Consultants 2014). This bathymetry data included the portion of the Genesee River from the base of the Lower Falls to the State Route 104 Bridge.

Federal Emergency Management Administration (FEMA) maps compiled to define floodplain extent indicate that several cross sections of the Lower Genesee River have been surveyed. Cross section survey data have been requested from FEMA in electronic format.

4.2.2 Sediment

Genesee River data from several sources were reviewed as part of the effort to prepare this work plan (see Section 2.6.1). Data from three of the most recent sediment sampling scopes (NYSDEC report from 2007 and USEPA reports from 2012 and 2013) have been consolidated and used to assess sediment concentrations. The consolidated data results are summarized and included in Appendix D as Tables D-1 through D-3. Analytical results from the previous investigations have been compared to the Screening and Assessment of Contaminated Sediment guidance values (NYSDEC, 2014b).

The 2014 NYSDEC Screening and Assessment document reviewed numerous sediment guidelines to develop numeric Sediment Guidance Values (SGVs) applicable for New York State. Two methods were chosen to develop freshwater SGVs: equilibrium partitioning and consensus based sediment quality guidelines (Long, et al., 1995). Equilibrium partitioning is a methodology for deriving sediment SGVs for non-polar organic compounds based on ambient water quality standards or guidance values (AQWS/GVs) and the compound's affinity to adsorb to organic carbon in sediment. Consensus based SGVs are derived from sediment toxicity data. The guidelines establish three classes of sediment contamination defined as:

- Class A – No Appreciable Contamination. Sediment concentrations in this class would present little or no risk to aquatic life. For equilibrium partitioning based SGVs, the toxicity effects threshold was derived using chronic AWQS/GVs, while consensus based SGVs were derived from the threshold effects concentration (TEC). The TEC is the threshold where no adverse impacts are anticipated.
- Class B – Moderate Contamination. Concentrations between the Class A and Class C thresholds are considered to present a reasonable probability of chronic toxicity to aquatic life.
- Class C – High Contamination. Sediment concentrations in this class present a significant risk of acute toxicity to aquatic life. For equilibrium partitioning based SGVs, the threshold was derived using acute ambient water quality standards and guidance values, while consensus based SGVs were derived from the probable effects concentration (PEC). The PEC is the concentration where adverse impacts are anticipated.

The 2007 NYSDEC report summarized sediment data collected to, "…fill in data gaps and update several AOC use impairments" (NYSDEC, 2007). Five sampling locations were selected both upstream and downstream of the KLWWTP as shown on Figure 5. Sampling for this investigation was conducted in July 2002. Surface sediment was collected using a ponar sampler while collocated vibracores were also advanced to collect deeper sediment samples. Sediment cores collected with the vibracore were divided into three equal sections and analyzed with the exception of sample station 001. At sample station 001, less than 1 meter of sediment was recovered, so the sediment core was not subdivided. Sample results are summarized in Tables D-1 through D-3 in Appendix D.

A 2012 USEPA report summarizes sediment samples collected to characterize sediment contamination outside of the navigation channel within the Genesee River and evaluates surface sediments with respect to potential impacts to the benthic community and fish (USEPA, 2012). Samples for this investigation were collected in September 2011 and are shown on Figure 5.

Surface sediments were collected with a ponar sampler at each of the 33 sample locations between the mouth of the river upstream and the State Route 104 Bridge. In addition, vibracore samples were collected at sample locations GR-01 through GR-24 adjacent to the dredge area. Vibracore samples were segmented into 3-foot sections and submitted for laboratory analysis. Sample results are summarized in Tables D-1 through D-3 in Appendix D.

Following the 2012 USEPA sampling effort, the MCDPH requested a re-sampling of sediment at eight locations (GR-02, GR-03, GR-11, GR-12, GR-20, GR-22, GR-31, and GR-32) and analyses of those samples for total metals and benthic toxicity. Surface sediment samples at these locations were collected with a ponar sampler. Sample results are summarized in Tables D-1 through D-3 of Appendix D of this report.

The USEPA identified silver and cadmium as the primary parameters of interest in 2012 (USEPA, 2012). Silver concentrations exceeded the effects range-median (ER-M) value in the majority of river sediment samples downstream of Kings Landing. A maximum concentration of 35.2 milligrams per kilogram (mg/kg) was observed downstream of the Turning Basin at a sediment depth of 6 to 9 feet. Cadmium concentrations in river sediment downstream of the Turning Basin generally were between the Class A threshold concentration of 1.0 mg/kg, and the Class C threshold effects concentration of 5.0 mg/kg. A maximum cadmium concentration of 15 mg/kg was observed in Turning Basin sediment. Metal concentrations in river sediment increased with depth (NYSDEC, 2007).

Dioxins and furans were identified in sediment from the lower reach of the Genesee River, and concentrations were classified based upon the NYSDEC Technical and Operational Guidance Series 5.1.9 for proposed in-water placement of dredged materials (NYSDEC, 2004). Concentrations of dioxins and furans were elevated in river sediment downstream of the Turning Basin. Elevated toxicity equivalent (TEQ) values were found in deeper sediments resulting in Class B and Class C designations, while surface sediments were designated primarily as having no appreciable contamination (Class A). TEQ values help account for differing toxicities when characterizing mixtures of dioxins and furans. The TEQ provides toxicity information about the mixture of congeners and is a better representation of toxicity than reporting individual congerer results. Similar to metal concentrations, TEQ values increased with depth. A maximum TEQ of 80.4 ng/kg was observed just upstream of the Turning Basin (USEPA, 2012).

Sediment PAH concentrations within the lower reach of the Genesee River were elevated at depths less than 3 feet and at depths greater than 12 feet (USEPA, 2012). Sediment PAH concentrations from the 2002 NYSDEC study (NYSDEC, 2007) exhibited several TEC exceedences but no PEC exceedences. TEC exceedences in surface sediments were not noted during the 2002 sampling except at sample station 002.

PCBs were detected at levels exceeding the Class A PCB sediment guidance value of 100 micrograms per kilogram (µg/kg) downstream of the Turning Basin and at one location just downstream of the KLWWTP. PCB exceedences of the Class A sediment criteria were found throughout the sediment column downstream of the Turning Basin and at sediment depths from 2.8 to 8.3 feet at the sampling location near the KLWWTP. No exceedances of the Class C sediment criteria for PCBs (1,000 µg/kg or 1 part per million [ppm]) were observed in the prior studies.

Total pesticides were below detection limits in sediments within the majority of the lower reach of the Genesee River, and when detected, concentrations generally increased with depth (NYSDEC, 2007). The pesticide constituents DDD, dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyltrichloroethane (DDT), chlordane, Mirex, and toxaphene have all been observed at concentrations exceeding the TEC (USEPA, 2012). In most cases, the maximum constituent concentrations occurred just upstream of the Turning Basin.

Representative river sediment and surface water samples have also been analyzed for what are called chemicals of emerging concern, which include prescription drugs, over-the-counter medications, and personal care products (USGS, 2012).

Some information describing physical characterization of surface sediments is available in the USGS Assessment of Habitat Use by Experimentally Stocked Juvenile Lake Sturgeon (no date) and USEPA Great Lakes National Program Offie (GLNPO) Technical Report: Genesee River Sediment Sampling under the Great Lakes Legacy Act – Rochester Embayment Area of Concern (USEPA, 2013). Both studies indicate the sediments in the lower reach of the Genesee River are primarily fine sand, silts, and clays. The USGS report shows that sediments just upstream of the lower reach include larger sand and gravel particles.

4.2.3 Surface Water, Porewater and Suspended Sediment

NYSDEC collected surface water samples in 1992 as part of the Phase II Lower Genesee River investigation (NYSDEC, 1995). These samples were analyzed for metals, pesticides, PCBs, and other organic compounds. The report concluded that analytical reporting limits from samples collected in 1992 were too high to effectively identify contaminants of concern.

NYSDEC also routinely collects Lower Genesee River surface water as part of their Rotating Intensive Basin Studies (RIBS) program. One RIBS sample location (location # 04010003) was identified near Boxart Street upstream of the Turning Basin (Figure 5). Unvalidated analytical data results from RIBS samples collected between 2001 and 2013 were reviewed and compared to NYCRR Part 703 Class B surface water standards/guidance values. Sample analyses for the RIBS studies include analyses of volatile organic compounds (VOCs) and metals. Results from RIBS studies to date indicate no VOC exceedances. The following metals were detected above NYCRR Part 703 Class B surface water standards/guidance values: aluminum, cadmium, copper, iron, lead, mercury, silver, and zinc. The unvalidated sample results are summarized in Table D-4 and included as Appendix D.

Some sediment porewater data are available from the lower reach of the Genesee River due to work completed by NYSDEC as two phases in 1992 and 1993 (NYSDEC, 1995). Porewater samples were collected from a sediment press and analyzed for metals and PAHs in Phase I and metals, cyanide, and fuel oil during the Phase II investigation. Results from both phases indicated porewater concentrations did not correspond well with sediment concentrations in the same areas.

Concentrations of contaminants in sediment suspended in the water column have not been measured based on information from reports reviewed as part of preparing this work plan.

4.2.4 Toxicity of Sediment and Surface Water

A review of existing toxicity data for the lower reach of the Genesee River (see Table 2) indicates that, in the past, Genesee River sediment and water samples have occasionally exhibited toxicity to aquatic organisms. There appears to be no consistent spatial pattern to the observations of toxicity. Toxicity has been sporadic but was observed more frequently in older sampling. No significant acute toxic effects have been observed since 2002. Moreover, the 2011 and 2013 surveys found no toxicity to *Hyalella azteca*, which is a sensitive aquatic invertebrate commonly used in toxicity testing. The only sediment toxicity tests that were not from surface sediment were cores completed by USEPA's Great Lakes National Program Office in 2011. None of the 2011 sediment from cores was toxic to Hyalella based on 10-day tests.

Multiple metals and organic compounds are present in sediment from the lower reach of the Genesee River at levels that could produce toxic effects based on review of existing sediment data. Near-surface sediments are less impacted than sediments present at depth. Cadmium and silver appear to be the most abundant metals present at potentially toxic levels in near-surface sediments. Cadmium is likely bound in non-toxic sulfide forms, based on data for acid volatile sulfides-simultaneously extractable metals. Silver will most likely be complexed with nitrate, sulfate, and/or bicarbonate depending on changing river water chemistry. Contaminant bioaccumulation studies of oligochaete worms and sturgeon indicate only mild to moderate levels of contaminant uptake from sediments (NYSDEC, 2007).

4.2.5 Discharges from Permitted Releases to Surface Water

Release waters reaching the Genesee River in the vicinity of the lower reach are primarily from point source discharges, CSOs and storm drains. Each of these types of releases is permitted and regulated through NYSDEC. Monroe County Pure Waters is the local agency responsible for monitoring and maintaining CSOs in the City of Rochester.

4.2.6 Groundwater Adjacent to the Genesee River at Eastman Business Park

The only industrial lands directly adjacent to the lower reach of the Genesee River are the KLWWTP and Northeast Kodak Park East areas within the EBP located west of the river and downstream of the State Route 104 Bridge. Groundwater quality at these two areas is being monitored, and groundwater flow controls are in place (NYSDEC, 2002 and 2003) and continue to be effective (Kodak, 2013). The primary performance criteria for the containment system at Northeast Kodak Park East is achievement of hydraulic head target values within fractured bedrock trenches.

Groundwater seeps discharging into the Genesee River gorge from the EBP were sampled twice in 1996 to evaluate bedrock groundwater quality entering the lower river (Blasland, Bouck and Lee, 1997). Two groundwater seeps along the western gorge wall were sampled, and the samples were analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, alcohols, and metals. Analytical results detected trichloroethene and 1,4-dioxane but below NYSDEC statewide action levels. Only iron, lead and sodium were detected in seep samples above NYSDEC statewide action levels.

4.2.7 Wetland-Floodplain Soils

No analytical data have been collected to date from wetland-floodplain soils adjoining the lower reach of the Genesee River.

4.2.8 Biota

Two previous benthic macroinvertebrate community analyses were conducted in the lower reach of the Genesee River by NYSDEC in 1992 and 1993 (NYSDEC, 1995) and in 2002 (NYSDEC, 2007). Both studies indicated mild to moderate impairment at most undredged locations. A third benthic community assessment was conducted in 2012-2013 from which results are pending.

Macroinvertebrate samples were collected in 1992 and 1993 in the water column using multiplate samplers and in sediment using ponar samples. Additionally, a trawl was used to collect mollusks for tissue analysis during the 1993 investigation. Multiplate samplers were installed 1 meter below the surface of the water at eight locations for three 5-week periods. Ponar sampling was also completed at each of the multiplate sample locations. Trawl sampling in 1993 was successful at collecting mollusks at three of the sample stations. Results of these studies indicated no exceedance of impairment criteria, however samples from two of the river locations were dominated by pollution-tolerant midges and worms.

In 2002, macroinvertebrate samples were collected from 16 locations within the Rochester embayment AOC. Five of 16 locations were located within the lower reach of the Genesee River. Macroinvertebrate samples were collected with a ponar sampler at all locations. The 2002 investigation concluded that there were slight impacts at two river locations and at one location in Lake Ontario, moderate impacts at three river locations and at one location in Lake Ontario, and severe impacts at one river location based on a field duplicate. The differences in results between the matrix and duplicate samples at the location indicating severe impacts may be explained by a higher proportion of sands in the duplicate sample.

The USFWS conducted sample collection efforts in 2010 and 2011 that included the lower reach of the Genesee River. The sampling effort in September 2010 resulted in collecting largemouth bass from two locations at the Turning Basin and at one location upstream of the EBP. As part of the 2010 work, surface water and sediment samples were also collected for chemical analysis. A second sampling effort by the USFWS in May 2011 resulted in collecting brown bullhead from three locations in the lower reach of the river. Surface water and sediment samples were also collected as part of the 2011 effort. Fish samples from these collections were not submitted for analyses of chemical parameters of interest. Analytical results from the USFWS surface water and sediment samples are not yet available.

The USGS, in cooperation with the USFWS, performed health assessments on individual fish collected in 2010 and 2011 from seven Great Lakes Areas of Concern (AOCs), including the Genesee River within the Rochester Embayment AOC (USGS, 2014). Thirty-nine largemouth bass and 20 brown bullhead were collected for assessments of overall health based on gross observations of fish condition, pathological and other tissue level analyses, reproductive health indicators, and molecular indicators (gene expression biomarkers). Some fish contained morphological anomalies such as lesions and external parasites. The observed effects in the afflicted individuals, however, could not be traced to a cause(s), and effects on fish at the population level could not be quantified due to what the report called “low sample sizes”.

Habitat observations were conducted in the lower reach of the Genesee River in 2013 by SUNY Brockport through the USFWS focusing on mink (Haynes et. al., 2014). Evidence of mink presence was found during these observations. While mink was the focus of this work, two

samples of crayfish, two samples of amphibians, and six samples of fish were collected and analyzed for mercury, PAHs, PCBs, and dioxins-furans, and also for carbon and nitrogen isotopes to provide additional evidence of positions of the collected biota within the food web. Concentrations for PAHs, PCBs, and dioxins-furans were expressed as TEQs. In one of the predatory fish analyzed, the dietary lowest observed adverse effect level was exceeded for PAHs and for dioxins-furans, while in one of the non-predatory fish, the dietary lowest observed adverse effect level was exceeded for PCBs.

4.2.9 Data Gap Assessment for Environmental Media

Data gaps have been identified based on an understanding of existing information about the nature and extent of contamination in the lower reach of the Genesee River and assessing data needed to meet the objectives and elements of this work effort presented in Section 1. Some of the existing sediment, surface water and toxicity data describing the nature and extent of contamination warrant updating. More detailed information to describe the nature and extent of contamination in the river adjacent to the EBP and more information about river hydraulics including river water movement variations are warranted. The extent of debris and potential cultural resources within the lower reach of the Genesee River needs to be assessed. No contaminant information or documentation is available to describe conditions of the wetland-floodplain soils that adjoin the lower reach of the river. Additional and updated data and assessment work to describe impacts on fish and benthic macroinvertebrates in OU-5 are also warranted.

To meet the objectives of this RFI and CMS, the following data collection activities will be conducted in the lower reach of the Genesee River as outlined in Section 5:

- River bathymetry, a survey in the river for debris and potential cultural resources, and measurements of water levels and velocities
- Additional river sediment sampling along multiple transects across the lower river and multiple sediment depths and additional coring to determine if total sediment depth is at least 20 feet
- Analyses of sediment samples for chemical parameters of interest and for engineering properties relevant to assess river remediation alternatives such as sediment stability
- Longer-term sediment toxicity analyses, including background location analyses
- Additional sampling of surface water under low-flow and high-flow conditions in the river as feasible (including analyses of suspended sediment)
- An updated assessment of groundwater quality at the KLWWTP area
- Wetland/floodplain soil sampling and analysis
- A follow up benthic community assessment at each sediment sampling transect and collecting benthic macroinvertebrates (focusing on mussels) for chemical analyses
- Additional fish tissue sampling and chemical analysis to include multiple fish types including small forage fish

4.3 SOURCES, PATHWAYS, AND SOURCE CONTROL

4.3.1 Potential Sources

As shown on Figure 1, land use adjacent to OU-5 is largely recreational and institutional in the form of parks, a college, and three adjoining cemeteries. The EBP is the only footprint of industrial land use directly adjacent to the lower reach of the river. Other potential sources of inputs to the lower reach of the Genesee River are upstream commercial-industrial locations that may directly impact the river, CSOs that drain to the river, two industrial operations on top of the gorge adjacent to the west bank of the river and downstream of the EBP (namely a cement manufacturer and International Paper, Inc.), and Port of Rochester and marina-related operations near the mouth of the river.

The two portions of EBP directly adjacent to the river are the KLWWTP located on a low plateau approximately 30 feet above river level and Northeast Kodak Park East adjacent to the north side of KLWWTP and on top of the gorge approximately 170 feet above river level (Figure 1). Both areas have been used for hazardous waste management operations and are subject to a RCRA (hazardous waste management) permit administered by NYSDEC.

The KLWWTP treats wastewater from multiple portions of the EBP. Treated wastewater is released from the KLWWTP in accordance with State discharge permit requirements to the lower Genesee River at a location approximately one half mile downstream of the State Route 104 Bridge.

The 40-acre KLWWTP area has been addressed with a remedy completed in 2003. The RFI completed for the KLWWTP identified 15 metals exceeding NYSDEC groundwater quality standards or guidance values. However, the presence of non-aqueous phase liquid at KLWWTP was reported to be unlikely, exceedances of groundwater quality standards for VOCs and SVOCs were limited, and no PCBs or pesticide exceedances of soil cleanup objectives were observed. Potential loadings of contaminants from the KLWWTP were determined to be negligible (NYSDEC, 2003). The remedy for addressing hazardous waste at the KLWWTP consists of property use restrictions and other administrative controls such as monitoring and maintenance to address potential exposure to contaminated soils, a wastewater treatment structure control program, and a groundwater monitoring program.

In Northeast Kodak Park East, groundwater concentrations decrease rapidly with lateral distance from the source. The Northeast Kodak Park East area is surrounded on three sides by CSO tunnels, and dense non-aqueous phase liquid was observed during construction of one of these tunnels in the late 1980's. However, no recoverable quantities of dense non-aqueous phase liquid were encountered (NYSDEC, 2002). The remedy for addressing hazardous waste at Northeast Kodak Park East includes groundwater controls, controls on property use, and other administrative controls. Groundwater controls consist of a two-trench fractured bedrock groundwater migration control system, pumping of four interior wells within source areas, and performance monitoring. The fractured bedrock trench system was installed in 2001. Performance and effectiveness evaluations are ongoing.

Other potential sources adjacent to the lower reach of the Genesee River include an International Paper operation on top of the escarpment along Boxart Street, approximately 1,000 feet upstream of the Turning Basin and a cement operation on top of the escarpment upstream of Boxart Street. The International Paper operation currently has a stormwater discharge permit with no analytical requirements and no industrial discharge to the river (NYSDEC personal communication 2014).

Two outfalls are evident in the vicinity of the lower reach of the Genesee River, one CSO outfall on the west bank of the river within 100 feet downstream of the State Route 104 Bridge, and a storm sewer outfall at Merrill Street along the northern border of Kodak Business Park. Both outfalls are constructed within the bedrock.

The Port of Rochester in the vicinity of the mouth of the Genesee River is currently expanding with development of adjacent land for recreational and commercial improvements. Many boats slips are present within the marina area at the river's mouth.

Potential commercial-industrial sources near the lower reach of the Genesee River upstream of EBP and below the Upper Falls include the former RG&E manufactured gas plant operations, the High Falls Brewing Company, a former City of Rochester incinerator, Rochester Metal Etching Company, former Raeco Products, a former Bausch and Lomb Manufacturing facility, and the Kodak Hawkeye Plant. Multiple CSO outfalls exist in this area as well (GEI Consultants, 2014).

The Genesee River immediately upstream of its lower reach flows through a series of three waterfalls called the Upper Falls, Middle Falls and Lower Falls, which are located downstream of the City of Rochester's central business district. Current and former industrial and commercial operations are located along the river's banks primarily between the Upper Falls and the Lower Falls to take advantage of the energy available from elevation changes along the river.

4.3.2 Source Control Efforts

Each of the potential sources described in Section 4.3.1, with the exception of Stormwater/CSO discharges and non-point sources, are being controlled through a variety of programs administered through the NYSDEC Division of Environmental Remediation and the NYSDEC Division of Water. These programs include the State Superfund Program, the Brownfield Cleanup Program, the Environmental Restoration Program, the Voluntary Cleanup Program, the Chemical Bulk Storage Program, and State Pollutant Discharge Elimination System (SPDES) permits. Control of identified potential sources is at various stages from one site to another ranging from ongoing investigations to operating source control systems. For some of the sources, such as Northeast Kodak Park East, the remedy is in place and performance is being monitored; however, it has been acknowledged that the remedy cannot practically remediate the area to pre-release conditions. In particular, contamination in the underlying bedrock cannot be fully removed.

Other potential sources that may be impacting the lower reach of the Genesee River are most likely located adjacent to the river within the City of Rochester upstream of the Lower Falls. Stormwater runoff from the heavily developed areas of the city upstream of the lower reach of the Genesee River is a potential source. Although combined sewer overflows have been greatly minimized through Monroe County's implementation of a combined sewer overflow abatement program, overflows could also still potentially be a source of loadings to the lower river.

4.3.3 Data Gap Assessment for Contaminant Sources

Two of the RFI objectives presented in Section 1 of this work plan are to identify and assess whether there are any significant remaining upstream sources of sediment contamination and to determine if and to what extent significant chemical loadings are continuing. The extent to which other potential sources could be impacting the lower reach of the river warrants additional data collection and assessment.

SECTION 5

RFI INVESTIGATION ELEMENTS

Elements of the RFI are presented in this section based on the data gap assessments presented in Section 4.

Prior to RFI investigation activities, active utilities that may be buried beneath the river and/or beneath adjacent wetland/floodplain soils to be sampled will be identified. In addition, permission to access land areas adjacent to the river will be arranged with landowners, as needed.

5.1 RIVER PHYSICAL CHARACTERIZATION

5.1.1 River Bathymetry

A bathymetric survey will be conducted to provide a representation of water depths and morphology in the lower reach of the Genesee River. Survey point data will have a required vertical accuracy of 0.1 foot to produce figures with a 0.5-foot contour line resolution. Obstructions and structures within the river and associated floodplains (e.g., culverts, bridge supports, bottom of crossings, and utilities) will be surveyed. Where appropriate, data collected for these points will include the size of obstruction/structure, flow direction and rim and invert elevations to the nearest 0.05 foot. Where possible, data will also be collected to define the shoreline and top of river banks.

The bathymetric survey will be conducted in the lower reach of the Genesee River with single or multibeam echo sounding equipment tied to global positioning to obtain elevation. In conjunction with echo sounding, sub-bottom profiling and side scan sonar will be used to further identify and map underwater features as described below.

- Single-beam or multi-beam echo sounding sub-bottom profiling to detect and map surficial river bed features and the subsurface stratigraphic sequence of the sediments
- Side-scan sonar to evaluate surficial sediment texture and uniformity and to identify surficial debris, pipelines, or other obstructions that may affect remedial efforts

Surveyed cross sections will be completed spaced at intervals needed to meet the 0.5-ft. contour requirement but not to exceed a spacing of 400 feet oriented perpendicular to the river flow where shallow water or other factors precludes use of sub-bottom profiling or side-scan sonar.

Minimum standards for performing the bathymetric survey will be based on the USACE January 1, 2002, Publication EM 1110-2-1003.

5.1.2 Cultural Resources and Underwater Debris Survey

A geophysical survey will also be conducted in conjunction with remote sensing technology (sub-bottom profiling and side scan sonar) described above to obtain current sub-bottom stratigraphy and geomorphological data. In addition, magnetic field intensity will be assessed using magnetometry to locate buried ferrous metallic debris, pipelines, or other obstructions that may affect future remediation efforts. These data will be used to interpret subsurface geological

conditions, to assess the extent of utilities, potential cultural resources and underwater debris within the lower reach of the river. This survey will be conducted using instruments linked to a digital global positioning system.

5.1.3 River Water Levels and Water Velocities

Water levels will be collected continuously at one location near the upstream boundary of OU-5 for a period of at least two months with the intent of collecting data from a wide range of river flow conditions. The time period for collecting water levels will be extended as warranted if the range of flow conditions monitored is not sufficiently wide. Long-term water level data are needed because there are several hydraulic control structures between the USGS gaging station at Ford Street and the upstream boundary of river's lower reach that can affect water level variability in the lower reach of the river. Long-term water level data will be used to assess the variability of stage and flow in the lower reach of the river. Water level data will also be used to quantify flow conditions in the lower reach of the river based on flow conditions at the USGS gage located at Ford Street measured since 2005, flow conditions measured at the Lower Falls area from 1904 to 2005, and water levels at the NOAA gage in Lake Ontario.

In conjunction with surface water sampling (see Section 5.5), velocity, temperature, and conductivity profiles of river water will be measured at each transect where river surface water samples are collected. Velocity will be measured using a boat mounted Acoustic Doppler current profiler. The current profiler measures velocities at multiple depths by assessing the Doppler effect of sound waves scattered by water column particles. Temperature and conductivity will be measured contemporaneously with a separate sonde.

5.2 SEDIMENT CHARACTERIZATION

5.2.1 River Sediment Core Sampling

Vertically-continuous core sampling of river sediment will be conducted across nine transects in the study area, as shown on Figures 6a through 6d and one additional transect located upstream of the upper falls (Figures 2 and 6e), with a vibracore or equivalent device to a depth of 20 feet or where refusal is encountered, whichever is shallower. Locations of each of the 10 transects are shown on Figure 6f. With the exception of a transect at the Turning Basin that will have four sample locations, either two or three sample locations are proposed across each transect, depending on width of the river at each transect. Some of the sediment sampling locations along Transects T-1 though T-3 will be in areas dredged previously, and some will be outside the dredged area. Transect have been positioned based on adjacent land use (e.g., transects adjacent to the EBP and outfalls) and representative downstream features (e.g., adjacent floodplains and bends in the river). Specifically, the transect positions were selected based on the following:

- Transect T-1: Furthest-most downstream near the mouth of the river. The transect is also located downstream of marinas and most commercial operations.
- Transect T-2: Downstream of the Turning Basin but upstream of portion of the river shoreline developed primarily with boat slips.
- Transect T-3: The Turning Basin which is a wider and potentially more depositional portion of the river.

- Transect T-4: Downstream from a bend in the river and adjacent to depositional area on the west bank.
- Transect T-5: Across a bend in the river with adjacent depositional area on the east bank.
- Transect T-6: Adjacent to the Merrill Street storm sewer outfall.
- Transect T-7: Adjacent to the KLWWTP discharge.
- Transect T-8: Upstream limit of the lower reach of the river.
- Transect T-9: Upstream conditions and located where the river energy sufficiently dissipates below the Lower Falls to allow for a safe sampling effort.
- Transect T-10: Background conditions upstream of the Upper Falls.

In addition, two other sediment cores will be completed near the Colonel Patrick O'Rourke Bridge north of the Turning Basin at a location to be identified.

Sampling and probing will be conducted from a motorized barge or pontoon boat. The barge or pontoon boat will be equipped with a spud system and anchors to be held in place.

The sediment sampler will be moved within several feet from the original location and re-driven if the sampler cannot be advanced due to buried rocks or other obstructions, or if recovery is less than 70 percent. If sediment recovery is still poor after two attempts, alternative methods will be considered for a follow-up sampling effort. Alternative methods will be based on sediment conditions but may include a larger or smaller diameter vibracore, alternative core catchers to better retain samples, or use of a drill rig from a barge to collect samples.

Each sediment sampling location will be surveyed using portable global positioning equipment and depth of water will be recorded at each location. Sediment cores will be collected using clear core tubing. In addition, at each core sediment location, sediment thickness will be determined by advancing a probe through the sediment unit to refusal. Probes will be advanced to a maximum sediment depth of 20 feet at 25-foot intervals horizontally across each transect in the lower reach of the river to profile sediment thickness.

If a vibracore is used to collect sediment samples, a small crane mounted to the barge or pontoon boat will be used to deploy the vibracore over the side of the barge. If required, a tripod or a small skid mounted drill rig may be used as an alternative to vibracore sampling to advance a split spoon or macrocore type sampler through a moon pool in the center of the barge or pontoon boat. Absorbent booms will be deployed on the water surface, surrounding the barge or pontoon boat.

Each sample core will be logged, classified in the field using the Unified Soil Classification System, and documented via photographs in its entirety. Sediment from 0- to 6-inches, 6- to 12-inches, and 12- to 24-inches below the mudline at each location will be sampled and submitted for laboratory analysis to evaluate the most recent deposition and characterize sediments that could potentially be re-suspended through erosion. The next 2-foot interval (2- to 4-feet below the mudline) will also be sampled at each sample location to characterize more historical sediment CPOI concentrations. These sediments may also be exposed during erosion events. The bottom 2-feet from each sample location will also be submitted for laboratory analysis to assess deeper sediment CPOI concentrations and attempt to bound the vertical extent of contamination.

In addition, two 2-foot segments will be selected and submitted for laboratory analysis from the remaining sediment at each sample location. The additional two sample intervals will target changes in sediment grain size composition (i.e., targeting a sand layer not seen at other sample locations), sediment color gradation and/or visual evidence of contamination (i.e., non-aqueous phase liquid or strong chemical-like odors). If no additional sediment intervals are identified, then two 2-foot sample intervals will be collected at approximate midpoints from the remaining sediment sample. For example, if a 20-foot sediment core is recovered, samples will be collected from the top four feet and from 18 to 20 feet leaving sediment between four and 18 feet. The two additional cores would then be collected between 6.5- to 8.5-feet and 13.5- to 15.5-feet in the absence of target changes. If clay or another native confining layer is encountered and recovered, separate samples will be collected above and below this layer within the targeted depth interval (i.e., clay will not be homogenized with sediments above or within the interval) and both samples will be submitted for analysis. Sediment samples will be analyzed as shown on Tables 3A through 3J.

5.2.2 Analyses of River Sediment Samples

Chemical analyses – One sample from each selected sediment sample interval will be submitted for analysis of Target Analyte List (TAL) metals, TCL, SVOCs, PCB Aroclors, TCL pesticides, TCL herbicides, and total organic carbon (TOC) using the Lloyd Kahn method. Sediment samples in the top interval with sufficient available sample volume and sediment in the bottom interval will also be analyzed for VOCs, total petroleum hydrocarbons, and dioxins/furans. Sediment samples for chemical analyses, except VOC samples, will be placed into a dedicated container, plastic bag, or stainless steel bowl and homogenized prior to loading into laboratory provided sample jars. VOC samples will not be homogenized, but rather collected directly from the opened core to minimize volatilization. The samples will be stored and shipped on ice to the analytical laboratory following chain-of-custody procedures.

Geotechnical Analyses (up to 30 samples) – A sediment sample will be collected and archived from each 2-foot sample interval at each river sediment sample locations. Upon completion of the initial sediment investigation, boring logs will be reviewed by a suitably-experienced geotechnical engineer and representative archived samples will be selected for geotechnical index testing based on the geotechnical engineer's review, types of analyses most useful for assessing corrective measure alternatives, variability of sediment type (i.e., fine versus coarse grained) and variability of sediment characteristics at different sample locations and sample depths. Selected archived samples for geotechnical testing will be reviewed with representatives from NYSDEC prior to submittal to the laboratory for analysis. The index testing will include moisture content (ASTM[2] D2216), specific gravity (ASTM 854/C127), grain size with hydrometer (ASTM D422), and organic content (ASTM D2974). Atterberg Limits (ASTM D4318), testing will be performed on fine grained samples only.

Radiodating Analyses (up to 60 samples) – Sediment from up to four cores in relatively low-energy (depositional) areas impacted by contamination will be collected during a second mobilization and analyzed for two radioisotopes. These four cores will be collected at locations sampled during the first mobilization. Radioisotope, or geochronology, analyses will be

[2] ASTM – American Society of Testing and Materials

conducted on sediment from up to 15 depth intervals within each of four cores. Sediment from each depth interval will be analyzed for lead-210 and cesium-137 radioisotopes. Based on known half-lives of these two radioisotopes and atmospheric release history for cesium-137, results from these analyses can be used to date sediments, estimate deposition rates, and provide information regarding contaminant discharge history (Velinsky et. al., 2011).

5.3 TOXICITY ANALYSIS IN SEDIMENT

The purpose of additional sediment toxicity work presented in this section is to conduct longer-term toxicity tests that include measuring longer-term, chronic endpoints such as test organism reproduction.

Results of the initial sediment characterization outlined in Section 5.2 will be reviewed in consultation with NYSDEC as locations for sediment toxicity sample collection and test methods for toxicity analyses are selected. Up to 18 sediment samples will be collected from the top one foot of sediment for toxicity testing based on results from the initial sediment chemical analyses outlined in Section 5.2.2. At least one of the locations for toxicity analyses will be from the background sampling transect (T-10). Given the sample volume needed for toxicity testing, these samples will be collected with a clamshell or similar device to obtain samples from the top one foot of sediment. At each location where sediment toxicity analyses will be conducted, a short core will be collected specifically for TAL metals, ammonia, and organic carbon (Lloyd Kahn method) analyses of the top one foot of sample.

In accordance with NYSDEC sediment guidance (2014), concentrations of contaminants at locations selected for toxicity analyses will most likely cover the range of contaminant concentrations observed in the top foot of river sediment. The upper one foot of sediment is the most biologically active zone and reflects the most appropriate depth interval for toxicity testing. Toxicity testing of subsurface sediment is not proposed due to the low energy and apparent low potential for scour in the lower river (see Section 2.5), the marked decrease in biotic activity in deeper sediment, and a low likelihood for the presence of significant tracts of deeply rooted submerged aquatic vegetation due to turbid river conditions.

Sediment Toxicity Analyses – A 42-day *Hyalella azteca* whole sediment bioassay (Method 100.4 [USEPA, 2000]) is one test method that will be considered in consultation with NYSDEC for each selected sediment toxicity sample location. A 42-day whole sediment toxicity bioassay has not been conducted to date in the lower reach of the Genesee River. The 42-day *Hyalella azteca* bioassay is also relatively insensitive to sediment grain size, and the bioassay has a (relatively) short test duration for assessing chronic effects including survival, growth, and reproduction. Sediment from each bioassay will be analyzed for TAL metals, ammonia and TOC given potential variability of concentrations over short distances. If results from initial sediment sampling of nearby sediment from cores indicates potential toxicity based on measured concentrations, analyses of sediment from each bioassay for PAHs and dioxins-furans may be added. If appropriate, the analytical list for this second set of chemical analyses may, in consultation with NYSDEC, be reduced based on the results of the initial sediment sampling described in Section 5.2. A toxicity sampling summary is included in Table 4.

In the case that substantial toxic effects are observed in sediment samples, Phase I sediment toxicity identification evaluation (TIE) procedures (USEPA, 2007) will be initiated on those samples using sediment collected initially for toxicity analyses. Knowing the substance(s)

responsible for toxicity provides better definition of the source(s) and focus to corrective measures. The purpose of a Phase I TIE is to characterize the class of contaminant responsible for the observed toxicity. In a Phase I TIE for whole sediments, sediments are amended with zeolite and *Ulva lactuca* to limit ammonia toxicity, with cationic exchange resin and sulfide to limit metal toxicity, and with coconut charcoal and Ambersorb resin to limit toxicity from non-ionic organic contaminants. Further phases of TIE may be performed as warranted by the Phase I results to provide more specific identification and confirmation of the toxicant.

5.4 WETLAND-FLOODPLAIN SOIL CHARACTERIZATION

Surface soil samples will be collected at 15 locations near the east and west bank of the lower reach of the Genesee River to coincide with designated wetland and floodplain areas as well as features along the river that may be relevant to the investigation (e.g., outfalls, CSOs, drainage features). Sampling locations identified in Figures 7a through 7d have been identified based on likely lowest-lying locations on both sides of the river away from developed areas. Final wetland-floodplain soil sample locations will be identified in consultation with NYSDEC based on site conditions at the time of sampling. Prior to sampling a reconnaissance of the wetlands-floodplains will be conducted to observe flora and fauna, assess topography, collect qualitative information related to stress on wetland-floodplain biota, and assess the potential for complete contaminant migration pathways. When locations for sampling are finalized, soil will be collected from the 0- to 6-inch vertical interval, which is most relevant to assess impacts on ecological receptors, and from 12- to 24-inch and 2- to 4-foot intervals as reasonably achievable to assess the depth of potential contamination (Table 5). In addition, soil from the 6- to 12-inch vertical interval will be collected and archived for possible future analyses pending results from the other vertical intervals.

If results from this first wetland-floodplain soil sampling effort show additional characterization is warranted, a second soil sampling effort will be scoped and conducted following NYSDEC review. The second soil sampling effort would most likely include additional locations in potential deposition areas.

Chemical analyses – Collected wetland-floodplain surface soil samples from each of the 15 locations will be analyzed for TAL metals, TCL SVOCs, PCB Aroclors, TCL pesticides, TCL herbicides, TOC based on the Lloyd Kahn method, and soil pH. Additionally, a total of up to 15 of the 45 wetland-floodplain samples will be analyzed for dioxin-furans (Table 5). Identification of these 15 samples for dioxin-furan analyses will be reviewed in advance with NYSDEC primarily based on results from the analysis of other organic CPOIs from the same sample group. The estimated time between sample collection and identifying soil samples for dioxin-furan analysis is anticipated to be approximately 30 days. Allowable sample holding times are 14 days for extraction and 40 days for analysis following extraction (see Table 4.2 in Appendix C).

Geotechnical Analyses (up to 15 samples) – Wetland-floodplain soil samples will be selected for geotechnical index testing based on observations during sampling. In particular, the soil type (i.e., fine versus coarse grained) and the variability in soil characteristics between locations and with depth will be considered in selecting which samples to test and which index testing to perform. Upon completion of the initial wetland-floodplain soil sampling, representative archived samples will be selected for geotechnical index testing based on sediment type (i.e., fine versus coarse grained) and the variability in sediment characteristics based on

sample locations and sample depth. Selected archived samples for geotechnical testing will be reviewed with representatives from NYSDEC prior to submittal to the laboratory for analysis. The index testing will include moisture content (ASTM D2216), specific gravity (ASTM 854/C127), grain size with hydrometer (ASTM D422), Atterberg Limits (ASTM D4318), and organic content (ASTM D2974).

5.5 SURFACE WATER AND SUSPENDED SEDIMENT CHARACTERIZATION

One depth-integrated surface water sample will be collected within the water column during three different timeframes from one location at five of the sediment-sampling transects downstream of the Lower Falls. The five transects for surface water sampling from upstream to downstream are upstream of the State Route 104 Bridge (T-9), downstream of EBP (T-6), approximately halfway between the State Route 104 Bridge and the Turning Basin (T-5), at the Turning Basin (T-3), and near the mouth of the river (T-1) (Figures 6a through 6d and 6f) (Table 6). The location at each transect where surface water samples will be collected will either be at mid-channel or where water movement appears to predominate based on visual observations at the time of sampling. A total of 15 surface water samples will be collected based on three surface water sampling events targeting one dry-weather period and two wet-weather flow conditions that take into account seasonal variations. Surface water sampling in the river to be conducted in association with wet-weather events in particular will include consideration of river conditions that will allow the sampling team to work safely (see surface water sampling SOP in Appendix A). Surface water samples for analysis of total suspended solids will be collected from the left, center and right portion of the five transects as feasible during the three water sampling events.

Chemical analyses – Surface water samples will be analyzed for total suspended solids (TSS), TAL metals, TCL SVOCs, PCB Aroclors, ammonia, hardness, alkalinity, total dissolved solids, and total as well as dissolved organic carbon. In addition, pH, turbidity and specific conductance will be monitored with field instruments as samples are collected. One third (*i.e.*, five) of the surface water samples collected during one of the wet-weather events will also be analyzed for VOCs, dissolved TAL metals and cations/anions important in oxygenated natural systems (i.e., nitrate, sulfate, and chloride in addition to metal cations). In addition, each of the five surface water samples from one dry-weather event and one wet-weather event will be filtered through a filter with a sub-micron pore size. Mass of sediment obtained from filtration will be recorded and used in the sediment transport modeling effort described in Section 6.1.3. If sufficient sediment mass exists following filtration, the filtered sediment will be analyzed for TAL metals followed in order of preference by grain size distribution, PCB Aroclors, and TCL SVOCs, respectively, while water passing through the filter will be analyzed for TAL metals.

5.6 CHARACTERIZATION OF SEDIMENT FROM DISCHARGES TO THE RIVER

If present and accessible, sediment samples from up to six representative combined sewer or storm sewer monitoring locations agreed to in advance with the responsible entity will be collected during one dry-weather period and also, as safe and practical, in association with one storm event. The goal for sediment from a storm event is to monitor sediment associated with peak daily flows at least twice the seasonal median daily flow. Selecting a storm event to monitor also depends on the frequency, intensity, and duration of the storms and flow conditions

in the river prior to each storm. Weather forecasts, river flow data available online from the USGS Ford Street Gauging Station, and professional judgment will be used to help identify target storm events. If the monitoring period is significantly drier than normal, then a storm event with lower peak flows will be targeted.

For planning purposes, one dry-weather sediment sample and one wet-weather sediment sample are assumed to be collected from each of the six representative locations for a total of up to 12 inflow sediment samples. High-flow storm events can carry significant loads of metals and organic compounds, however sediment can also be scoured from sewer pipes during wet-weather events.

Up to 12 inflow sediment samples will be analyzed for TAL metals, TCL SVOCs, PCB Aroclors, and solids content. In addition, four of the 12 inflow sediment samples collected during this sampling effort will be analyzed for TCL VOCs and dioxins-furans. The basis for selecting sediment samples for analysis of TCL VOCs will include visual observations of the sediment and sample location relative to former or ongoing industrial operations. Samples to be analyzed for dioxins-furans will be identified with NYSDEC input based on factors such as analytical results for other CPOIs.

5.7 BIOTA CHARACTERIZATION

5.7.1 Macroinvertebrate Sampling

A benthic community assessment will be conducted along each of the nine sampling transects in the lower reach of the Genesee River (Figures 6a through 6d), and along a tenth sampling transect upstream of the Upper Falls (Figure 2 and 6e). All 10 transects are shown on Figure 6f. The purpose of macroinvertebrate community sampling is to confirm results of prior benthic community assessments in the river and provide a line of evidence for assessing potential sediment impacts to sediment-dwelling biota associated with each of the 10 sampling transacts in the river. Three replicate petite ponar grab samples will be collected at each of the 28 river sediment sampling locations for a total of 84 samples to assess benthic macroinvertebrate community abundance, composition, and structure. Upon retrieval of the sampling device, large particles of debris and organic matter will be removed, and sediment samples will be sieved though a 500-micron sieve. The retained invertebrates will be rinsed into glass containers, preserved and transferred to a biological (taxonomic) laboratory for counting and identification to the lowest practicable taxonomic level.

In addition to a benthic community assessment, attempts will be made to collect and analyze representative benthic macroinvertebrates for certain CPOIs in areas of the lower river that have been potentially impacted. Mussels are relatively immobile benthic macroinvertebrates that generally represent local conditions and filter large amounts of water. The focus of this benthic macroinvertebrate sampling effort will be mussels first and crayfish second if mussels are not present in significant numbers. Given mussels are most likely not able to be captured in sufficient quantities using a ponar dredge, a trawl or drag dredge (also called a biological dredge with net) will attempt to be used to collect mussels along the following three transects:

- Downstream of the EBP (T-6)
- Approximately halfway between the State Route 104 Bridge and the Turning Basin (T-5)

- Along Transect T-4 located between T-5 and the Turning Basin (Table 7A)

Transects T-4, T-5 and T-6 are the first three transects downstream of the EBP, and sediments at these transects have not been impacted by recent river dredging operations. The goal is to collect one sample of mussels in the vicinity of each sediment sample locations along Transects T-6, T-5 and T-4 which are the first three transects downstream of the EBP. In addition, sediment at Transects T-6, T-5 and T-4 have not been affected by recent river dredging operations. If use of a trawl or drag dredge is not effective or if mussels are not found in sufficient quantities for chemical analyses following reasonable effort, an attempt will be made along shorelines at Transects T-6, T-5 and T-4 to collect crayfish using baited traps.

Benthic macroinvertebrate sampling and community assessment procedures will be consistent with NYSDEC SOP 208-14 (NYSDEC 2014c).

Benthic Macroinvertebrate Chemical Analysis

Whole-body composite samples will be collected to obtain sufficient mass for chemical analysis. Mussels will be shucked prior to compositing. Benthic macroinvertebrate samples collected for chemical analysis will be analyzed for eight metals (arsenic, cadmium, copper, lead, mercury, nickel, silver and zinc), PCB Aroclors, TCL PAHs, TCL pesticides, TCL herbicides, and lipid content consistent with guidance values provided in NYSDEC SOP 208-14 (except silver is not included in the NYSDEC SOP). Reasons for analyzing benthic macroinvertebrate samples for arsenic, cadmium, lead, mercury, and silver are that cadmium and silver have been identified as primary parameters of interest for this study area (USEPA, 2012), while arsenic, copper, lead, mercury, nickel and zinc are metals that potentially bioaccumulate in the environment and have been detected at concentrations in study area sediment exceeding NYSDEC sediment guidance (see Appendix D).

5.7.2 Fish Sampling

The purpose of fish tissue chemical monitoring is to further document contaminant body burdens for different segments of the river's lower reach.

To allow for a comparative assessment of tissue concentrations, fish samples will be collected from four lower river segments that extend continuously from upstream of the State Route 104 Bridge to the mouth of the river and from the Transect T-10 (background) area upstream of the Upper Falls. The four lower river segments downstream of the falls area will consist of the area upstream of the State Route 104 Bridge, the area between the State Route 104 Bridge and the river bend at Seneca Park, the area between Seneca Park and the downstream (northern) end of the Turning Basin, and the area furthest downstream to the river's mouth (Figure 6f). Attempts will be made to collect ten composites of small prey fish, five bottom-dwelling adult game fish and five adult predatory game fish (representing each of the two groups of fish described below) from each river segment. As practical, adult game fish samples will be evenly distributed among all five of the river segments.

Fish samples will likely be collected using a boat-mounted electroshocking unit and/or trap nets as warranted according to the procedures described in the Fish Sampling SOP (Appendix A). Fish species, length, weights, condition, as well as water quality conditions (e.g., temperature, pH, dissolved oxygen, turbidity, conductivity) will be recorded.

Three groups of fish will be targeted for collection according to position within the food web and habitat preference. These three fish groups are:

- Composites of small forage fish that serve as prey for larger fish, birds and mammals. The forage fish targets are gizzard shad (*Dorosoma cepedianum)* and less mobile forage fish such as darters, minnows, shiners and/or killifish depending on abundance during the fish collection effort. Significant reasonable effort will be made to collect individual fish from a single species when compositing prey fish samples. However, in the event that sufficient mass of the target forage fish cannot be obtained with reasonable effort, an alternative species of forage fish may be sampled. Given the availability of shad can vary, alewife (*Alosa pseudoharengus*) will be a backup in case gizzard shad are not available. Small forage fish such as darters, minnows, and/'or killifish likely do not have a wide range of movement within the river relative to more migratory resident forage fish species. The prey fish sampling effort will also be conducted to ensure consistency in the species, sizes, and numbers of prey fish that comprise composited samples. The number of individuals to be composited in a given prey fish sample will be based on fish weights and minimum sample mass requirements specified by the analytical laboratory. Forage fish to be collected for composite samples will be sorted by size so that fish of similar size will comprise a single sample. For example, a large forage fish with sufficient mass will be analyzed by itself rather than being composited with much smaller fish. The goal is to collect more than the minimum mass required to meet project data quality objectives;
- Adult game fish targeting common carp (*Cyprinus carpio*) or channel catfish (*Ictalurus* punctatus) with a preference for common carp. Both carp and channel catfish have a high degree of exposure to bed sediments; and
- Adult predatory game fish targeting largemouth bass (*Micropterus salmoides*), that have been sampled successfully previously, feed on smaller fish, and may be consumed by humans.

Actual species of prey fish collected for chemical analysis will be based on availability at the time of collection and after consultation with NYSDEC. Numbers of other fish collected incidentally will be recorded. Migratory fish will not be collected for chemical analyses. A scientific collector's license will be obtained from NYSDEC for this fish tissue sampling effort.

Fish Sample Numbers and Lengths

For forage fish, 10 composite samples will be targeted from each of the five river segments, for a total of 50 composite forage fish samples. From the four lower river segments and the upstream river segment, the forage fish samples in total will consist of five composites from the west side of the river and an additional five composites from the east side of the river. Lengths of the forage fish will be up to 6 inches as reasonably possible.

Twenty-five individual adult sport fish from each of the two adult sport fish species will be targeted for a total of 50 adult sport samples distributed uniformly as reasonably possible among the five river segments (see Table 7B). Lengths of each adult sport fish will be at least 10 inches for common carp or channel catfish and 12 inches for largemouth bass (based on the legal limit of 12 inches for bass) as reasonably possible.

Types, numbers and sizes of target fish collected will be reviewed with NYSDEC prior to submitting the fish for laboratory tissue analysis.

Fish Tissue Analysis

Adult sport fish will be filleted using the updated NYSDEC procedure for preparing fish fillets (NYSDEC 2014d). Forage fish will be composited as whole-body samples.

Individual adult game fish fillet samples will be processed from each adult game fish collected for analysis. Whole body composite samples will be collected for prey fish. A fillet from each of the 50 adult fish and the 50 forage fish composite samples will be analyzed for eight metals (arsenic, cadmium, copper, lead, mercury, nickel, silver and zinc), PCB Aroclors, TCL pesticides, TCL herbicides, and lipid content. In addition, a total of 25 samples (15 adult carp fillets and 10 composites of small forage fish distributed among all five river segments) will be analyzed for dioxins-furans. Fish tissue analyses are summarized in Table 7B. Excess fish sample mass not used for other analyses will be frozen and archived for possible future analyses such as analyzing additional carp fillets for dioxins-furans.

Reasons for analyzing fish samples for arsenic, cadmium, lead, mercury, and silver are that cadmium and silver have been identified as primary parameters of interest for this study area (USEPA, 2012), while arsenic, copper, lead, mercury, nickel and zinc are metals that potentially bioaccumulate in the environment and have been detected at concentrations in study area sediment exceeding NYSDEC sediment guidance (see Appendix D). If total arsenic concentrations to be measured in fish tissue show significant potential for impacts from local discharges, selected archived fish samples will also be analyzed for inorganic arsenic.

Adult sport fish carcasses will also be archived for possible future analysis. The numbers and nature of carcass analyses will be determined based on calculated whole-body predictions extrapolated from fillet results. For planning purposes, 20 percent of the archived samples have been assumed to need testing. Specific tests to be conducted on carcasses will be determined by NYSDEC in consultation with USEPA based in part on calculated whole-body predictions, appropriateness of the fish type as a prey item and need for additional information to confirm whole-body predictions.

5.8 GROUNDWATER QUALITY CHECK AT THE KLWWTP

Groundwater at the EBP is hydraulically controlled through a system of pumping wells and collection trenches to prevent migration of contaminated groundwater off-site. Operations and monitoring of the groundwater remediation systems, including the system for Northeast Kodak Park East that is directly adjacent to the lower Genesee River, are described in semi-annual groundwater remedial system summary reports submitted to and reviewed by NYSDEC. The most recent available summary report (Kodak, 2013) indicates that the containment systems are performing to design specifications and are effective at meeting remedial goals.

As part of this work scope, one round of water levels and groundwater samples will be collected from up to 10 monitoring wells at the KLWWTP area which is the only EBP area situated at an elevation near the river water level elevation; other EBP areas are on top of the river gorge at an elevation over 150 feet higher than the river. Collected groundwater samples will be analyzed in a laboratory for TCL VOCs, TCL SVOCs, TAL metals, PCB aroclors, total dissolved solids and total suspended solids. Field parameters to be collected from each of these

monitoring wells will be water levels, pH, specific conductance and oxidation-reduction potential. The monitoring wells to be sampled will be wells for which specific well construction logs are available.

SECTION 6

RFI DATA EVALUATION AND REPORTING

6.1 DATA EVALUATION

6.1.1 Data Validation

Analytical data generated during this investigation will be reviewed and validated as described in the QAPP (Appendix C). Analytes will be subject to Level III data validation protocols. In addition, 10 percent of the results for metals and organic compounds will be validated based on Level IV data validation protocols consisting of complete checks of the results. The validated results will be incorporated into a NYSDEC-compatible database (such as Equis) following validation.

Once the data validation has been completed, a data usability and summary report that presents the results of data validation and data usability assessment will be prepared and submitted to NYSDEC as part of the RFI report.

6.1.2 Evaluation of Toxicity and Bioaccumulation

Sediment characterizations are complicated by the presence of many contaminants and potential stresses to aquatic life not related to contamination. Multiple lines of evidence will be assessed to account for these complications. The goal is to determine if sediment in the lower reach of the Genesee River warrants remediation based on one or more significant impacts. Results from contaminant and physical-geotechnical measurements of samples, toxicity tests, and other results from work specified in Section 5 of this work plan will be evaluated together with previous comparable results in what is called a sediment quality triad analysis (Chapman, 1996).

Contaminant-by-contaminant comparisons will be developed of measured concentrations in river sediment against NYSDEC's Class A, B, and C sediment guidance values (NYSDEC, 2014b). Contaminants exceeding sediment guidance values will also be assessed considering site-specific grain size and organic carbon content results. In addition, mean sediment guidance value quotients will be calculated to evaluate the expected toxicity from mixtures of contaminants in sediments, in accordance with NYSDEC guidance (2014b).

Contaminant-by-contaminant comparisons will also be developed of measured concentrations in surface water with New York State's surface water quality standards (6 NYCRR Part 703) and for metals based on equilibrium partitioning (USEPA, 2005). Contaminants exceeding water quality standards and guidance values will be assessed considering hardness, pH, suspended solids, and organic carbon in light of the biotic ligand model and equilibrium partitioning. Comparison will also be provided with of toxicity results from this investigation with previously-observed toxicity results.

Contaminant-by-contaminant comparisons will be made of measured wetland-floodplain soil, fish tissue and benthic macroinvertebrate concentrations with NYSDEC guidance values (such as soil concentrations in NYSDEC and NYSDOH 2006 and benthic macroinvertebrate

concentrations in NYSDEC 2014c). Other sources for media guidance values to assess extent of contamination will be applied as appropriate in consultation with NYSDEC.

6.1.3 Assessment of River Hydrodynamics and Sediment Transport

Hydrodynamic and sediment transport modeling will be performed as part of the RFI data evaluation in relation to contamination from historic releases from EBP. The model will be used to evaluate deposition and erosion potential of the sediment bed and the likelihood of burial or resuspension, transport of surficial and buried contaminants under varying flow conditions, and to better assess how physical processes affect sediment movement in the river's lower reach. The model's domain will extend from the Driving Park Avenue Bridge (Figure 1) immediately downstream of the Lower Falls to the river's mouth. Hydrodynamic and sediment transport modeling will provide analyses needed to assess current sediment bed conditions in the river's lower reach and to help evaluate remedy alternatives later as part of the Corrective Measures Study. Key questions that the hydrodynamic and sediment transport model will address include:

- What is the stability of the current bed?
- What is the likelihood of buried contaminants resuspending due to future high flow events?
- What is the likelihood of recontaminating Lower Genesee River surface sediment following remedy activities?
- Will various remedy alternatives be able to meet remediation goals?

A hydrodynamic and sediment transport model will be developed for the lower reach of the Genesee River using a USEPA-supported modeling framework called the Environmental Fluid Dynamics Code (EFDC). The version of the EFDC that will be used incorporates a custom sediment transport model based on the SEDZLJ model algorithms developed by Craig Jones and Wilbert Lick at the University of California – Santa Barbara (Jones and Lick, 2001). LimnoTech anticipates that the EFDC/SEDZLJ model domain will extend from the Lower Falls to Lake Ontario. Details about the modeling approach, including development of model inputs, model calibration, and model sensitivity analyses can be found in the modeling SOP in Appendix A. Data needed as input for the hydrodynamic and sediment transport model are as follows:

- Suspended solids concentrations under varying flow conditions
- Depth, flow and velocity measurements under varying flow conditions
- Changes in bathymetry over time due to ongoing maintenance dredging
- Sediment thickness measurements and geotechnical analyses
- Deposition history (buried contaminants linked with geochronology [Cesium-137 and Lead-210 dating], cores or discharge histories)

Erodability parameters will be assessed as part of model calibration. Physical characterization data to be obtained for the lower Genesee River during the RFI such as bulk density, grain size distribution, and total organic carbon will be incorporated into initial estimates of erodibility parameters to be completed as part of model calibration.

Sensitivity simulations will be performed with the model to evaluate the influence individual parameters have on model predictions. These simulations will illustrate the variability of model predictions based on reasonable variations in model parameterization as well as the range of probable hydrodynamic conditions that could exist in the lower reach of the Genesee River.

If hydrodynamic modeling to be conducted as described in this section demonstrates that erosion is likely under high-flow conditions, toxicity testing could be performed on sediment samples that could be collected at appropriate depth intervals as a follow up to the sediment sampling described in Section 5.2.

Site-specific river bed erodability data using a tool called SEDflume are typically input to the EFDC/SEDZLJ models. SEDflume is a custom-designed flume device that can be used to measure erosion rates and sediment properties for an intact sediment core. However, a large dataset of existing SEDflume measurements is available from many different sediment sites outside the lower Genesee River which can be applied to this modeling effort together with site-specific sediment characteristics to develop initial estimates of bed erodibility. Several studies from which SEDflume data are available have been completed for Great Lakes tributaries that cover a wide range of flow conditions and sediment characteristics.

6.1.4 Assessment of Potential Contamination from Other Sites

Potential contamination sources within and upstream of the lower reach of the Genesee River will be identified early in the RFI effort working primarily with NYSDEC and accessing relevant available databases. Sites adjacent to the Genesee River in the City of Rochester will be identified from the various remediation initiatives ongoing within NYSDEC. The extent of potential impacts to the Genesee River from each of the identified sites will be assessed qualitatively based on the extent of contamination, type(s) of contamination, the potential for impacted site groundwater to reach the river, and control of any contamination remaining at ground surface relative to the Genesee River's flow regime. Relevant available surface water quality data from other sources will be included to this assessment. Sites with potential to significantly impact the lower reach of the Genesee River will be highlighted within this analysis.

6.1.5 Fish and Wildlife Resources Impact Analysis

Fish and Wildlife Resources Impact Analysis (FWRIA) will be conducted for the lower reach of the Genesee River and for adjoining wetland-floodplain soils in accordance with NYSDEC's Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10, Section 3.10.1) which is based on a two-phased approach. Part I of each FWRIA will be based on information collected to date by other investigators. Part II of each FWRIA will incorporate data that is collected during this RFI effort and results for the lower reach of the Genesee River to be provided by others from ongoing investigation efforts.

The outline for conducting Part 1 of a FWRIA includes five main topics that will be addressed: 1. Identifying local fish and wildlife resources based upon knowledge of the site. 2. Describing fish and wildlife resources on site and within 0.25 mile of the site (field verify as warranted). 3. Identifying contaminant migration pathways and any fish and wildlife exposure pathways. 4. Identifying CPOIs associated with ecological impacts. 5. Evaluating actual or potential for adverse impacts to fish and wildlife resources. FWRIA technical details will be provided to USEPA for review prior to assessing impacts on fish and wildlife resources. USEPA

ecological risk assessment guidance documents (USEPA, 1997 and USEPA, 1998) will be used to supplement the development of the FWRIA for the river and a FWRIA for the wetland-floodplain soils.

FWRIA for the Lower Genesee River

Part I of the FWRIA will be prepared prior to the sampling efforts outlined in Section 5 of this RFI work plan and based primarily on data presented and described in NYSDEC (2007), Battelle (2012), USEPA GLNPO (2013), results from ongoing investigations being conducted by others, and queries of state and federal conservation agency databases. The ecological characterization of the lower reach of the Genesee River will be conducted through the development of topographic and cover type figures. Fish and wildlife resources to be presented on the figures will include (as applicable) habitats for rare, threatened, and endangered species; state-regulated wetlands; surface water designations, including wild, scenic, and recreational river designations, as applicable; and designations of significant coastal habitats. Fish and wildlife resources to be described for the lower reach of the Genesee River include:

- Vegetation cover types and listed plant species
- Typical fish and wildlife species for each cover type
- Any endangered, threatened, or rare species, or species of special concern
- Visual observations of stress (e.g., ecologically barren areas or stressed/dead vegetation)
- Historic fish kills and wildlife mortality
- Fish and wildlife consumption advisories
- Suitability of the area to support fish and wildlife based on habitat characteristics and water/sediment quality conditions
- Current and potential future use of the Lower Genesee River for fishing, recreational, or economic use

CPOIs associated with ecological impacts will be identified. Part I of the FWRIA will also describe contaminant migration pathways and complete exposure pathways for the lower reach of the Genesee River as a follow up to the preliminary site conceptual model presented in this work plan (Section 3). The presence of outfalls, drainage ditches, and other features that could represent migration pathways of contaminants to the lower reach of the river will be described.

Part II of the FWRIA for the lower reach of the river will focus on assessing impacts of contamination in local fish and wildlife resources. Data collected during the RFI will be integrated with results from past and other ongoing Lower Genesee River data collection efforts. The primary focus within Part II will be on evaluating chronic ecological exposures for representative ecological receptors based on multiple lines of evidence and in conjunction with assessment work described in Section 6.1.2 of this work plan. Ecological exposure concentrations will be quantified and used to evaluate direct contact exposure to benthic invertebrates and fish, and to quantify food chain exposure to wildlife receptors. Ecological exposure concentrations will then be compared to ecotoxicity values for representative eco-receptors. Results of the sediment toxicity tests will be used as an additional line of evidence for determining the potential for adverse effects to aquatic life in the lower river.

Part II of the FWRIA will also include quantification of biological indices for benthic macroinvertebrate samples collected and enumerated as part of this RFI. The following indices will be quantified as warranted to describe the abundance, richness, diversity, pollution tolerance of the benthic community (NYSDEC, 2014c): Hilsenhoff's Biotic Index, species richness, Percent Model Affinity, species dominance, and the Ephemeroptera ([mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]) Index. Statistical comparisons of the scores of each of the indices will be conducted for Lower Genesee River samples and for background samples to identify the degree of impairment to the benthic invertebrate community from potential exposure to sediment in the lower reach of the Genesee River.

Complexities and uncertainties in this Part II type of analysis will be assessed including how uncertainties may impact FWRIA results.

<u>FWRIA for Adjoining Wetland-Floodplain Soils</u>

As identified in the preliminary site conceptual model described in Section 3 of this work plan, contaminants may be able to migrate to wetland-floodplain areas adjoining the lower river via the river itself during high river flow events. The FWRIA for wetland-floodplain soils adjoining the lower reach of the Genesee River will consist of a qualitative ecological characterization of the fringe habitats adjoining the lower reach of the river and a reconnaissance of the wetlands-floodplain adjoining the lower reach of the river to be conducted prior to the collection and analysis of soil surficial wetland-floodplain samples described in Section 5.4.

Part I of the FWRIA for the wetland-floodplain will identify CPOIs associated with ecological impacts through a screening process for each relevant medium. It will also describe contaminant migration pathways and complete exposure pathways of Lower Genesee River-related contaminants and fish and wildlife resources in wetland-floodplain habitats as a follow-up to the preliminary site conceptual model presented in this work plan (Section 3).

The selection of CPOIs for the wetlands-floodplain will be completed by comparing soil concentrations to potentially applicable screening, criteria and guidance values (SCGs). CPOIs will be retained for further evaluation (in Part II of the FWRIA, if warranted), if they are found to exceed applicable SCGs, if no applicable criteria or guidance value are available, or if detected contaminants are considered bioaccumulative.

The scope of a FWRIA – Part II for the wetlands-floodplain area will be determined based on the details obtained through Part I, evaluation of analytical data, and input from the NYSDEC. Part II of the FWRIA for wetlands-floodplains in the lower reach of the Genesee River may also include additional wetland boundary delineation work as warranted and in coordination with NYSDEC.

6.1.6 Human Health Exposure Assessment

A qualitative human health exposure assessment will be completed for the lower reach of the Genesee River based on the six pathways of potential concern identified in the preliminary site conceptual model (Figure 4): incidental river water ingestion, incidental river water contact, incidental river sediment contact, incidental wetland-floodplain soil contact by trespassers or construction workers, incidental wetland-floodplain soil ingestion, and fish consumption.

Consistent with NYSDEC's DER-10, the qualitative human health exposure assessment will evaluate and document how people might be exposed to site-related contaminants and identify

and characterize potentially exposed population(s) now and in the reasonably anticipated future that may use site resources. The exposure elements that will be addressed include: 1) a description of the contaminant source at the point of exposure, 2) potential for media and transport mechanisms to the exposed population(s), 3) potential exposure point(s) where actual or potential human contact with the contaminants may occur, 4) route(s) of exposure, and 5) characterization of the receptor populations that may be exposed.

The lower Genesee River is a Class B body of water under NYCRR Part 701 for which the best usages are primary and secondary recreation and fishing, which indicates the goal for the river is to be suitable for fish, shellfish, wildlife propagation and wildlife survival. Thus, applicable human health corrective action objectives for the river include surface water quality standards established in NYCRR Part 703 for Class B waters. For direct contact with wetland-floodplain soils adjacent to the river and sediments in the river, applicable human health corrective action objectives, including soil cleanup objectives defined in NYCRR Part 375-6, will be considered. Applicable corrective action objectives for river sediment may also include bioaccumulation-based sediment guidance values for protection of human health for fish ingestion presented in Table 8 of the NYSDEC 2014 guidance document for screening and assessing contaminated sediment. Fish action levels potentially applicable from scientific literature and fish action levels that may be provided by the NYSDOH will also be incorporated into the identification of applicable corrective action objectives as appropriate.

The qualitative human health exposure assessment for the lower reach of the Genesee River and adjoining wetland-floodplain areas will be based on the following assumptions:

- Current land uses surrounding the river's lower reach will continue for the foreseeable future
- Groundwater will continue to not be used for potable purposes
- The assessment will not include adjacent land parcels outside the adjoining wetland-floodplain

A quantitative human health risk evaluation will not be conducted given SCGs are available to address the potential impacts of the lower Genesee River on human health.

6.2 RFI REPORT

Information obtained from the field investigations, validated data from laboratory analyses described in Section 5, and results from the data analyses described in Section 6.1 will be compiled, assessed, and summarized. An RFI Report will then be prepared. This report will document, in summary form, the RFI activities specified in this work plan. Chemical analytical results for each of the sampled media will be compared to appropriate standards, criteria and guidelines not already included in the fish and wildlife resources impact analysis and the human health exposure assessment described in Section 6.1. Other results from work efforts described in Sections 5 and 6 of this work plan will also be summarized. A brief summary of relevant results from prior site investigations will be included for comparison purposes. A path forward toward preparing a CMS will also be provided within the RFI report

Analyses presented in the RFI Report will distinguish between data collected from dredged areas and data collected from areas where sediment has not been dredged. Data will be evaluated with respect to potential remobilization of contaminants due to dredging.

SECTION 7

CORRECTIVE MEASURES STUDY AND REPORT

The CMS will include, as warranted, identifying and evaluating corrective measure alternatives for sediment in the lower reach of the Genesee River that has been significantly impacted and associated impacted wetland-floodplain soils.

7.1 CORRECTIVE MEASURE OBJECTIVES AND REMEDIAL GOALS

The development of corrective measure objectives and preliminary remedial goals requires the identification of applicable or relevant and appropriate federal and state statutes and regulations and other advisories, criteria, or guidelines. Remediation of the lower reach of the Genesee River as needed is subject to federal and state environmental statutes and regulations pertinent to the RCRA program. Response actions must attain a degree of cleanup that assures protection of human health and the environment and attains standards, criteria and guidelines to the extent practical.

Applicable media of concern, contaminants that can significantly impact the lower reach of the Genesee River, and completed exposure pathways identified as part of the RFI effort will be assessed in association with applicable or relevant and appropriate standards, criteria and guidelines to formulate corrective measure objectives and preliminary remedial goals to be used throughout this CMS effort.

7.2 IDENTIFICATION OF IMPACTED AREAS

The extent and distribution of contaminants that could result in significant impacts in river sediment and wetland-floodplain soils will be evaluated based on monitoring data available from the RFI and from past investigation efforts. This information will be used as the basis for developing potential corrective measure alternatives as warranted.

7.3 DEVELOPING AND EVALUATING CORRECTIVE MEASURE ALTERNATIVES

General response actions are broad categories of media-specific actions that, by themselves or in combination with other general response actions, will satisfy the corrective measure objectives. General response actions that are potentially applicable to the lower reach of the Genesee River are:

- Institutional controls such as fishing advisories and access controls
- Monitored natural recovery (MNR) in the form of gradual burial over time
- Sediment containment in the form of capping (enhanced MNR)
- In-situ treatment
- Sediment or soil removal and management

Corrective measure alternatives (CMAs) will be developed as warranted based on the RFI results from work described in Sections 5 and 6 of this work plan. CMAs will likely include a combination of remedial technologies. The corrective measure alternatives to be identified will meet RCRA's threshold criteria, as specified in 6 NYCRR Part 373 and DER-10:

- Protection of human health and the environment
- Attainment of applicable or relevant and appropriate requirements

Each corrective measure alternative will be described and evaluated using the evaluating/balancing criteria listed below.

- Long-Term Effectiveness: Anticipated CMA effectiveness, reliability, and risk of failure
- Reduction of Toxicity, Mobility or Volume of Wastes: CMAs capability of effectively reducing contamination in media
- Short-Term Effectiveness: CMAs capability of achieving media clean-up objectives in a short period of time
- Implementability: Degree of relative ease to install CMA and time required to achieve given level of response
- Community Acceptance: Extent of community acceptance of CMA
- State Acceptance: CMA capability to comply with all NYSDEC and USEPA regulations applicable to CMS activities (e.g., permit requirements)
- Cost Estimate: Cost to implement and maintain each alternative at a level of detail appropriate for comparing various corrective measure alternatives

Potential future river uses and effects from ongoing upstream sources of contamination will be assessed as part of the CMS as warranted based on discussions with NYSDEC.

Following the evaluation of alternatives, a preferred corrective measure will be recommended for river sediment and for wetland/floodplain soils (if warranted). The recommended corrective measure(s) will be described and supporting rationale will include how the recommended measure will protect human health and the environment, meet requirements, and address the balancing criteria presented above.

7.4 CORRECTIVE MEASURES STUDY REPORT

Once each alternative is evaluated and compared, a comprehensive CMS Report will be developed. The CMS Report will document the process by which the CMAs were formulated and evaluated. The report will include a comparative assessment of the alternatives' prospects for achieving the corrective measure objectives and will as warranted identify a preferred corrective measure for addressing significantly impacted river sediment and adjoining wetland-floodplain soils. The report will include recommendations for additional work that may be necessary to more specifically define elements of the remedy.

SECTION 8

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TABLES

TABLE 1
PRIOR STUDIES TIMELINE AND SCOPE

Investigation/Report Name	Prepared by	Report Date	Period of Study	Media Investigation	Summary of Scope	Sediment	Toxicity	Surface Water	Biota
Final Report for Sediment Sampling, Chemical and Mechanical Analysis in the Rochester Harbor and Irondequiot Bay, New York - Volume I Technical Report	**PADIA Environmental Inc., for USACE**	November 2000	September 1999	Surface Sediments	Collection of surface sediment samples (9) from mouth of Genesee River to just beyond Turning Point Basin. Chemical analysis on collected sediment focused on PCBs, PAHs, and Metals. Confirmed presence of PAHs, Metals, and inorganic materials (i.e. NH_3-N)	x			
Lower Genesee River Project Phase II Report - Summary of 1992, 1993 & 1994 Results	**NYSDEC**	1995	1992 - 1994	Fish; Water Column; Surface Sediments; Bottom Sediments; Sediment Pore Waters; Macroinvertebrates	Study site stretched from south of downtown Rochester to the mouth of the Genesee River. Two primary objectives existed - determine the presence and concentration of toxic compounds within river sediments; explore reports of fishless river reaches downstream of Lower Falls. Study observed increased fish mortality, sediment toxicity, and motel concentrations in the downstream portion of the study site.	x	x	x	x
Rotating Integrated Basin Studies Water Quality Assessment Program - The Genesee River Basin Sampling Years 1999 - 2000	**NYSDEC; Statewide Waters Monitoring Section**	February 2004	1999 - 2000	Surface Water; Bottom Sediment; Invertebrates	Pertinent to study area - Lower Genesee part of ambient monitoring network since 1968. Water column chemistry, bottom sediment contaminant concentrations, invertebrate tissue sampling, ambient water toxicity testing and assessment of macroinvertebrate communities conducted. (Pages 19-29)	x	x	x	x
Final Report - Assessment of Habitat Use by Experimentally Stocked Juvenile Lake Sturgeon	**USGS for USEPA-GLNPO**	March 2005	1999-2005	Lake Sturgeon; Surface Sediments	Primary focus of study involved the monitoring of pre-stocked Lake Sturgeon within the Lower Genesee River study area. Habit assessment took place is order to place suitability estimates on the stocking/spawning sites. Surface sediment and benthic community sampling conducted, only physical sediment characteristics analyzed. Water column chemistry and sturgeon diet tests also conducted.	x		x	x
Contaminant Analysis in the Rochester Embayment Area of Concern - GLNPO Project Number GL97582701 - Final Project Report	**Gary Neuderfer for USEPA-GLNPO**	May 18, 2007	July 2002 - Summer 2004	Surface sediments; Bottom sediments; macroinvertebrates; sturgeon	Determine physical characteristics and contaminant concentrations in Lower Genesee river sediments; Conduct sediment toxicity tests with two macroinvertebrate species; Assess benthic microinvertebrate community; Measure contaminant concentrations in blackworms exposed to surface sediments; measure contamination concentrations in stocked Lake Sturgeon.	x	x		x

TABLE 1
PRIOR STUDIES TIMELINE AND SCOPE

Investigation/Report Name	Prepared by	Report Date	Period of Study	Media Investigation	Summary of Scope	Sediment	Toxicity	Surface Water	Biota
Task 6: Final Summary Report for Site Characterization at the Genesee River Sediment Site, Rochester Embayment AOC, Rochester, New York	**Batelle**	June 2012	May 2011 - September 2011	Contaminated Sediments; Fish	Lower Genesee site characterization in order to evaluate contamination in areas border the dredged navigation channel. Limited habitat assessment for possible habitat restoration in parallel with sediment remediation.	x	x		x
Technical Report: Genesee River Sediment Sampling under the Great Lakes Legacy Act - Rochester Embayment Area of Concern Rochester, New York	**USEPA-GLNPO**	September 2013	July 2013	Contaminated Sediments; Benthic toxicity	Study carried out as a quality control measure on 2012 EPA sediment study. Eight sample locations observed in the 2012 study were re-evaluated for metals and benthic toxicity, with comparison to prior study results. Study found reduced sediment silver concentrations; no impact to *Hyalella azteca* survivability.	x			x
Assessment of MGP-Related NAPL Residuals in Sediments in the Genesee River Project Area	**GEI Consultants for Rochester Gas and Electric Corporation**	March 31, 2014	2008 - 2013	Surface sediments; Bottom sediments; Surface water	Study explored the possible impacts of NAPL released from a manufactured gas plant on downstream sediments. River bathymetry, sediment probing, sediment coring, and laboratory analysis of sediment conducted. No presence of NAPL was from Lower Falls to the Veterans Bridge.	x		x	

TABLE 2

SUMMARY OF TOXICITY AND BIOACCUMULATION DATA FROM THE LOWER GENESEE RIVER

SAMPLING YEAR	TEST TYPE	ENTITY	TEST ORGANISM	LOCATIONS	EFFECT OBSERVED
1975-1976	Surface water bioassays	Kodak	5-day survival of *Daphnia magna, Pimephales promelas, Helisoma (Planorbella) trivolvis,* and *Dugesia (Girardia) tigrina*	Route 104 bridge and St. Bernard's Seminary (downstream of KLWWTP)	About 25 percent of tests toxic to Daphnia, mostly from upstream station Mortality of other organisms less than 1.4 percent
1980 - 2006	Whole sediment and sediment elutriate bioassays for dredged material evaluations	USACE	*Hyalella azteca* and *Chironomus tentans* 7-10 day survival and growth; *Hexagenia limbata*, *Daphnia magna*, *Pimephales promelas* 96-hour acute toxicity	Rochester Harbor	• Moderate to high occurrence of toxicity was observed from 1980 to 2001, but no toxicity was observed in the more recent samples from 2006
1989, 1990, 1999, 2005	Surface water bioassays	NYSDEC	*Ceriodaphnia dubia* 7-day survival and reproduction	Rochester Harbor	• No significant effect on survival, but reproduction as apparently impaired in some samples from 1990 and 1999
1992 - 1993	In situ caged fish study	NYSDEC	Fathead minnow *Pimephales promelas*	6 main sites from upstream of Barge Canal to above Rochester Harbor	• 1992: Significant toxicity from upstream of barge canal to below Kings Landing WWTP • 1993: No significant toxicity attributable to contaminants; • Apparent bioaccumulation of silver and PCBs
1992 - 1993	Whole sediment bioassays	NYSDEC	*Hyalella azteca* 14-day survival and growth; *Chironomus tentans* 10-day survival and growth; Microtox assay	6 main sites from upstream of Barge Canal to above Rochester Harbor	• 1992: No significant toxicity to *Chironomus* • 1992: Significant toxicity to *Hyalella* from station below KLWWTP • 1993: Apparent toxicity in Microtox assay from all sites, but highest in sample from near Kings Landing WWTP.
1992 - 1993	Sediment porewater bioassays	NYSDEC	*Hyalella azteca* 14-day survival and growth; *Ceriodaphnia dubia* 48-hr acute survival and 5-day survival and reproduction; Microtox assay	6 main sites from upstream of Barge Canal to above Rochester Harbor	• No significant toxicity to *Hyalella azteca*; one 1993 sample from near Merrill Street exhibited marginal effects on growth of *Hyalella*. • 1993: No acute toxicity to *Ceriodaphnia*, except caused by ammonia at Merrill Street. • 1992: Chronic toxicity to *Ceriodaphnia* observed in one sample from near Merrill Street. • No acute toxicity observed in Microtox test
2002	Whole sediment bioassays	NYSDEC	*Hyalella azteca* 28-day survival and growth; *Chironomus tentans* 10-day survival and growth	5 lower Genesee River sites	• Slight but significant reduction in survival to *Hyalella*. • No statistically significant effects on *Chironomus* except in a replicate sample from Rochester Harbor.
2002	Whole sediment lab and field bioaccumulation study	NYSDEC	*Lumbriculus variegatus* Lake sturgeon	5 lower Genesee River sites	• Significant bioaccumulation of some pesticides, PCBs, PBDE, and dioxins/furans at some locations.
2001, 2004	Whole sediment lab bioaccumulation	USACE	*Lumbriculus variegatus*	Rochester Harbor	• No significant bioaccumulation of PAHs or PBDEs compared to Lake Ontario sites
2011	Whole sediment bioassays	Battelle, for USEPA GLPO	*Hyalella azteca* 10-day survival and growth	40 samples along lower Genesee River	• No statistically significant toxicity
2013	Whole sediment bioassays	USEPA GLPO	*Hyalella azteca* 10-day survival and growth	9 samples along lower Genesee River	• No statistically significant toxicity

TABLE 3a
SEDIMENT
SAMPLING SUMMARY FOR TRANSECT T-1

Two Core Locations Along T-1: West and East						
Station	West		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	Depth probe at each defined station and at other locations along transect at ~25' spacing. Probes advanced to equipment refusal or max 20' depth.
	Sample and Test Types					
Depth Interval (Segment)	Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6"	Yes		Yes		Yes	
6-12"	Yes		Yes			
12-24"	Yes		Yes		None	
24-48"	Yes	Yes	Yes	Yes		
Anticipate total core depth = 20 feet. Between 4' below top and 2' above bottom	Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals			
Bottom 24"	Yes	Yes	Yes	Yes		

Legend:

Sediment (Sed)

Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)

Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.

(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)

Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.

Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).

Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:

1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3b
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-2

Three Core Locations Along T-2: West, Center and East								
Station	West		Central		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	Extras
	Sample and Test Types							Depth probe at each defined station and at other locations along transect at ~25' spacing. Probes advanced to equipment refusal or max 20' depth.
Depth Interval (Sediment)	Sediment		Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6"	Yes		Yes		Yes		Yes	
6-12"	Yes		Yes		Yes			
12-24"	Yes		Yes		Yes		None	
24-48"	Yes	Yes	Yes		Yes	Yes		
Anticipate total core depth = 20 feet. Between 4' below top and 2' above bottom	Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals			
Bottom 24"	Yes	Yes	Yes		Yes	Yes		

Legend:
Sediment (Sed)
Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)
Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.
(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)
Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.
Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).
Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:
1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3c
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-3

Four Core Locations Along T-3: West, Center West, Center East, and East										
Station	West		Center West		Center East		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	
	Sample and Test Types									
Depth Interval (Sediment)	Sediment		Sediment		Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6"	Yes		Yes		Yes		Yes		Yes	Depth probe at each defined station and at other locations along transect at ~25' spacing. Probes advanced to equipment refusal or max 20' depth.
6-12"	Yes		Yes		Yes		Yes			
12-24"	Yes		None		Yes		Yes		None	
24-48"	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Anticipate total core depth = 20 feet. Between 4' below top and 2' above bottom	Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals			
Bottom 24"	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		

Legend:
Sediment (Sed)
Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)
Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.
(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)
Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.
Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).
Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:
1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3d
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-4

Three Core Locations Along T-4: West, Center and East								
Station	West		Center		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	
	Sample and Test Types							
Depth Interval (Sediment)	Sediment		Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6"	Yes		Yes		Yes		Yes	Depth probe at each defined station and at other locations
6-12"	Yes		Yes		Yes			
12-24"	Yes		Yes		Yes		None	Probes advanced to equipment refusal or max 20' depth.
24-48"	Yes	Yes	Yes	Yes	Yes	Yes		
Anticipate total core depth = 20 feet. Between 4' below top and 2' above bottom	Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals			
Bottom 24"	Yes	Yes	Yes	Yes	Yes	Yes		

Legend:

Sediment (Sed)

Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)

Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.

(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)

Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.

Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).

Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:

1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3e
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-5

Three Core Locations Along T-5: West, Center and East								
Station	West		Center		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	
	Sample and Test Types							
Depth Interval (Segment)	Sediment		Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6”	Yes		Yes		Yes		Yes	Depth probe at each defined locations on transect at ~25’ spacing. Probes advanced to equipment refusal or max 20' depth.
6-12”	Yes		Yes		Yes			
12-24”	Yes		Yes		Yes		None	
24-48”	Yes	Yes	Yes	Yes	Yes	Yes		
Anticipate total core depth = 20 feet. Between 4’ below top and 2’ above bottom	Select 2 additional 24” thick intervals		Select 2 additional 24” thick intervals		Select 2 additional 24” thick intervals			
Bottom 24”	Yes	Yes	Yes	Yes	Yes	Yes		

Legend:

Sediment (Sed)

Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)

Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.

(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)

Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.

Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).

Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:

1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3f
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-6

Three Core Locations Along T-6: West, Center and East								
Station	West		Center		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	
	Sample and Test Types							
Depth Interval (Segment)	Sediment		Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6”	Yes		Yes		Yes		Yes	Depth probe at each defined station and at other locations on transect at ~25’ spacing. Probes advanced to equipment refusal or max 20' depth.
6-12”	Yes		Yes		Yes			
12-24”	Yes		Yes		Yes		None	
24-48”	Yes	Yes	Yes	Yes	Yes	Yes		
Between 4’ below top and 2’ above bottom Anticipate total core depth = 20 feet.	Select 2 additional 24” thick intervals		Select 2 additional 24” thick intervals		Select 2 additional 24” thick intervals			
Bottom 24”	Yes	Yes	Yes	Yes	Yes	Yes		

Legend:

Sediment (Sed)

Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)

Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.

(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)

Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.

Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).

Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:

1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3g
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-7

Three Core Locations Along T-7: West, Center and East								
Station	West		Center		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	Depth probe at each defined station and at other locations along transect at ~25' spacing. Probes advanced to equipment refusal or max 20' depth.
	Sample and Test Types							
Depth Interval (Segment)	Sediment		Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6"	Yes		Yes		Yes		Yes	
6-12"	Yes		Yes		Yes			
12-24"	Yes		Yes		Yes		None	
24-48"	Yes	Yes	Yes	Yes	Yes	Yes		
Between 4' below top and 2' above bottom Anticipate total core depth = 20 feet.	Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals			
Bottom 24"	Yes	Yes	Yes	Yes	Yes	Yes		

Legend:

Sediment (Sed)

Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)

Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.

(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)

Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.

Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).

Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:

1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3h
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-8

Three Core Locations Along T-8: West, Center and East								
Station	West		Center		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	
	Sample and Test Types							Depth probe at each defined station and at other locations
Depth Interval (Segment)	Sediment		Sediment		Sediment		Sediment	Along transect at ~25' spacing.
	Sed A	Sed B	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	Probes advanced to equipment refusal or max 20' depth.
0-6"	Yes		Yes		Yes		Yes	
6-12"	Yes		Yes		Yes			
12-24"	Yes		Yes		Yes		None	
24-48"	Yes	Yes	Yes	Yes	Yes	Yes		
Between 4' below Anticipate total core depth = 20 feet.	Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals			
Bottom 24"	Yes	Yes	Yes	Yes	Yes	Yes		

Legend:
Sediment (Sed)
Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)
Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.
(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)
Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived
Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).
Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:
1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3i
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-9

Two Core Locations Along T-9: West and East						
Station	West		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	
	Sample and Test Types					Depth probe at each defined station and at other locations along transect at ~25' spacing. Probes advanced to equipment refusal or max 20' depth.
Depth Interval (Segment)	Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6"	Yes		Yes		Yes	
6-12"	Yes		Yes			
12-24"	Yes		Yes		None	
24-48"	Yes	Yes	Yes	Yes		
Between 4' below top and 2' above bottom Anticipate total core depth = 20 feet.	Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals			
Bottom 24"	Yes	Yes	Yes	Yes		

Legend:
Sediment (Sed)
Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)
Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.
(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)
Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.
Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).
Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:
1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 3j
SEDIMENT SAMPLING SUMMARY FOR TRANSECT T-10

Two Core Locations Along T-10: West and East						
Station	West		East		Second Mobilization:Tox-1 (1 per transect) plus eight additional locations	
	Sample and Test Types					Depth probe at each defined station and at other locations along transect at ~25' spacing. Probes advanced to equipment refusal or max 20' depth.
Depth Interval (Segment)	Sediment		Sediment		Sediment	
	Sed A	Sed B	Sed A	Sed B	Sed Tox if selected	
0-6"	Yes		Yes		Yes	
6-12"	Yes		Yes			
12-24"	Yes		Yes		None	
24-48"	Yes	Yes	Yes	Yes		
Between 4' below top and 2' Anticipate total core depth = 20 feet.	Select 2 additional 24" thick intervals		Select 2 additional 24" thick intervals			
Bottom 24"	Yes	Yes	Yes	Yes		

Legend:
Sediment (Sed)
Sed A = Target Analyte List (TAL) metals, SVOCs, PCB Aroclors, pesticides, herbicides, and total organic carbon (TOC)
Sed B = VOCs, total petroleum hydrocarbons, dioxins/furans. The top interval to be sampled will be the interval with sufficient sample volume for the specified analyses.
(Include at 1/3 of Sed A samples = ~65 total for project - which equates to about 2 test samples per location.)
Sed G = Geotechnical (Total of 30 for project which equates to about 1 per location.) Sample depths to be determined based on review of archived samples.
Sed R = Radiodating (Total of 60 samples for project from 4 locations to be determined based on results from first mobilization).
Sed Toxicity = TAL Metals, ammonia, TOC, and 42-day Hyalella azteca bioassy (possibly PAHs and dioxins-furans as well).

Notes:
1. Each core will be described and photographed. Each soil type within each core will be classified. Color gradations and evidence of contamination , if any, will be recorded.
2. A sediment sample from each 2-foot depth interval will be collected and archived.

TABLE 4
NUMBER OF TOXICITY TEST SAMPLES

Transect ID	Number of Locations	Sediment Depth	Possible Transect for Toxicity Test Location[1]	TAL Metals	Ammonia	VOCs	PAHs	Dioxins/ Furans	TOC	Toxicity bioassay [1]
Transect 1	1	0 - 1 ft	Mouth of river	1	1	0	[2]	[2]	1	1
Transect 2	1	0 - 1 ft	Downstream of Turning Basin	1	1	0	[2]	[2]	1	1
Transect 3	1	0 - 1 ft	At Turning Basin	1	1	0	[2]	[2]	1	1
Transect 4	1	0 - 1 ft	~2.5 miles upstream of mouth	1	1	0	[2]	[2]	1	1
Transect 5	1	0 - 1 ft	~3 miles upstream of mouth	1	1	0	[2]	[2]	1	1
Transect 6	1	0 - 1 ft	At Merrill St	1	1	0	[2]	[2]	1	1
Transect 7	1	0 - 1 ft	At Kings Landing WWTP	1	1	0	[2]	[2]	1	1
Transect 8	1	0 - 1 ft	At CSO just upstream of Kings Landing	1	1	0	[2]	[2]	1	1
Transect 9	1	0 - 1 ft	Downstream of Seth Green Island	1	1	0	[2]	[2]	1	1
Transect 10	1	0 - 1 ft	Upstream of Upper Falls	1	1	0	[2]	[2]	1	1
Additional Locations [1]	8	0 - 1 ft	To be determined	8	8	0	[2]	[2]	8	8
			TOTALS	**18**	**18**	**0**	[2]	[2]	**18**	**18**

Notes:

[1] Locations for toxicity testing and the toxicity test method will be selected in consultation with NYSDEC based on the results of the initial sediment analytical results.

[2] Analyses of sediment from bioassay locations for PAHs and for dioxins-furans may be added following initial analyses of sediment from nearby cores.

TABLE 5
NUMBER OF WETLAND-FLOODPLAIN SAMPLES FOR CHEMICAL ANALYSIS

Sample Location (a)	Sample Interval (b)	TAL Metals	SVOCs	PCB Aroclors	Pesticides	Herbicides	TOC	pH	Dioxins/ Furans (c)
1	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	3
2	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
3	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
4	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	3
5	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
6	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
7	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	3
8	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
9	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
10	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	3
11	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
12	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
13	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	3
14	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	
15	0- 6 in, 12-24 in, 2-4 ft	3	3	3	3	3	3	3	

(a) 15 locations shown in Figures A through D are tentative and will be finalized following a reconnaissance and follow-up consultation with NYSDEC.

(b) In addition, samples from the 6- to 12-inch vertical interval will be collected and archived for possible analyses.

(c) Precise samples to be analyzed for dioxins-furans at each location will be identified in consultation with NYSDEC based on results for other CPOIs.

TABLE 6
NUMBER OF SURFACE WATER AND DISCHARGE SEDIMENT SAMPLES

			Number of Surface Water Samples (3 events)										
Transect ID	Number of Locations	Description	TAL Metals	SVOCs	VOCs	Dissolved TAL Metals	PCB Aroclors	Total and Dissolved Organic Carbon	Cations/ Anions	Total Suspended Solids	Total Dissolved Solids	Ammonia	Alkalinity and Hardness
Transect 1	1	Mouth of river	3	3	1	1	3	3	1	3	3	3	3
Transect 3	1	At Turning Basin	3	3	1	1	3	3	1	3	3	3	3
Transect 5	1	At Seneca Park	3	3	1	1	3	3	1	3	3	3	3
Transect 6	1	Downstream of the Eastman Business Park	3	3	1	1	3	3	1	3	3	3	3
Transect 9	1	Downstream of Seth Green Island	3	3	1	1	3	3	1	3	3	3	3
				Number of Sediment Samples									
Monitored Discharges	4	To be identified following consultation	12	12	4	0	12	0	0	0	0	0	0

Notes:

1. In addition, pH, turbidity, and specific conductance of water will be measured in-situ, and left, right and center surface water samples will be collected for total suspended solids as feasible.
2. Suspended sediment will be collected in conjunction with surface water samples. Suspended sediment samples will be single composite samples from each of five water-sampling transects during at least one dry-weather and, as feasible, during one wet-weather sampling event.
3. Suspended sediment obtained when surface water is sampled will be analyzed for TAL metals and if sufficient mass is available, grain size distribution, PCB Aroclors, and SVOCs in the order listed. Water passing through the filter used to generate suspended sediment will be analyzed for TAL metals.
4. All twelve sediment samples from monitored discharges will also be analyzed for solids content; and four of the sediment samples will also be analyzed for dioxins-furans based on prior results.
5. Dissolved metals, organic carbon and solids will be analyzed from water sample filtrate passing through a 0.45-micron filter.

TABLE 7A
NUMBER OF BENTHIC MACROINVERTEBRATE SAMPLES FOR CHEMICAL ANALYSIS [1]

Transect	Location Description		Eight Metals [2]	PCB Aroclors	Pesticides	Herbicides	PAHs	Lipid Content
4	Upstream from the Turning Basin	Mussels [1]	3	3	3	3	3	3
5	Riverbend	Mussels [1]	3	3	3	3	3	3
6	Downstream of the EBP	Mussels [1]	3	3	3	3	3	3

(1) If sufficient mass of mussel tissue needed for chemical analysis is not able to be collected, attempts will be made to collect two crayfish samples per transect - one sample from both shorelines.

(2) Arsenic, cadmium, copper, lead, mercury, nickel, silver and zinc

TABLE 7B
NUMBER OF FISH SAMPLES FOR CHEMICAL ANALYSIS

River Segment (upstream to downstream)	Location Description		Eight metals (2)	PCB Aroclors	Pesticides	Herbicides	Dioxins/ Furans	Lipid Content
Background	Upstream of the Upper Falls	Small Forage Fish	10	10	10	10	2	10
		Sport Fish (1)	10	10	10	10	3(3)	10
1	Upstream of the State Route 104 bridge	Small Forage Fish	10	10	10	10	2	10
		Sport Fish (1)	10	10	10	10	3(3)	10
2	Between the State Route 104 bridge and the river bend at Seneca Park	Small Forage Fish	10	10	10	10	2	10
		Sport Fish (1)	10	10	10	10	3(3)	10
3	Area between Seneca Park and the north end of the Turning Basin	Small Forage Fish	10	10	10	10	2	10
		Sport Fish (1)	10	10	10	10	3(3)	10
4	Turning Basin to the mouth of the river	Small Forage Fish	10	10	10	10	2	10
		Sport Fish (1)	10	10	10	10	3(3)	10

(1) Two types of adult sport fish: largemouth bass and either common carp or channel catfish (common carp preferred). Adult sport fish will be filleted.
(2) Arsenic, cadmium, copper, lead, mercury, nickel, silver and zinc
(3) Carp only

FIGURES

APPENDIX A

STANDARD OPERATING PROCEDURES

APPENDIX B

SITE-SPECIFIC HEALTH AND SAFETY PLAN

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

APPENDIX D

HISTORICAL DATA SUMMARY TABLES