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EXECUTIVE SUMMARY

The remediation of Ninemile Creek is part of Honeywell’s continuing efforts to restore and clean up Onondaga Lake and adjacent plant properties and tributaries. Ninemile Creek is one of the main tributaries to Onondaga Lake and is part of the complex system that provides habitat corridors to upstream wetlands and green areas. This system flows through the restored LCP wetlands, connects with the West Flume, flows into Geddes Brook and Ninemile Creek, and empties into Onondaga Lake.

This 50% design report was developed in consideration of the New York State Department of Environmental Conservation’s (NYSDEC) Green Remediation and the U.S. Environmental Protection Agency’s (USEPA) Region 2 Clean and Green policies. It presents design analysis and preliminary plans for the Ninemile Creek remediation.

The selected remedy addresses contaminated sediment located in the Ninemile Creek channel and soil/sediment in the adjoining floodplains, and provides the following ecological benefits:

- Increased length and sinuosity in Ninemile Creek
- Improved channel bed material for fish and macroinvertebrates
- Channel stability that protects surrounding roads and bridges while providing ecological function
- Increased connectivity between the Ninemile Creek channel and floodplain
- Increased buffer between Ninemile Creek and berms on former Allied industrial properties
- Habitat enhancements such as pools and riffles
- Increased habitat diversity to support native plants and animals

The remedy includes the following components:

- Removal and proper management of soil/sediment from the Ninemile Creek channel and adjoining floodplains, followed by consolidation at either the LCP Containment Area or the sediment consolidation area off Airport Road
- Placement of clean materials throughout the site
- Re-establishment and enhancement of habitat affected during work activities
- Long-term operation, maintenance, and monitoring

Honeywell has conducted pre-design activities to support the design of the selected remedy and to supplement data collected during the Remedial Investigation (RI) (TAMS Consultants, 2003). Pre-design activities have included Feasibility Study (FS) analyses (Parsons, 2005, 2008a, 2008b), a pre-design investigation (Parsons, 2010a), and a cultural resource assessment. Design-related investigation activities have been conducted since 2007 and consist of the following:

- Land surveying
- Underwater surveying
- Modeling how water flows through the stream channel and interacts with adjacent wetlands
- Assessing wetlands and floodplain
- Sampling soils and sediment in the channel and floodplain
- Investigating movement of groundwater

This report describes design elements that are necessary for implementing the remedy, including channel design, floodplain/wetland design, sediment and soil removal design, and habitat restoration design.
SECTION 1

INTRODUCTION

1.1 PURPOSE

This report presents the 50% Design for the Remedial Action (RA) for Operable Units (OU) 1 and 2 of the Geddes Brook/Ninemile Creek Site. As shown on Figure 1-1, Ninemile Creek has been organized into three reaches – AB, BC, and CD. Reaches CD and BC comprise OU-1; Reach AB comprises OU-2.

This 50% Design Report has been prepared pursuant to:

- Record of Decision (ROD) for OU-1 of the Geddes Brook/Ninemile Creek Site (NYSDEC and USEPA 2009a)
- ROD for OU-2 of the Geddes Brook/Ninemile Creek Site (NYSDEC and USEPA 2009b)

This 50% Design Report focuses on the Ninemile Creek channel and adjoining floodplains and builds upon the following previous submittals:

- Final Draft Geddes Brook / Ninemile Creek Operable Unit 1 Supplemental Feasibility Study Report (Parsons, 2008) (OU-1 Supplemental FS)
- Final Draft Geddes Brook / Ninemile Creek Operable Unit 2 Supplemental Feasibility Study Report (Parsons, 2009) (OU-2 Supplemental FS)
- Ninemile Creek Pre-Design Investigation Data Summary Report (Parsons, 2010a).

The Ninemile Creek RA Design is being prepared for Honeywell by a team led by Parsons that includes Anchor QEA, LLC to provide channel and floodplain habitat restoration design services. The design elements presented in this 50% Design Report include preliminary plans for:

- Removal of approximately 95,000 cubic yards (cy) of soil/sediment from the Ninemile Creek channel and adjoining floodplains
- A habitat restoration approach for the Ninemile Creek channel and adjoining floodplains that includes:
  - Increased sinuosity and length of Ninemile Creek in Reach CD
  - Improved channel substrate for fish spawning and benthic macroinvertebrates
  - Riparian, wetland and upland habitats with a diversity of native species
  - Water depth under low flows to provide fish and canoe passage

Also presented in this report are preliminary engineering properties and descriptions of key materials, including topsoil, channel substrate, stone, other backfill materials, and plantings.
Figure 1-2 presents the areas of focus and key remedial design elements included in this report. To accelerate the project schedule and to coordinate with other sites and remedy requirements, the following areas are not included in this 50% Design Report, but have been or will be presented in other submittals:

- **Geddes Brook**: As shown on Figure 1-1, OU-1 includes Geddes Brook, Outfall 019, and their adjoining floodplains. To expedite overall project schedule, these areas upstream of Ninemile Creek are being remediated pursuant to an Interim Remedial Measure (IRM). A Draft Final Design (Parsons, 2010b) has been prepared for these areas in accordance with the Geddes Brook IRM Order on Consent (Index #D7-0003-01-09) (NYSDEC 2002) and the Geddes Brook Response Action Document (NYSDEC and USEPA, 2009). It is anticipated that remedial construction will be initiated in 2011. Figure 1-3 illustrates areas addressed by the Geddes Brook IRM Design relative to those addressed by the Ninemile Creek RA Design.

- **SYW-10 Forested Wetland**: As shown on Figure 1-1, forested wetland SYW-10 is located at the mouth of Ninemile Creek and is part of OU-2. Pursuant to the OU-2 ROD (NYSDEC and USEPA, 2009b), a focused investigation is currently underway at SYW-10 to determine what portions of SYW-10 will require remediation, and whether portions can be excluded from remediation so that the area can continue to provide valuable wetland functions. As such, the remedial design for SYW-10 will be developed separately, and is not included in this 50% Design Report. Figure 1-4 illustrates areas to be addressed by the remedy for SYW-10 relative to those addressed in this 50% Design Report.

- **Ninemile Creek Spits**: As shown on Figure 1-1, at the mouth of Ninemile Creek, spits of land formed by deposition of sediment extend into Onondaga Lake. Based on the immediate proximity to Onondaga Lake, close design and construction coordination between the remedy for the spits and Onondaga Lake will be required (e.g., coordination of lines and grades, stability during removals, habitat restoration). To facilitate this coordination and enhance the overall success of the project, the design for the spits will be presented in design documents for Onondaga Lake (e.g., Draft Onondaga Lake Capping, Dredging and Habitat Intermediate Design (Parsons, 2011a)). Figure 1-4 illustrates the area of the spits to be addressed in the Onondaga Lake design submittals relative to the areas to be addressed in Ninemile Creek Design documents.

### 1.2 SITE DESCRIPTION AND BACKGROUND

Ninemile Creek and its tributary, Geddes Brook, collectively referred to as the Geddes Brook/Ninemile Creek site, are located northwest of the City of Syracuse. Ninemile Creek, a primary tributary of Onondaga Lake, originates at Otisco Lake, approximately 16 miles southwest of Onondaga Lake. Geddes Brook originates in the town of Camillus and flows approximately 3.3 miles to its confluence with Ninemile Creek. Today, Geddes Brook/Ninemile Creek are impacted by past industrial pollution, relocated and channelized by road and bridge construction, and populated largely by non-native invasive plant species.
The Geddes Brook/Ninemile Creek subsite is a discrete portion of the Onondaga Lake National Priorities List (NPL) Site. The selected remedy for OU-1 of Ninemile Creek is outlined in the ROD issued on April 29, 2009 (NYSDEC and USEPA 2009a), and the selected remedy for OU-2 is outlined in the ROD issued on October 1, 2009 (NYSDEC and USEPA 2009b).

1.3 REMEDIATION OBJECTIVES AND GOALS

Response action objectives (RAOs) are identifiable goals to protect human health and the environment. The RODs present the following RAOs for the site:

- **RAO 1**: To eliminate or reduce, to the extent practicable, further transport of sediments and soils, containing mercury and other chemical parameters of interest (CPOIs), from the channel and floodplain of lower Geddes Brook and lower Ninemile Creek to Geddes Brook, Ninemile Creek, and ultimately Onondaga Lake.
- **RAO 2**: To eliminate or reduce, to the extent practicable, existing and potential future adverse ecological effects on fish and wildlife resources, as well as potential risks to humans.
- **RAO 3**: To eliminate or reduce, to the extent practicable, levels of mercury and other CPOIs in surface water in order to meet surface water quality standards.

To achieve the RAOs, remedial goals (RGs) were developed to provide specific goals to address the four primary affected media within the site: channel sediments, floodplain soils/sediments, biological tissue, and surface water. The RODs present the following PRGs for the site:

- **RG 1**: Reduce, contain, or control, to the extent practicable, mercury and other CPOI concentrations in erodible channel sediments and in erodible floodplain soils/sediments within the site.
- **RG 2**: Achieve CPOI concentrations, to the extent practicable, in channel sediments and floodplain soils/sediments that are protective of human health and fish and wildlife resources. This PRG covers a range of risk levels for mercury and other CPOIs.
- **RG 3**: Achieve CPOI concentrations, to the extent practicable, in fish tissue that are protective of humans and wildlife that consume fish.
- **RG 4**: Achieve, to the extent practicable, aqueous CPOI concentrations to meet surface water quality standards.

RG 1 addresses RAOs 1 through 3. RG 2 addresses RAOs 1 and 2. RG 3 addresses RAO 2. RG 4 addresses RAO 3.

1.4 REMEDY OF RECORD

The RODs for OU-1 and OU-2 of the site present the remedy selected by NYSDEC and USEPA for addressing the RAOs and RGs presented in Section 1.3 above. Major components of the selected remedy, as set forth in the RODs, are summarized as follows and illustrated on Figure 1-2:
• Remove contaminated channel sediment and floodplain soil/sediment in Reaches BC and CD of Ninemile Creek. The estimated volume of removal in the ROD, based on feasibility study level evaluation, is 59,000 cy. The estimated volume of removal in this 50% Design Report, based on additional pre-design investigation and further evaluation, is 60,100 cy.

• Relocate a portion of Reach CD to facilitate remedial construction and to create a buffer between Ninemile Creek and Wastebeds 9 and 10.

• Remove contaminated channel sediment and floodplain soil/sediment in Reach AB of Ninemile Creek. The estimated volume of removal in the ROD, excluding SYW-10 and the spits, based on feasibility study level evaluation, is 34,700 cy. The estimated volume of removal in this 50% Design Report, based on additional pre-design investigation and further evaluation, is 34,900 cy.

• Place clean materials throughout the site. These materials will consist of one or more of the following layers, from the surface down: habitat layer, backfill, and where needed, an isolation layer. Within the engineering / feasibility constraints of required removals, eliminate or minimize the need for an isolation cap in the Reach CD channel.

• Dispose contaminated sediment and soil removed from the channel and floodplains at the Linden Chemical and Plastics (LCP) Bridge Street subsite containment system, which was constructed pursuant to the requirements of a September 2000 ROD, or the Sediment Consolidation Area (SCA) that will be constructed at Wastebed 13 as part of the Onondaga Lake Bottom Site Remedy pursuant to the requirements of a July 2005 ROD.

• Treat construction water generated by remedial activities.

• Restore stream bed and banks, wetlands, and habitats following sediment and soil removal.

The environmental benefits of the remedy may be enhanced by consideration, during remedial design, of technologies and practices that are sustainable in accordance with EPA Region 2’s Clean and Green policy. The selected remedy also includes the implementation of institutional controls, as well as the implementation of a long-term operation, maintenance, and monitoring (OM&M) program to monitor and maintain the effectiveness of the remedy.
SECTION 2

PRE-DESIGN INVESTIGATIONS

2.1 SUMMARY OF PRE-DESIGN INVESTIGATIONS

Ninemile Creek was investigated as part of a comprehensive remedial investigation/feasibility study (RI/FS). Initial investigations are described in the Geddes Brook/Ninemile Creek Remedial Investigation Report (TAMS, 2003), and subsequently summarized with other available data in the Draft Final Geddes Brook/Ninemile Creek FS Report (FS) (Parsons, 2005).

Subsequent to the submittal of the FS (Parsons, 2005), supplemental field investigations and evaluations were conducted in 2007, 2008, and 2009 to gather additional data to advance remedy development and evaluation at the site. The data resulting from these investigations were presented in the OU-1 Supplemental FS (Parsons 2008) and OU-2 Supplemental FS (Parsons, 2009).

Between 2008 and 2010, a series of pre-design investigations was conducted at the site which included: topographic/bathymetric survey, wetland delineation and habitat assessment, chemical analysis of soil/sediment, assessment of material handling properties of soil/sediment, assessment of constituents which may be present in construction water, assessment of the geotechnical properties of site soils and sediments, an assessment of sediment porewater, and a study of site groundwater and surface water elevations. The results of these assessments were presented in the Ninemile Creek Pre-Design Investigation Data Summary Report (Parsons, 2010a).

2.2 INCORPORATION OF PRE-DESIGN DATA

2.2.1 Sediment and Soil/Sediment Chemical Analytical

Sediment and soil/sediment mercury analytical data from the investigations identified in Section 2.1 are summarized on Figures A-01 through A-09 presented in Appendix A. Data for other CPOIs are presented in the reports described in Section 2.1 and summarized on tables presented in Appendix A. These other CPOIs consist of:

- Benzo(a)pyrene
- Hexachlorobenzene
- Total Polychlorinated Biphenyls (PCBs)
- Total Polyaromatic Hydrocarbons (PAHs)
- Arsenic
- Lead
- Phenol
As described in the OU-1 Supplemental FS (Parsons, 2008) and OU-2 Supplemental FS (Parsons, 2009), and as confirmed during the pre-design investigations, other CPOIs, when present, are generally co-located with mercury.

2.2.2 Geology

The relevant geology at the Site consists of soil mantle overlying the bedrock. These soils are primarily a result of glaciation that deposited a thin layer of glacial till over the bedrock surface with subsequent glacial meltwater lakes depositing thick glacio-lacustrine deposits. Since the disappearance of the glacial lakes, local alluvial deposits from creeks, organic wetland soils, and Onondaga Lake sediments, and man-made fills have covered the glacial soils in many areas. The Ninemile Creek channel bottom is generally incised into the underlying glacial deposits and recent alluviums while the banks are often composed of man-made fills of various origins.

The glacial till consists of a poorly sorted mixture of clays, silts, sands, and boulders. The glacial till is generally 10 to 15 feet (3 to 5 m) thick and is overlain by glacio-lacustrine deposits. The glacio-lacustrine deposits consist of horizontally bedded marl, clays, silts, and sands with gravels present at increasing depth. The glacio-lacustrine deposits generally are finer grained in the near-surface soils than at depth.

The soils overlying bedrock and glacial material in the study area include alluvial deposits along Geddes Brook and Ninemile Creek, organic-rich sediments and peat deposited in post-glacial marshes and swamps, and lacustrine deposits in the Onondaga Lake basin. The lacustrine deposits consist primarily of marl with varying amounts of silts and fine sand.

Fill deposits, including fills placed for construction of the I-690 and I-695 Interstate system, and Solvay waste are located above the native soils in several upland areas near the Site. Portions of Ninemile Creek abut Wastebeds 1 through 8 and 9 through 15, where berm fills and Solvay waste were placed. Much of the east side of Reach CD is abutted by waste soils, construction debris, and other materials related to the State Fair operations (i.e., State Fair Landfill).

As described in the Ninemile Creek Pre-Design Investigation Data Summary Report (Parsons, 2010a), 26 borings were installed in the Ninemile Creek channel and floodplain during the pre-design investigation in 2009 to better define site conditions and provide a basis for remedial design. Geotechnical data and observations from these borings and information from previous investigations indicate the following:

- The stratigraphy is variable within the depths of the proposed excavations due to the complex history of post-glacial erosion by creeks, deposition of various types of alluviums, and man-made filling.
- The nature of the fills is diverse, but they are generally loose. It should be noted, however, that borings were not advanced at locations where it is expected that NYSDOT placed structural fills for highway embankments; these structural fills would be expected to be compacted and not loose.
- Some of the fills were placed over various recent alluvial deposits.
• Glacio-lacustrine materials generally begin at or below the water surface in Ninemile Creek. Upper glacio-lacustrine soils are generally soft to stiff low plasticity clays and clayey silts, that occasionally exhibit high plasticity. Soft, low plasticity silt and loose non-plastic silts generally underlie the upper clayey glacio-lacustrine soils.

• Loose silty sands are present below the fine-grained glacio-lacustrine soils.

The collected geotechnical information is used to evaluate the stability of the expected excavations, assist with understanding groundwater flows and excavation dewatering requirements, and provide data on the expected material properties for dewatering, handling, and placement.

2.2.3 Groundwater and Surface Water Elevations

As described in the *Ninemile Creek Pre-Design Investigation Data Summary Report* (Parsons, 2010a), in order to better assess site hydrology and hydrogeology, a series of piezometers were installed on the Ninemile Creek banks and in the creek channel to create six transect arrays, as shown on Figure 2-1. Transect arrays generally consisted of a piezometer pair on the bank (i.e., one piezometer screened at the water table and one screened nominally 10 to 13 feet below the water table), a piezometer pair located in the creek, and a stilling well constructed onshore to collect creek water surface elevation data. The piezometer pair in the creek consisted of vibrating wire piezometers positioned approximately 2 and 10 feet below the channel bottom.

Transducers were used to hourly record the water levels from early September to early December 2009 and then again from early March to early June 2010. In addition, a transducer recorded the creek level at the confluence of Ninemile Creek and Geddes Brook between January 19th and 28th of 2010, a period of substantial snowmelt. Manual hand measurements were taken on a regular basis for quality assurance/quality control (QA/QC) purposes. Data from United States Geological Survey (USGS) Gauges 04240495 (Onondaga Lake at Liverpool) and 04240300 (Ninemile Creek at Lakeland) were also downloaded for comparison to creek level data.

The *Ninemile Creek Pre-Design Investigation Data Summary Report* (Parsons, 2010a) summarizes groundwater and surface water elevation data from this investigation. Review of this report, and other site observations, indicate that:

• Surface water elevations in Geddes Brook and Ninemile Creek are heavily influenced by precipitation. Heavy rain or rapid snowmelt causes rapid increases in the creek levels, usually within hours. Greatly increased flows show a rapid rise in surface water elevation to a peak that quickly begins to taper off, but often takes several days to several weeks to return to the pre-event surface water elevations.

• Groundwater flow in the Ninemile Creek valley is dominated by groundwater flow from Wastebeds 9-15 to the creek. The groundwater heads in piezometers installed on the wastebed side of the creek are typically higher than piezometers installed on the other side of the creek, indicating that groundwater flows both into the creek and underneath the creek towards Onondaga Lake.
The deep underlying glacio-lacustrine sands and silts have higher heads than the shallow groundwater and creek surface water, providing a consistent upward gradient from the creek bottom to the creek. This gradient was measured to be up to 0.5 in some locations in Reach CD and upper Reach BC.

As Ninemile Creek moves away from Wastebeds 9-15, the gradients reduce to measured values of less than 0.13.

The glacio-lacustrine clays present in Reach CD tend to cause groundwater to perch with little interaction with the underlying groundwater flow, particularly on the east side of the creek.

The upward gradients in the underlying soils cause stability of excavations to decrease as excavations become deeper and as the increasing pore pressures at the slope toe reduce the soil shear strength.

The groundwater and surface water elevation data were used to estimate groundwater upwelling velocities, as described in the report *Evaluation of Upwelling Rates Ninemile Creek, Onondaga County, New York* (S.S. Papadopulos, 2010), included in Appendix B.

### 2.2.4 Material Handling

Implementing the remedy will require removal, handling, and placement of site soil and sediment. To support an evaluation of material handling properties and overall remedy constructability, pre-design investigations were conducted that included geotechnical laboratory testing on soil and sediment samples to assess material properties (e.g., grain size, Atterberg Limits) and modified column testing to assess the ability of removed material to drain. Test results were presented in the *Ninemile Creek Pre-Design Investigation Data Summary Report* (Parsons, 2010a). Data summary tables are presented in Appendix B; further discussion is included in Section 3.6.2 and 3.6.4.

### 2.2.5 Construction Water Characterization

Implementing the remedy will result in the generation of construction water when storm water or surface water comes in contact with disturbed contaminated soil and sediment. As part of a pre-design investigation, to support the design of a construction water treatment plant, water samples were obtained from test pits excavated in the Geddes Brook and Ninemile Creek floodplains to assist in the characterization of construction water. Water samples were also collected using a modified sediment column test to assess construction water quality associated with channel sediment. The water samples were tested for analytical chemistry parameters for both likely discharge parameters and parameters that may require specific steps in a treatment process, such as precipitation. Test results were presented in the *Ninemile Creek Pre-Design Investigation Data Summary Report* (Parsons, 2010a). Data summary tables are presented in Appendix B; further discussion is included in Section 3.6.4.

### 2.2.6 Wetlands

Wetland delineations and functional assessments were completed for the project area in 2003 and 2009 (TES, 2009). The lower portion of Ninemile Creek (downstream of the State Fair
Boulevard bridge) was originally delineated in 2003 and reassessed in October 2008 for potential changes in the original delineation. The upper portion of Ninemile Creek from the State Fair Boulevard Bridge to upstream of the confluence with Geddes Brook was delineated in 2008. Delineated wetland boundaries are shown on Figure 2-2.

**Lower NMC**

Wetlands areas in lower Ninemile Creek are composed of fringing wetlands along the creek banks and a large forested floodplain wetland (state designated wetland SYW-10) near the mouth of the creek. There are also two emergent wetlands adjacent to the mouth of Ninemile Creek. There are a total of 11.8 acres of wetlands in lower Ninemile Creek, the majority comprised by SYW-10. The fringing wetlands are dominated by common reed (Phragmites australis). Other common emergent wetland species include reed canary grass (Phalaris arundinacea), seaside orach (Atriplex patula), garlic mustard (Alliaria petiolata), prickly cucumber (Echinocystis lobata), and purple loosestrife (Lythrum salicaria).

The trees found in the forested floodplain wetland include silver maple (Acer saccharinum), American elm (Ulmus americana), and box elder (Acer negundo). Common shrubs and saplings included green ash (Fraxinus pennsylvanica), buckthorn (Rhamnus cathartica), silver maple, and box elder. Herbaceous layer species included poison ivy (Toxicodendron radicans), garlic mustard, common reed grass, and false nettle (Boehmeria cylindrica). The emergent wetlands at the mouth of Ninemile Creek are dominated by common reed (Phragmites australis).

**Upper NMC**

Most of the wetlands in Ninemile Creek above State Fair Boulevard are partially or wholly within the mapped area of state-regulated wetland SYW-181. There are several distinct wetland types/areas within the study area. A small (approximately 0.38 acre) emergent/deciduous forest wetland fringes the south side of Ninemile Creek south of the existing small islands. Common plant species found in this wetland were green ash (Fraxinus pennsylvanica), box elder (Acer negundo), silky dogwood (Cornus sericea), buckthorn (Rhamnus cathartica), common reed, and rough-stem goldenrod (Solidago rugosa). Other fringing emergent wetlands occur along the northern and upstream banks of the creek, totaling approximately 1.74 acres. Common plant species found in these fringing emergent wetlands include common reed, willow (Salix sp.), buckthorn, and purple loosestrife. Wetlands also occur on the large and small islands that total approximately 0.67 acres. The dominant plant species present were common reed, reed canary grass and purple loosestrife. Finally, there are two small isolated deciduous forest wetlands totaling 0.31 acres located in the floodplain south of Ninemile Creek. The dominant plant species in these wetlands are green ash in the tree layer, buckthorn in the shrub layer and common reed and moneywort (Lysimachia nummularia) in the herbaceous layer.

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1 The study area for wetland delineation and assessment covers a larger area than the footprint of the remediation and restoration. Not all wetland areas described in TES 2009 will be affected by the project.
2.3 CULTURAL RESOURCES

The New York Archeology Council has developed a step-wise process for assessing cultural resources within a project area. The process is based on the standard practices of archeology and is designed to identify potential cultural resources prior to construction that could impact historic sites. Honeywell completed the first step of a cultural resource assessment, which includes a literature review and field reconnaissance for Onondaga Lake. Additional assessments of Geddes Brook and Ninemile Creek were conducted by Public Archeology Facility (PAF) in 2004 and 2005. A summary of this research is presented in a Phase 1B Work Plan (PAF, 2010). The Phase 1B Work Plan also provides a description of the proposed archaeological work in the areas of Geddes Brook and Ninemile Creek where potentially intact soil horizons may be impacted by remediation activities.

The Phase 1B Work Plan is available at the public document repositories. Following NYDEC’s review and approval, future final reports will be available at the public repositories.
SECTION 3

DESIGN ELEMENTS

3.1 INTRODUCTION

This section presents design evaluations, preliminary plans (Appendix C), and preliminary properties for key earthen materials (Appendix D) for the project, and describes how principal design elements are addressed. The section is organized by following remedy components, which recognizes that the design will be driven in large measure by the intended habitat endpoints:

- **Channel Design**: Fundamental to the long-term success of the project and a cornerstone of the remediation is the creation of a stable, ecologically improved and functional channel. The channel 50% design, including associated habitat restoration, is presented in Section 3.2.

- **Floodplain Design**: Similar to the channel design, a fundamental component of the floodplain remediation is the creation of an ecologically improved and functional riparian habitat (floodplains and wetlands). The floodplain 50% design, including associated habitat restoration, is presented in Section 3.3.

- **Removal Design**: Removals are required to support both restoration and remediation in the channel and floodplain. The removal 50% design is presented in Section 3.4.

- **Chemical Isolation Layer Design**: A chemical isolation layer may be required in portions of the Ninemile Creek channel. The chemical isolation layer 50% design is discussed briefly in Section 3.5, and will be provided as an addendum to this report.

- **Material Handling**: Technical considerations associated with removing, transporting, and placing site soil and sediment, the anticipated location for consolidating site soil and sediment, and construction water treatment are discussed in Section 3.6.

- **Site Preparation and Controls**: Temporary facilities, coordination with existing utilities, and storm water and erosion controls are discussed in Section 3.7.

3.2 CHANNEL AND HABITAT RESTORATION DESIGN

3.2.1 Engineering Evaluations

Engineering evaluations and considerations to support the development of the Ninemile Creek channel design are presented in the *Ninemile Creek Intermediate Channel Design Analysis Report* (Anchor QEA, 2010), included in Appendix E. As further described in Appendix E, the channel design includes the following primary components and features:

- Increased sinuosity and length in Ninemile Creek
- Improved channel substrate (i.e., bed material) for fish and macroinvertebrates
• Channel stability that protects surrounding infrastructure while providing ecological function
• Increased connectivity between Ninemile Creek and the floodplain (Reach CD)
• A defined channel thalweg in Reaches CD and BC
• Habitat enhancements such as pools, riffles, and hydraulic refuge
• Bioengineering treatments to provide bank/channel stability and habitat

Appendix E also presents an evaluation of the anticipated performance of the proposed channel, including assessment of:
• Thickness and composition of habitat / erosion protection layer
• Water depth under low flows
• Water surface elevation and clearance under high flows
• Shear stress and velocities under various flows

Appendix E presents the basis for the preliminary plans and material specifications described below. To avoid redundancy, the information in Appendix E is generally not repeated in the main report text.

3.2.2 Preliminary Plans

Appendix C presents the following preliminary plans for the Ninemile Creek channel design:
• Finished Grade Drawings (C-029 through C-035)
• Site Restoration Drawings (C-036 through C-042)
• Cross Sections (C-043 through C-051)
• Typical Cross Section Details (C-052 through C-054)
• Site Restoration Details (C-055, C-056, and C-059)

As shown on Drawing C-030, Reach CD will be converted from a split-channel system to a single-thread, meandering channel. The realigned Reach CD channel will be slightly longer than the existing channel with increased sinuosity. The channel alignments in Reaches AB and BC will remain the same due to the presence of adjacent infrastructure (Drawings C-031 through C-035). For all reaches, the channel grade for the restored channel was designed so there is no adverse increase in water surface elevations under high flows, and sufficient water depth for canoe and fish passage under low flows.

As shown on Drawings C-029 through C-035, as part of the restoration, a 2-foot thick habitat / erosion protection layer will be installed in the channel in all remediated areas. The basis for the thickness and composition of this layer is presented in Appendix E. Pools and/or hydraulic refuge will be created at various locations throughout all three reaches (Drawings C-036 through C-042). In-stream features such as logs, boulder clusters, or live crib walls (Drawing C-058) will be placed in the creek to provide hydraulic refuge and structure. The specific locations will be determined during 95% design.
Bank stabilization treatments have been incorporated into the design to maintain bank stability and control significant bank erosion or channel migration. Drawings C-036 through C-042 depict the locations where local bank stabilization measures will be applied. Riprap previously placed by DOT will be maintained. In other areas biotechnical measures will be used to stabilize the stream banks. The biotechnical measures will include live brush mattresses, live fascines and joint plantings, as shown on Drawings C-057 and C-058.

3.2.3 Preliminary Material Properties

Appendix D presents preliminary material properties for the following key earthen materials for the Ninemile Creek channel design:

**Common Fill**

Common fill will be used as necessary to shape subgrades. The proposed common fill will be a generally coarse granular material that will be imported to supplement the re-use of on-site materials, especially where a silt or clay soil would be undesirable or impracticable.

**Base Layer**

Base layer fill will be placed over excavated surfaces in channel areas where contaminated sediments have been removed and no chemical isolation layer is required, to support the overlying habitat/erosion protection layer and attenuate residuals that may remain after dredging. Base layer fill will be a sandy material.

**Channel Substrate Fill**

The channel substrate fill material (i.e., habitat/erosion protection layer material) is intended to have a dual purpose of combining habitat media in a matrix that will be protective against erosion by scouring in major flood events. As described in Appendix E, the types of bed material suitable for the aquatic organisms were identified through review of relevant literature and guidance documents and from work on Onondaga Lake. The types of material that would be needed to provide the required stability were evaluated using particle stability calculation methods.

The channel substrate fill material described in Appendix D is a heterogeneous, broadly-graded granular material that contains cobbles, gravel, and sand. The source of the material is a relatively local glacio-fluvial deposit; glacio-fluvial material was moved by glaciers and subsequently sorted and deposited by streams flowing from melting ice and, as such, provide a suitable stream substrate.

It is intended that the installed material would allow for surficial scour of sand and gravel from the channel surface in high shear stress locations with re-deposition of the sand and gravel downstream in lower shear stress environments to provide a heterogeneous channel habitat surface through the remediated sections of Ninemile Creek. The cobble matrix would protect and retain the gravel and sand inside it through most of the section thickness as the surface self-sorts. It should be noted that the channel substrate fill falls within the broader gradation of the common fill material, so that the channel substrate fill may be used during construction instead of...
common fill for some or all of the subgrade preparation, if that is more efficient than using multiple material types.

**Rip Rap / Rounded Stone**

Rip rap and rounded stone will be placed as required to provide stability in areas with high shear stresses.

Rip rap is an angular crushed rock material with very high erosion resistance. It may be required at infrastructure locations or on steep slopes where the high friction angle of the angular material provides superior stability.

Rounded stone is a rounded to sub-angular rock that is usually from glacio-fluvial deposits. Rounded stone is expected to be used where localized shear stresses are high and the lower friction angle of the material will be stable. It would be used to provide erosion resistance where needed in the channel and specific bank locations; its use would also increase substrate diversity for fish habitat. In general, it is expected that rounded stone sizes will need to be about 25% larger than the equivalent rip rap sizes to provide the same degree of erosion resistance.

### 3.3 FLOODPLAIN AND HABITAT RESTORATION DESIGN

#### 3.3.1 Engineering Evaluations

Engineering evaluations and considerations to support the development of the Ninemile Creek floodplain design are presented in the *Ninemile Creek Intermediate Channel Design Analyses* (Anchor QEA, 2010), included in Appendix E. As further described in Appendix E, the floodplain restoration design includes the following primary components and features:

- Increased floodplain buffer between Ninemile Creek and Wastebeds 9 and 10
- Clean habitat subgrade and topsoil material to support planting and seeding of native vegetation
- Riparian buffers to provide shade and leaf litter input to Ninemile Creek
- Emergent wetland habitats with a diversity of native wetland species

Appendix E presents the basis for the preliminary plans and material specifications described below. To avoid redundancy, the information in Appendix E is generally not repeated in the main report text.

#### 3.3.2 Preliminary Plans

Appendix C presents the following preliminary plans for the Ninemile Creek floodplain design:

- Finished Grade Drawings (C-029 through C-035)
- Site Restoration Drawings (C-036 through C-042)
- Cross Sections (C-043 through C-051)
- Typical Cross Section Details (C-052 through C-054)
- Site Restoration Details (C-055 through C-059)
As shown on Drawings C-029 through C-036, as part of the restoration, a 2-foot thick habitat layer consisting of 6 inches of topsoil over 18 inches of habitat / subgrade material will be installed in the floodplain in all remediated areas, except at banks in Reach AB and BC that underlain by NYSDOT structural fill or armor stone. For banks underlain by structural fill or armor stone, the material overlying the structural fill or armor stone will be removed, and replaced where feasible, with 1 foot of topsoil. 2 The basis for the thickness and composition of habitat layer is presented in Appendix E. The finished floodplain surface provides topographic variability that will support native upland and wetland species. The final elevations result in no adverse increase in the extent of the 100-yr floodplain. The final elevations of the riparian and upland areas may be adjusted in the final design or during construction to allow for re-use of excavated clean materials on-site and associated variability in volume, taking into consideration flood storage capacity.

As shown on Drawing C-037, two emergent wetlands and a wooded wetland will be created in the Reach CD floodplain and planted and seeded with native vegetation. Riparian and upland habitats in Reaches AB, BC, and CD will be planted with native vegetation to provide habitat diversity and transition areas (Drawings C-036 through C-042). On the lower portions of the banks, where there is sufficient interaction with the surface water, fringing wetlands will be planted and seeded with native wetland vegetation.

3.3.3 Preliminary Material Properties

Appendix D presents the preliminary properties for the following key earthen materials for the Ninemile Creek floodplain design:

**Habitat Subgrade Fill**

Habitat subgrade fill is a generally granular material containing a low to medium organic content that will serve as a suitable rooting zone for deeper rooted plants. It is intended for this material to contain predominantly sand and gravel sized particles with occasional cobbles so that it will have a reasonable resistance to erosion and will also provide good anchoring for plant roots so that they can better resist scour, erosion, and windthrow. The generally granular nature of the soils should allow for full-depth penetration by roots and reduce perched water build-up that could destabilize the slope surface during spring thaw and wet weather.

**Topsoil**

Topsoil is proposed to be a loam material with a medium to high organic content. It is anticipated that plant roots will quickly stabilize the topsoil against surficial erosion and that many of the plants will then establish deeper roots into the habitat subgrade fill on the bank slopes to lock the upper soils in place.

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2 In some locations, such as where there is currently no soil overlying the structural fill or armor stone, or near bridge piers, it may not be feasible to place and maintain 1 foot of topsoil.
The habitat restoration will include a diversity of wetland and upland plant species. Plant species proposed for the Ninemile Creek restoration were derived from the species to be used for the Geddes Brook IRM and are described in Appendix E.

3.4 REMOVAL DESIGN

3.4.1 Introduction

Finished surfaces for the channel and floodplains are presented in Sections 3.2 and 3.3. These finished surfaces, with the updated topographic and bathymetric survey and site chemical data, form the basis for the removal design, as described in Appendix F.

Appendix C presents the following preliminary drawings for the Ninemile Creek removal design. Included in this grouping of drawings are the associated backfill / subgrade drawings:

- Excavation Drawings (C-012 through C-018)
- Backfill Subgrade Drawings (C-019 through C-025)
- Cross Sections (C-043 through C-051)
- Typical Cross Section Details (C-052 through C-054)

The horizontal extents of removal shown on the excavation drawings are consistent with the remedial extents identified in the RODs (e.g., breaks in grade, elevation 370 contour), and incorporate refinements based on a more detailed topographic survey and pre-design investigation data. The excavation drawings also show the remedial excavation surface elevations (i.e., vertical removals) required to remove mercury and other CPOIs in sediments, floodplain soils, and bank soils pursuant to the RODs. The backfill subgrade plans show the subsequent subgrade elevations shaped for placement of the habitat and channel restoration surface materials. Since the final grading is being driven by habitat restoration and slope stability geometry requirements, the subgrade elevations require both cutting and filling to shape the restoration. Therefore, the backfill subgrade plans show some areas where the subgrade cuts extend below the proposed remedial excavation surfaces. These cuts are generally expected to be in native undisturbed soils and the cut materials are generally expected to be suitable for re-use on site as backfill for subgrade shaping.

Significant design considerations during development of the removal design included:

- An assessment of the need for a chemical isolation layer in Reach CD and if the chemical isolation layer could be eliminated or minimized
- Hot spot removal pursuant to the OU-1 ROD
- Water infiltration during construction at the deep excavation adjacent to the large island
- The presence of infrastructure, including bridge abutments and existing bank armoring
- Slope stability of channel banks during construction
- Source and residual concentrations remaining post-remedial excavation
A summary of these design considerations is included in Appendix F and details of slope stability and water infiltration are provided in Appendix B.

Figures A-10 through A-18, in Appendix A, present concentrations of mercury in sediment and soil/sediment remaining following the removals shown on Drawings C-012 through C-018. Concentrations of other CPOIs remaining following the removals are also presented in tables in Appendix A.

A preliminary assessment of removal areas and volumes is presented Appendix F and discussed below.

3.4.2 Channel Removals

A channel plan and profile for Ninemile Creek, which presents finished surfaces for the channel, is presented in Section 3.2. Removal beyond the proposed finished surface will be required to install the habitat/erosion protection layer and underlying base layer (or the habitat/erosion protection layer and chemical isolation layer/mixing layer where required). The assumed thicknesses of these layers is discussed in Appendix F, and shown on the typical sections on drawing C-052 through C-054. Based on the finished surface and assumed thicknesses of underlying layers, the excavation plans identified in Section 3.4.1 were developed. In Reach CD in the vicinity of the Large Island, additional removals beyond that required to install the identified layers will be performed to remove hotspots and eliminate the chemical isolation layer. These removals are reflected on Drawings C-012 and C-013.

Based on these drawings, preliminary removal areas and volumes for the channel have been estimated using AutoCad Civil 3D, as presented in Appendix F. As shown in Appendix F, the preliminary removal areas and volumes are generally consistent with the estimated volumes presented in the remedy decision documents. General differences are explained by an updated site topographic and bathymetric summary, increased hydraulic understanding of the site, and additional pre-design site investigation since previous proposed areas and volumes were estimated. Details of specific area and volume differences are presented in Appendix F.

3.4.3 Floodplain Removals

Remedial removals will be required in the floodplains to remove soil and soil/sediment impacted with mercury and other CPOIs. Planned removal depths by specific area are summarized in Appendix F; preliminary excavation plans to achieve these removals are presented on the sub-grade Drawings C-012 through C-018.

Beyond the remedial removals, excavations will be required in the Reach CD floodplain to relocate the Ninemile Creek channel and to create wetlands. These excavations are expected to be conducted after completing post-excavation sampling so that the excavated materials from below the remedial removals can be re-used on-site as backfill. Backfill of removed material will be used to restore wastebed slopes and to enhance floodplain diversity. These removals and backfills are shown on Drawings C-019 through C-025.

Based on the existing condition drawings, excavation drawings, and backfill subgrade drawings, preliminary removal areas and volumes for the floodplains have been estimated using
AutoCAD Civil 3D, as presented in Appendix F. As shown in Appendix F, the proposed removal areas and volumes are generally consistent with the estimated volumes presented in the remedy decision documents. General differences are explained by an updated site topographic and bathymetric survey, increased hydraulic understanding of the site, and additional pre-design site investigation since previous proposed areas and volumes were estimated. Details of specific area and volume differences are presented in Appendix F.

3.4.4 Removal Methods

Floodplain soil/sediment removal is generally expected to be performed using backhoes; channel sediment removal is generally expected to be performed using backhoes or crane-mounted clamshell buckets, with limited use of sheet pile. Hydraulic dredging methods may also be used for the Ninemile Creek Reach AB channel and adjoining floodplains (e.g., spits) in OU-2. Potential removal methods will be further evaluated in the 95% Design Report.

3.4.5 Constructability

The sediment removals in the Ninemile Creek channel occur in a variety of different current site configurations, including adjacent to man-made fill slopes and transportation infrastructure such as bridge abutments. Appendix B provides a summary of slope stability analyses performed in selected transects representing the variety of anticipated removal depths and adjacent ground conditions. A summary of the assessment performed by reach is presented below.

In Reach CD, the analyses focused on slope stability during construction along the southern channel bank adjacent to the state fair landfill. The objective was to maintain a factor of safety of at least 1.3 during the deepest excavations, which is generally considered to be an acceptable factor of safety for temporary slopes. This requires slope angles of 2H:1V to 3H:1V. There is an upward groundwater gradient in the sands and fine silts underlying the recent creek sediments, which would tend to temporarily reduce the factor of safety for deeper excavations until a new steady-state seepage condition evolves. Excavations deeper than those considered in the evaluation and shown on the drawings in Appendix C would need to be analyzed to evaluate their feasibility.

The proposed excavation design for the Large Island Area in Reach CD is deeper than was evaluated in the Supplemental FS in order to eliminate the need for a chemical isolation layer. The nature of the underlying natural soils (i.e., relatively permeable silts and sands), the upward groundwater gradient, and the depth of the removals lead to the conclusion that the sediments will need to be removed while maintaining the existing surface water elevations in the Large Island excavation. Berming or sheet piling the ends of this channel section and diversion of flow to the north channel as assumed in the Supplemental FS would be performed to keep flowing water out of the excavation area.

In Reach BC, the unarmored bank areas were evaluated for slope stability for excavations extending approximately 4 feet below the existing sediment surface, roughly following the slope angle of the existing bank. The factor of safety for these activities was calculated to be greater than 1.3. Similar to the Large Island Area, much of upper Reach BC appears to have an upward groundwater gradient that could cause temporary lower factors of safety for deeper excavations.
until a new steady-state seepage condition evolves. If deeper removals are considered near the banks, then additional analyses will be necessary.

Much of the visible armor stone in Reach BC appears to be fairly large with minimum plan dimensions of about 2 feet or greater. This armor stone appears to be stable at this time. The NYSDOT as-built drawings show the armor stone extending down about 2 feet into the channel bed and approximately 4 feet out into the channel as toe protection. Removal of this armor stone is both impractical and unnecessary for the purposes of this remediation project. With the armor stone in place, the slope stability during the remedial removals is expected to be about the same as immediately following placement of the armor stone during the original construction. If removals need to extend below the bottom of the armor stone immediately adjacent to the toe, then the slope stability evaluation will need to be re-assessed. In this scenario, it is anticipated that a wedge of material (sediment) would remain in place adjacent to the armor stone to avoid undermining it.

The NYSDOT as-built drawings of the bridge structures indicate that the bridge abutments are founded on deep pile foundations. The abutments and pile caps are generally set back from the water edge of the creek. Since the piles are founded on stable materials well below the excavations, the excavations should not cause settlement or lateral movement of the bridge abutments. Maintaining slope angles similar to the existing banks at the edges of the sediment removals should suffice to prevent undermining of the pile caps; further evaluation will be conducted during the 95% Design when actual required removal depths in Reach BC have been determined.

In the Reach AB channel, an excavation of approximately 2.5 feet was evaluated for slope stability. In general, the waste bed slopes are sufficiently flat such that the factors of safety exceed 1.5. On the I-690 side, the slopes are relatively steep but are generally expected to consist of compacted embankment fills until close to the surface water elevation. The calculated factor of safety for this slope during removals is over 1.3.

### 3.4.6 Base Layer

Where the anticipated remedial removal method is dredging through the water column and a chemical isolation layer is not installed, thin layers of the removed material will remain (i.e., residuals). Base layer material will be installed in these areas (e.g., upstream of Large Island, Large Island Area, Reach AB) to support and prevent fines from migrating into the overlying habitat/erosion protection layer. This base layer will have the added benefit of attenuating residuals that may remain after dredging. Estimates of residual concentrations in the base layer, prepared in a manner consistent with that presented in the OU-2 Supplemental FS (Parsons, 2009), are presented in Appendix B.

### 3.5 CHEMICAL ISOLATION LAYER

It is anticipated that a chemical isolation layer may be required in the portions of the channel shown on Figure 3-1 (i.e., Reach BC, and immediately adjacent portions of Reaches CD and AB, which are similar in nature to Reach BC). Concentrations of mercury remaining in these areas, assuming removals to accommodate a 2-foot thick habitat / erosion protection layer and a 6-inch
allowance for either a base layer or a portion of the chemical isolation layer/mixing layer, are shown on Figures A-11 and A-13 through A-15 in Appendix A. Additional removals would be conducted, if required, to install a chemical isolation layer. The need for a chemical isolation layer in these areas, design parameters, required thickness of mixing layer, additional removals if required, and design conceptual approach will be provided as an addendum to the 50% Design.

3.6 MATERIAL HANDLING

3.6.1 Location for Consolidation and Containment of Soil and Sediment

The RODs for Ninemile Creek OU-1 and OU-2 indicate that soil and sediment removed from the Ninemile Creek site will be placed at the LCP OU-1 Containment Area or the SCA, and that the decision regarding final placement location would be made during remedial design taking into consideration various factors, including the design and construction schedules for the Ninemile Creek remedy and the SCA, so that the remediation of Ninemile Creek would not be unnecessarily delayed. An assessment of the relative merits of the two locations indicates the following:

- The Geddes Brook IRM, scheduled to be conducted in 2011, is a precursor to the Ninemile Creek Remedial Action, scheduled to be initiated in 2012. Soil / sediment removed from Geddes Brook will be consolidated at the LCP OU-1 Containment Area; as such, material management infrastructure at this location will be fully operational and available to facilitate a smooth transition for removals at the adjoining Ninemile Creek channel and floodplain. The volume of Ninemile Creek soil/sediment (approximately 95,000 cy, exclusive of soil/sediment from the spits and SYW-10), is of the same order of magnitude as the Geddes Brook IRM material (approximately 84,000 cy). Consistent with the Records of Decision for OU-1 and OU-2, transport would be over a short distance on non-residential roads.

- Lake dredging and SCA operations are scheduled to be initiated in 2012, concurrent with the initiation of the Ninemile Creek Remedial Action. Management of the Ninemile Creek soil and sediment at the SCA would add complexity to SCA start-up operations from the perspective of management of multiple waste streams of variable volume and quality. However, managing materials from the two projects separately during start-up will provide more stable baseline conditions for start-up and enhance flexibility for making process adjustments.

- The majority of the Ninemile Creek soil and sediment will require mechanical removal (e.g., floodplain soils, Reach CD and BC shallow channel sediment) and is amenable to trucking. However, to place Ninemile Creek material at the SCA, material that is not hydraulically dredged would need to be slurried (i.e., liquefied) for subsequent placement and dewatering in SCA geotextile tubes. The slurrying / dewatering process would add additional material handling steps that could impact schedule at the task basis, and would increase the volume of water requiring treatment at the SCA water treatment plant, potentially displacing water from lake dredging operations and potentially impacting the lake dredging schedule.
Consistent with the Ninemile Creek OU-2 Supplemental Feasibility Study (Parsons, 2009), sediment from portions of Ninemile Creek OU-2 proximate to Onondaga Lake are amenable to hydraulic removal in coordination with the lake remedy, with consolidation of removed material at the SCA.

Based on these factors, and with the goal of enhancing schedule performance for both the Ninemile Creek and the Onondaga Lake remedies, Ninemile Creek soil and sediment that is mechanically removed will be placed at LCP OU-1 Containment Area. Sediment for which hydraulic removal may be the preferred method (e.g., OU-2 spits, lower portion of OU-2 channel) will be further evaluated to determine if hydraulic removal and placement at the SCA is appropriate.

### 3.6.2 Properties of Soil and Sediment at Point of Excavation

As described in Appendix B, the expected properties of soil and sediment at the point of excavation are as follows:

- **Reach CD Floodplain Soils.** The glacio-lacustrine clays and overlying soils should be suitable for excavation and direct loading onto trucks without dewatering or solidification, providing that they are not exposed to additional water (e.g., excessive precipitation, flooding). These materials can be placed and compacted, as long as they do not become excessively wet. Non-plastic silts underlie the glacio-lacustrine clay. This material may require drying or solidification to be transported and placed. The estimated volume of this material to be excavated and consolidated is 18,600 cy; the estimated volume of this material to be excavated and re-used is 13,200 cy.

- **Reach BC and AB Bank Soils.** The bank soils consist of a variety of materials, primarily silts and clays. It is expected that these bank materials will be relatively dry above the waterline and suitable for immediate transportation and placement after excavation, provided that they are kept relatively dry. The estimated volume of this material to be excavated and consolidated is 24,000 cy.

- **Reach CD Channel Sediment.** The Reach CD channel sediment generally consists of high plasticity clays. This material will unlikely drain by gravity and will likely require mixing with dry soils or solidification to make it suitable for transport and placement. The estimated volume of this material to be excavated and consolidated is 22,600 cy.

- **Upper Reach BC Channel Sediment.** The Upper Reach BC channel sediment generally consists of a sandy silt. This material will unlikely drain by gravity and will likely require mixing with dry soils or solidification to make it suitable for transport and placement. The estimated volume of this material to be excavated and consolidated is 6,400 cy.

- **Lower Reach BC Channel Sediment.** The Lower Reach BC channel sediment generally consists of silty sands and clayey gravels. These materials are partially amenable to draining by gravity, with the larger grain-sized materials being more free-draining. Free draining, and potentially mixing with dry soils will likely be required to
make these soils suitable for transport and placement. The estimated volume of this material to be excavated and consolidated is 8,100 cy.

- Reach AB Channel Sediment. Reach AB channel sediment generally consists of low plasticity silts and silty sands. These materials will unlikely drain by gravity and will likely require mixing with dry soils or solidification to make it suitable for transport and placement. The estimated volume of this material to be excavated and consolidated is 15,300 cy.

3.6.3 Transportation and Placement of Soil and Sediment

Material that is mechanically removed will be either staged adjacent to haul roads prior to being loaded onto trucks, or directly loaded into trucks, and hauled to the LCP containment area. If necessary for secure transport, wet sediment may be mixed with dry excavated materials or material solidification may be required prior to loading the materials onto trucks. Hauling of materials over public roads will be performed in accordance with local, state, and federal regulations.

Material placement at LCP is expected to be conducted in phases to limit the area of contaminated materials open to stormwater contact. Before consolidating soil/sediment in the LCP containment area, berms will be installed to contain and direct runoff from storm events. Material placement and grading are expected to be conducted so that areas can be graded and capped, as soon as practical, to reduce the open area and generation of construction water.

Material that is hydraulically removed will be pumped as a slurry directly from the dredge to a dual wall HDPE pipe that runs from shore, through intermediate booster pumps, and up to the SCA. Once the slurry reaches the SCA, it will be prepared as required for final placement in geotextile tube bags at the SCA. Preparation of the slurry includes removal of oversized materials and polymer addition to enhance decanting of sediments, as required. The hydraulic removal of the Ninemile Creek sediments will be coordinated with the Onondaga Lake hydraulic dredging and will use the dredging equipment and slurry transport system in place for the lake remediation. Disposal of the sediments at the SCA, SCA operations, and treatment of the water generated from the hydraulic removal will use the equipment and protocols in place for the lake remediation work.

3.6.4 Construction Water Treatment

A temporary construction water treatment plant (CWTP) is being designed and constructed to support the implementation of the Geddes Brook IRM. Based on the proximity of the sites and similarities of soil and sediment characteristics, this CWTP will also be used to support the implementation of the Ninemile Creek Remedial Action, which will follow the Geddes Brook IRM. This section presents an overview of the planned CWTP, and the basis for its use for the Ninemile Creek RA.

Information regarding the design and construction of the temporary CWTP is presented in the Draft Final Engineering Report for the Geddes Brook and Ninemile Creek Construction Water Treatment Plant (Parsons, 2011b). As described in that report, the system will include the following unit operations:
• Primary Settling
• Influent Holding and Equalization
• Coagulation, Flocculation, and Solids Settling
• Pre-Carbon Bag Filtration
• Granular Activated Carbon (GAC) Adsorption
• Post-Carbon Filtration
• Effluent Holding, Discharge, and Reuse
• Solids Handling

Table B.3.1 in Appendix B presents the anticipated discharge criteria for the CWTP. As described in Section 2.2.4, water samples from test pits and sediment elutriate were obtained to inform CWTP design. The data set comprises grab samples collected from thirteen locations from the Geddes Brook and Ninemile Creek areas in 2009 and 2010. Table B.3.2 summarizes the data collected for a variety of parameters, including those with potential discharge limits. For screening purposes, cells are highlighted if the sampled value (or method detection limit (MDL) if the sample was non-detect) was 80% or more of the anticipated discharge limit for a regulated parameter. Table B.3.3 further summarizes the data.

A review of Tables B.3.2 and B.3.3 against the anticipated discharge criteria in Table B.3.1 indicates that the following parameters will likely require treatment in the CWTP, during remedial construction activities in the Ninemile Creek remediation area:

• Total suspended solids
• Aluminum
• Iron
• Mercury

In some cases, detection limits used to generate the data set for PCBs (specifically Aroclor-1248, Aroclor-1254, and Aroclor-1260), ammonia, phosphorous (total), and xylenes were equal to or above the discharge permit limits. As such, the data set is inconclusive with regards to the requirement for treatment of these parameters. Subsequent sampling to support the treatability testing described in Draft Final Engineering Report for the Geddes Brook and Ninemile Creek Construction Water Treatment Plant (Parsons, 2011b) yielded non-detect values below the draft discharge limits for PCBs, ammonia and xylenes.

Review of Table B.3.2 indicates that sediment elutriate sample NMC-TP-1 (from Reach CD channel near Large Island) and NMC-TP-3 (from Reach BC channel) had ammonia concentrations higher than the discharge criteria. The other sediment elutriate sample (NMC-TP-2 from Reach CD) was below the discharge criteria. All samples that were collected outside of the stream channel (i.e., not sediments) were either below the ammonia discharge criteria or were non-detect.

Dewatering of the excavated channel sediments is only a portion of the total construction water that will be managed. Other construction water will include water from the LCP.
containment area, floodplain removals, and decontamination pads. Construction water generated at these areas will largely be derived from rain water. Taking into consideration the various construction water sources and the fact that water from various sources will be equalized and managed as a single stream of water, it is not anticipated that construction water entering the CWTP will contain ammonia concentrations above the discharge limit.

3.7 SITE PREPARATION AND CONTROLS

3.7.1 Temporary Facilities

Temporary facilities, such as trailers, utilities, site access roads, decontamination pad(s), and staging areas will be required to implement the remediation. The location of the facilities will be identified in the Construction Work Plan to be prepared for the project.

It is anticipated that many of the temporary facilities established for the Geddes Brook IRM will be suitable for use for the Reach CD construction. The use of previously established facilities will facilitate project start-up and implementation.

3.7.2 Utilities

Known existing utilities are shown on Drawings C-009 through C-011.

Most existing utilities within the channel alignment and the lower portion of the banks are above ground. Specific exceptions include an underground communications line in lower Reach CD as shown on Drawing C-009, and the following underground utilities crossing the channel in Reach BC as shown on Drawing C-10A: a fiber optic communications line following the CSX right of way, two county sewer lines encased in a 72-inch by 44-inch Armco arch-pipe casing north of the CSX railroad bridge, and an idle Buckeye petroleum line. Based on investigations to date, the following information has been identified for each of these underground utilities. Field verification and further assessment as described below will be required prior to remedial construction.

**Verizon Communications Line**: Verizon Communications (Verizon) owns an underground line that crosses the channel in Reach CD, immediately downstream of the second small island. Verizon has indicated that there are no existing as-builts or design drawings from the installation of the line. Verizon has confirmed that this communications line is active, was installed in 1974, and contains nine 4-inch plastic conduits positioned in a 3x3 grid with one active fiber cable and three copper cables. The exact location and elevation are uncertain. This line will require utility location surveying (e.g., ground penetrating radar, hand dug test pits) to confirm location and elevation prior to construction.

**Wiltel Communications Line**: An existing Wiltel Communications (Wiltel) underground fiber optic line runs beneath the creek within the CSX right of way. Through correspondence with Wiltel it has been confirmed this line was installed in 2001 and is active. The as-built drawing of this line provided by Wiltel Communications is provided in Appendix B. Further evaluation will be required to ascertain the depth of the line in the channel.
Onondaga County Sewer Lines: Two Onondaga County Department of Water Environment Protection (OCWEP) sanitary sewers run parallel to each other in Reach BC just downstream of the CSX track. OCWEP indicated that the 18-inch sanitary sewer and 18-inch force main were installed in 1970 and are still active. Both lines were installed within a casing pipe (72-inch x 44-inch Armco No. 8 gage arch-pipe casing). The casing pipe was filled with concrete and then placed between steel sheets running perpendicular to the creek flow and backfilled, according to as-built drawings provided by OCWEP. These drawings are provided in Appendix B.

Buckeye Oil Petroleum Line: A Buckeye Oil historic petroleum line crosses under Ninemile Creek in the lower portion of Reach BC. This “idle” line is still in place but not currently operated. A preliminary field location investigation conducted by Buckeye Oil indicated that this line is approximately 16 feet below the existing grade at the channel edge. A plan view and cross section view of the pipe obtained from Buckeye Oil is provided in Appendix B. Due to the quality of this drawing, the exact location and elevation of the line is uncertain; it is also not known whether it has been emptied of product. Further investigation will be required.

During development of the ROD for the site, Onondaga County Water Authority (OWCA) provided a written comment indicating that an active 8-inch water line exists beneath the creek between the existing utility bridge and State Fair Boulevard. Upon further investigation by OWCA and their review of record drawings, OWCA concluded that this line does not exist beneath the creek, and is actually running over the creek on the existing utility bridge. Related correspondence from OWCA is included in Appendix B.

Drawings C-010 and C-010A show several communication, gas, and water lines along the State Fair Boulevard bridge alignment. Based on a review of NYSDOT as-built drawings, it is believed these lines were abandoned and re-routed in 1970 onto the pipe bridge about 100 feet south of the State Fair Boulevard bridge during the construction of the I-690 and I-695 Interstate interchanges in this area. The utilities intended to be abandoned or removed are displayed with a hatching pattern on the NYSDOT record drawing in Appendix B. Additional investigation will be conducted prior to construction to determine if the abandoned lines remain in place.

The pipe utility bridge and other overhead utilities crossing the Ninemile Creek channel will require protection during the removal and backfilling process in the channel. The areas where these utilities go underground on the channel banks will also require protection during remediation, which may require limited excavation and backfilling along their alignment. The owners of the active utilities will be notified prior to any work in close proximity to the utilities.

3.7.3 Stormwater and Erosion Control

During removals, backfilling and restoration, stormwater, erosion, and sediment control are anticipated to consist of silt fencing and similar elements to prevent significant soil or sediment erosion from the site. Typical details for these features are provided on Drawings C-060 and C-061. Stormwater from upgradient locations will be routed away from exposed materials and excavations. Stormwater contact with exposed material will be minimized to the extent practical, to reduce the volume of construction water.
The channel habitat / erosion protection material is designed to be resistant to erosion. Therefore, temporary measures will not be required in the channel once the habitat and erosion protection material is placed. Bio-degradable fabrics, live fascines, and brush mattresses will be used as required over topsoil on steep banks while vegetation is being established. Typical details for these features are provided on Drawing C-057. Floodplains will be protected using silt fencing and fiber mulch as needed while vegetation is being established.

The remedial contractor will develop a Stormwater, Erosion, and Sediment Control Plan, which will further describe the stormwater and erosion controls to be implemented. The remedial contractor will be required to maintain stormwater, erosion, and sediment control structures for the duration of the project. These structures will be removed once permanent vegetation, or an otherwise stable surface, is established in the disturbed areas.
SECTION 4

SUMMARY

The remedial action for OU-1 and OU-2 of Nine mile Creek presented in this 50% Design Report includes:

- Removal of approximately 95,000 cy of soil/sediment from the Nine mile Creek channel and adjoining floodplains
- Restoration of the Nine mile Creek channel and adjoining floodplains that includes:
  - Increased sinuosity and length of Nine mile Creek in Reach CD
  - Improved channel substrate for fish spawning and benthic macroinvertebrates
  - Riparian, wetland and upland habitats with a diversity of native species
  - Sufficient water depth under low flows to provide fish and canoe passage

The remedial design is based on significant field investigations conducted in 2007 through 2010 to advance the remedy for the site. These investigations included a topographic/bathymetric survey, wetland delineation and habitat assessment, chemical analysis of soil/sediment, assessment of material handling properties of soil/sediment, assessment of constituents that may be present in construction water, assessment of the geotechnical properties of site soils and sediments, an assessment of sediment porewater, and a study of site groundwater and surface water elevations at the site.

Data from those investigations were evaluated to develop the major components of the 50% Design described in this report, which include:

- Removing contaminated channel sediment and floodplain soil/sediment in Reaches AB, BC and CD of Nine mile Creek
- Relocating a portion of Reach CD to facilitate remedial construction and to create a buffer between Nine mile Creek and Wastebeds 9 and 10
- Transporting and managing the soil/sediment offsite at either the LCP Containment Area (for material from OU-1 and a portion of OU-2) or the SCA (for material from a portion of OU-2)
- Treating construction water generated by remedial activities at a temporary CWTP
- Placing clean materials throughout the site, including a 2-foot thick habitat/erosion protection layer in the channel
- Providing bank stability through a combination of stabilization techniques, including bioengineering techniques and armoring

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3 A chemical isolation layer, which may be needed in portions of Reach BC, and in immediately adjacent portions of Reaches CD and AB that are similar in nature to Reach BC, will be described as an addendum to the 50% Design.
• Creating pools and hydraulic refuge to provide in-stream habitat
• Restoring stream bed and banks, wetlands, and habitats following sediment and soil removal, including planting and seeding with a diversity of native species
SECTION 5

REFERENCES


Backfill Existing Channel. Restore with Minimum 2 ft of Clean Soil Over Channel and Adjacent to Wastebeds to Ease Slopes.


1 ft Removal of Soil/Sediment from Floodplain. Restore With Minimum 2 Ft of Clean Soil Over Floodplain to Ease Slope Adjacent to Wastebeds.

State Fair Landfill

Geddes Brook IRM

1 ft Removal of Soil/Sediment from Floodplain. Restore With Minimum 2 Ft of Clean Soil Over Floodplain to Ease Slope Adjacent to Wastebeds.

Regional Hot Spot Removal Area

Break in Grade

Removal of Sediment to Allow for Remediation and Restoration. Install Habitat / Erosion Protection Layer.

FIGURE 1-2

Honeywell

Remedial Approach

Ninemile Creek
Syracuse, New York

PARSONS

301 Plainfield Rd, Suite 350, Syracuse, NY 13212, Phone 315-451-9560

Reach AB

Reach BC

Reach CD

Removal of Sediment as Required for Installation of Isolation Cap and Habitat Layer. Restore With Required Isolation Cap and 2 Ft Habitat Erosion Protection Layer.

Upland - Remove 2 ft Soil/Sediment. Replace With 2 ft Clean Soil.

Spits Removal and Restoration Approach Included In Onondaga Lake Design

Remove 2 ft Soil/Sediment. Replace With 2 ft Clean Soil.

Spits Removal and Restoration Approach Included In Onondaga Lake Design

Remove Sediment 2.5 Ft. Below Proposed Finished Grade. Restore With 0.5 Ft. Base Layer And 2.0 Ft. Channel Habitat / Erosion Protection Layer

Break in Grade

Break in Grade

Break in Grade

FIGURE 1-2

Honeywell

Remedial Approach

Ninemile Creek
Syracuse, New York

PARSONS

301 Plainfield Rd, Suite 350, Syracuse, NY 13212, Phone 315-451-9560
LEGEND

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CONTOURS

WATER BOUNDARY OR STREAM

DELINEATED WETLAND BOUNDARIES

FIGURE 2.2

Honeywell CEDDS II Rook/Nine Mile Creek Site Wetland Boundaries

Parsons

308 Flanaga Road, Suite 310, Bingham, NY 13070, Phone 315-681-4880

PLOT DATE: 2/18/2011 2:24 PM PLOTTED BY: GOLDTHWAIT, JAMES

SCALE: 1" = 360'

SITE WETLAND BOUNDARIES
FIGURE 3-1

Potential location of chemical isolation layer