ONONDAGA LAKE BASELINE MONITORING
BOOK 3
TRIBUTARY MONITORING WORK PLAN FOR 2009

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LIST OF ACRONYMS

CPOI	Chemical Parameter of Interest
DUSR	Data Usability and Summary Report
IRM	Interim Remedial Measure
NYSDEC	New York State Department of Environmental Conservation
LCP	Linden Chemicals and Plastics
OCDWEP	Onondaga County Department of Water Environment Protection
QA/QC	Quality Assurance / Quality Control
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
ROD	Record of Decision
SMU	Sediment Management Unit
SOPs	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
UFI	Upstate Freshwater Institute
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This work plan describes the objectives, sampling design and approach, and methods for monitoring tributaries to Onondaga Lake in 2009 as part of the baseline monitoring program. Tributary monitoring will provide additional data for future understanding of remedy effectiveness in achieving remediation goals for Onondaga Lake. There are three data uses for the tributary baseline monitoring. To address the first (i.e., quantify loadings of mercury entering the lake), this work plan includes sampling and analysis of total mercury, methylmercury, and total suspended solids (TSS) in the water column from Ninemile Creek and Onondaga Creek on a bi-weekly basis, in water from near the mouth of seven other tributaries four times, and for various storm events. To address the second (i.e., verify effectiveness of upland Honeywell remedies), this work plan includes water sampling in Ninemile Creek, the West Flume, East Flume, Tributary 5A, and Harbor Brook to provide baseline data on mercury loading to Onondaga Lake associated with various Honeywell upland sites. To address the third (i.e., evaluate potential for chemical parameters of interest (CPOIs) to enter the lake in the future), this work plan includes sampling and analysis of sediment in the lower reaches of Onondaga Creek and Ley Creek as well as water analyses from each of the nine lake tributaries for polychlorinated biphenyl (PCB) aroclors and for dioxins-furans. Standard operating procedures (SOPs) for installing and maintaining a sonde to monitor turbidity in lower Ninemile Creek are provided as Appendix A of this work plan. The field and analytical methods and quality assurance program supporting the field work are described in the Quality Assurance Project Plan (QAPP), which is provided in Appendix B of this work plan.

SECTION 1

INTRODUCTION

This work plan describes the objectives, sampling design and approach, and methods for monitoring tributaries to Onondaga Lake in 2009 as part of the baseline monitoring program. A general description of tributary monitoring was previously provided in the draft Baseline Monitoring Scoping Document for the Onondaga Lake Bottom Subsite (Parsons 2008a). Field and laboratory SOPs are provided in Appendix A of this work plan. The field and analytical methods and quality assurance program supporting the field work are described in the QAPP, which is provided in Appendix B of this work plan. In subsequent years, it is anticipated that any changes to the field or analytical program described in this work plan will be documented by addenda to this work plan.

Various tributary monitoring programs have been conducted around Onondaga Lake over the past several years by various entities and these programs are summarized in Table 4 of the draft Baseline Monitoring Scoping Document (Parsons 2008a). The baseline monitoring described in this work plan builds on previous efforts so that a consistent database can be maintained.

1.1 OBJECTIVES

The baseline monitoring for Onondaga Lake has three objectives that are listed below as discussed in the Baseline Monitoring Scoping Document (Parsons, Exponent and Anchor QEA, 2010). Tributary monitoring addresses the second objective.

- Establish a comprehensive description of baseline chemical conditions prior to remediation to assess remedy effectiveness and to facilitate remedy design
- Provide additional data for future understanding of remedy effectiveness in achieving remediation goals for Onondaga Lake
- Provide habitat-related information

1.2 DATA USES

The three data uses for the tributary baseline monitoring as presented in the draft Baseline Monitoring Scoping Document are discussed below along with a brief description of how each will be addressed by the work proposed herein. The sampling design and rationale for each activity is fully described in Section 2 of this work plan.

- Quantify external loading of mercury

This work plan for 2009 includes sampling and analysis of total mercury, methylmercury, and total suspended solids (TSS) in the water column from Ninemile Creek and Onondaga Creek biweekly in water from seven other lake tributaries four times, and during various storm events. Tributary sampling for mercury loading analysis would be repeated after completion of the Geddes Brook IRM and Ninemile Creek remedial actions.

- Verify effectiveness of upland Honeywell remedies for all CPOIs.

  This work plan includes water sampling in Ninemile Creek, the West Flume, East Flume, Tributary 5A and Harbor Brook to provide baseline data on mercury loading to Onondaga Lake associated with remediation by Honeywell of various upland sites. Tributary sampling for effectiveness verification would be repeated after completion of the Geddes Brook IRM, the Ninemile Creek remedial actions, the Harbor Brook/Wastebed B remedial action, and after completion of other Honeywell remedial actions in tributaries as appropriate such as Tributary 5A (Willis Avenue and Semet sites). In addition, surface water sampling may be needed in the lake following remediation of Sediment Management Units 1, 2, 3, and 7 within the lake, the Willis/Semet and Wastebed B IRMs and Wastebeds 1 through 8 along the lakeshore.

- Evaluate potential for CPOIs in Ley Creek and Onondaga Creek to impact the lake following remediation.

  Review of historical sediment data in tributaries and in lake sediment at mouths of tributaries identified Onondaga Creek and Ley Creek as potential conduits for CPOIs to the lake. This work plan includes sampling and analysis of sediment in the lower reaches of Onondaga Creek and Ley Creek. Water sampling in these tributaries for CPOIs other than mercury may be initiated later this year if sediment data indicate that these tributaries could significantly impact Onondaga Lake after the lake is remediated in accordance with the 2005 Record of Decision (ROD) prepared by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) (NYSDEC and USEPA, 2005).

SECTION 2

SAMPLING DESIGN AND RATIONALE

This section describes the sampling design and rationale. A summary of the sampling activities is provided in Table 1.

2.1 SURFACE WATER

The rationale for selection of tributary, station location, frequency, and analytes is provided below.

Tributaries to Sample Surface water sampling will focus on Ninemile Creek and Onondaga Creek. These two tributaries were identified in the Onondaga Lake Remedial Investigation Report (TAMS 2002) as the tributaries providing the significant contributions of mercury to the lake (i.e., 50.8 and 13.7 percent, respectively, of the combined load from tributaries and Metro).

Seven smaller tributaries (Ley Creek, Harbor Brook, Tributary 5A, the East Flume, the West Flume, Sawmill Creek, and Bloody Brook) also contributed mercury to Onondaga Lake in 1992, so they will also be sampled once during four baseflow sampling efforts.

Sampling Locations Surface water samples will be collected in Ninemile Creek at Amboy Dam just upstream of the Warners Road (State Route 173) bridge and at State Fair Boulevard (at the United States Geological Survey (USGS) gauging station) 30 yards downstream of the State Fair Boulevard (State Route 48) bridge and in Onondaga Creek 30 yards upstream of the Spencer Street bridge. At the seven smaller tributaries, surface water samples will be collected as close to the tributary mouth as practicable (see Figure 1 for tributary surface water sampling locations). These locations are consistent with historical sampling stations in the Onondaga Lake remedial investigation, the Onondaga County annual ambient monitoring program, and the annual monitoring program implemented by the Upstate Freshwater Institute (UFI). In Ninemile Creek, data from Amboy Dam provide information on the mercury mass load from upper reaches, while data from State Fair Boulevard include the mercury mass load contributed by Geddes Brook and the lower reaches of Ninemile Creek and provide estimates of mercury mass load entering Onondaga Lake from Ninemile Creek. In Onondaga Creek, the Spencer Street location provides estimates of mercury mass load entering Onondaga Lake from Onondaga Creek.

Surface water samples will be collected from one location in the West Flume downstream of the Linden Chemicals and Plastics (LCP) site remediated by Honeywell; one location in Ley Creek near the Park Street bridge; and at a downstream location to be identified near the mouth of Harbor Brook, Tributary 5A, the East Flume, Sawmill Creek, and Bloody Brook.

In addition, discussions with Onondaga County will be conducted to determine if suitable surface water samples can be collected and analyzed from the discharge exiting the Metropolitan Wastewater Treatment Plant located on Hiawatha Boulevard near the mouth of Onondaga Creek.

Frequency Sampling from the two Ninemile Creek locations and from the Onondaga Creek location will take occur a biweekly basis from May through November. In addition, water samples will be collected during three 2009 storm events. The goal for 2009 is to monitor storm events with peak daily flows at least twice the seasonal median daily flow. Median daily flows in Onondaga Creek from 1971 through 2008 were 209 cubic feet per second (cfs) during April-May, 88 cfs during June-July-August, and 91 cfs during September-October. Median flows in Ninemile Creek have been similar: 216 cfs during April-May, 81 cfs during June-July-August, and 76 cfs during September-October. On this basis, the plan for 2009 is to target storm events with peak daily flows of at least 450 cfs during April-May and 200 cfs during June through October. Selecting storm events to monitor also depends on the frequency, intensity, and duration of storm events and flow conditions in the creeks prior to each storm. Weather forecasts, creek flow data available online and professional judgment gained from storm event monitoring conducted in Central New York during previous years will be used to help identify target storm events. If the spring, summer and/or fall of 2009 is significantly drier than normal, then storm events with lower peak flows will be targeted. The number of samples per storm event will be determined in the field. For planning purposes, six samples per event are assumed. The intent is to collect three of the six storm event samples prior to peak stream flow associated with a storm event. Numerous studies in other creeks and rivers have indicated that high flow events can carry significant portions of the annual total mercury load due to resuspension of particles from the sediment bed and runoff of particles from the watershed.

Surface water sampling from the West Flume, Ley Creek, Harbor Brook, Tributary 5A, the East Flume, Sawmill Creek, and Bloody Brook will be conducted four times during 2009 as part of base flow sampling.

Analytes For surface water, the primary objective is to quantify mercury loading to the lake. Therefore, analytes for each of the baseflow and storm flow samples are unfiltered total mercury, unfiltered methylmercury, and TSS. TSS is often correlated with total mercury. A sonde to provide hourly measurement of turbidity will be deployed in Ninemile Creek at State Fair Boulevard. Turbidity measurements will be compared to TSS measurements to identify the relationship between these two parameters, which are likely to be correlated with total mercury concentration. Strong empirical relationships amongst these analytes would support more accurate estimates of mercury loading. In addition, three base flow and three storm event water samples from both Ninemile Creek locations and from Onondaga Creek will also be analyzed for dissolved total mercury following filtration in the laboratory.

Surface water samples to be collected from Onondaga Creek, both Ninemile Creek locations, Ley Creek, Harbor Brook, Tributary 5A, the East Flume, the West Flume, Sawmill

Creek, and Bloody Brook during four base flow sampling events will also be analyzed for PCB aroclors and for dioxins and furans.

2.2 SEDIMENT

The rationale for selection of tributary, station locations, timing, and analytes is provided below. NYSDEC will be notified at least one to two weeks prior to initiating sediment sampling.

Tributaries to Sample Onondaga Creek and Ley Creek were selected for tributary sediment sampling, because they are potential sources of CPOIs to Onondaga Lake.

Sampling Locations Samples will be collected at up to ten locations along Onondaga Creek and at four locations along Ley Creek. The number of samples roughly reflected the relative size of the creeks. Depositional regions near the mouths of the creeks will be targeted as these locations most closely reflect sediment that is potentially mobile within the creeks in the future from large storm events.

Timing Sediment sampling will take place in 2009 early enough to allow surface water sampling in 2009 if sediment sampling results indicate that these tributaries could ultimately impact the lake remedy (e.g., contribute to exceedance of remedial goals for sediment, fish, and water).

Analytes Sediment samples will be analyzed for volatile organic compounds (VOCs), PCB Aroclors (and PCB congeners on a sample subset based on results of Aroclor analysis), semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), metals, percent solids, and total organic carbon (TOC). The metals to be analyzed are arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. In addition, a subset of representative sediment samples will be analyzed for grain size.

SECTION 3

METHODS

3.1 SURFACE WATER SAMPLING AND ANALYSIS

3.1.1 Continuous Measurements

Two types of continuous measurements will be conducted: turbidity and flow rates. A sonde to monitor turbidity on an hourly basis will be deployed in Ninemile Creek at State Fair Boulevard from May through November (see Appendix A for sonde procedures). The sonde will be swapped every two weeks for downloading and maintenance. Sonde measurements from Ninemile Creek will not be available in real time. Sonde measurements are also collected from Onondaga Creek near Spencer Street. The availability of sonde measurements from Onondaga Creek is being checked. To quantify flow rates, USGS monitored flow rates in Ninemile Creek at State Fair Boulevard and Onondaga Creek at Spencer Street, and these data will be available on the USGS website in almost real-time.

3.1.2 Base Flow Sample Collection

Surface water samples will be collected manually as grab samples on a biweekly basis from May through November. These samples will be collected using ultraclean sample jars and clean hands/dirty hands sampling technique.

Surface water samples for base flow and for storm events will be collected from near the water surface to avoid disturbance and collection of sediments that are not naturally suspended in the stream. Samples will be collected from the main channel of the streams, avoiding areas of stagnant water. Whenever it is deemed appropriate by the field staff samples will be collected by dipping the sample container directly into the stream. This method is preferred, because it is simple and opportunities for contamination are minimized. When the field staff determine that a representative sample cannot be collected safely by hand, a 6- to 12- ft. long polyethylene dipper will be used. The dipper will be rinsed with distilled water and rinsed in the stream prior to sample collection. The dipper will be double-bagged when stored and during transport from site-to-site. Grab surface water samples will be collected at each location; samples will not be composited.

3.1.3 Storm Event Sample Collection

Storm events will be identified using a combination of real-time flow data available on the USGS website for Ninemile and Onondaga Creek, the weather forecast, and direct observations to identify significant runoff events. Samples will be collected manually as grab samples as flows are rising during a significant storm event and also as storm flows are falling. Surface

water samples will be collected during three 2009 storm events. The intent is to collect three of the six storm event samples prior to stream flows peaking as a result of a storm event.

3.1.4 Laboratory Analyses

Water samples will be submitted to the analytical laboratory primarily for total mercury (unfiltered), methylmercury (unfiltered), and total suspended solids analysis in accordance with the methodologies presented in the QAPP (Appendix B). Total mercury and methylmercury analyses will be conducted using low-level sample handling and analytical techniques. Dissolved (filtered) total mercury (1630 series methods), PCB aroclors (EPA Method 8082), and dioxins-furans (EPA Method 8290) will be measured for a subset of surface water samples as described in Section 2.1.

3.2 SEDIMENT SAMPLING AND ANALYSIS

Sediment samples will be collected using a push core or equivalent to a consolidated bottom layer. The core will be sectioned into two to four depth intervals depending on total depth of unconsolidated sediment and observable changes in texture or color with depth. The intent is to sample at least the top 6 inches of unconsolidated sediment at each location as available. Each interval will be homogenized and submitted to the analytical laboratory. Samples for analysis of VOCs and total petroleum hydrocarbons will be collected prior to samples being homogenized. Chain-of-custody forms will be maintained and processed samples kept cool (below 4^{o}C) and shipped overnight to the analytical laboratory.

Sediment samples will be submitted to the analytical laboratory for analysis of VOCs, SVOCs, including PAHs, PCB aroclors, eight metals, total petroleum hydrocarbons, total organic carbon, and percent solids in accordance with the QAPP (Appendix B). In addition, PCB congeners will be analyzed in sediment samples from selected locations depending on Aroclor results, and grain size (by sieve/hydrometer) will be analyzed in representative samples from each tributary. The metals to be analyzed are arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

3.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC procedures are presented in the QAPP (Appendix B). QA/QC sampling and analytical activities will include the collection of equipment rinse blanks, matrix spike samples, and laboratory duplicate samples consistent with procedures conducted for Honeywell during the pre-design and 2008 baseline monitoring work efforts. A summary of field QA/QC samples to be collected is presented in the QAPP. Personnel conducting surface water sampling will be trained in proper use of the “clean hands/dirty hands” technique for low-level mercury analysis.

3.4 HEALTH AND SAFETY

The safety of field team members and the general public is the highest Honeywell priority. The Project Safety Plan for Parsons field efforts (Parsons, 2008b) and the UFI Safety Plan prepared for previous Onondaga Lake field activities will be used for this investigation and will be strictly followed by all personnel. Any task outside of the current scope defined in the relevant safety plans will have new job safety analyses completed as warranted before the task begins. Copies of these Parsons and UFI safety plans will be maintained at the lakeshore support trailer.

SECTION 4

DATA MANAGEMENT AND REPORTING

4.1 DATA COMPILATION

The data will be organized into a compilation of laboratory and field generated data in electronic file format consistent with compilations provided of previous Honeywell pre-design and baseline monitoring efforts. Core logs or sediment descriptions will be provided. Electronic data files will be generated by the analytical laboratory, while pertinent field data will be entered into electronic format during collection. Data will be added to Locus Focus™ through an input module of the system by the Data Manager. Access to the input module will be restricted to the Syracuse Portfolio Data Managers or delegates. Chemical analytical data will be loaded/entered into a database as discussed in the QAPP. The QAPP specifies minimum requirements for sample information that will be entered into the database.

4.2 REPORTING

Unvalidated data will be submitted to NYSDEC consistent in content and timing with submissions being provided for other pre-design investigation and baseline monitoring efforts for Onondaga Lake. Analytical data generated during this investigation will be reviewed and validated as described in detail in the QAPP associated with this work plan (Appendix B). All analytes will be subject to Level III validation as described in the QAPP for the Phase I Pre-Design Investigation (Parsons 2005). In addition, ten percent of the total mercury, methylmercury, VOCs, SVOCs, PCBs, and metals results will be validated based on Level IV protocols. The validated results will be incorporated into the Locus Focus™ database by Parsons following validation.

Once the data validation has been completed, a data usability and summary report (DUSR) will be prepared and submitted to NYSDEC. The DUSR will present the results of data validation and data usability assessment. A data export will be provided in the DUSR on CD/DVD. Data interpretation and trend analysis will be discussed with the Baseline Monitoring Technical Work Group.

SECTION 5

REFERENCES

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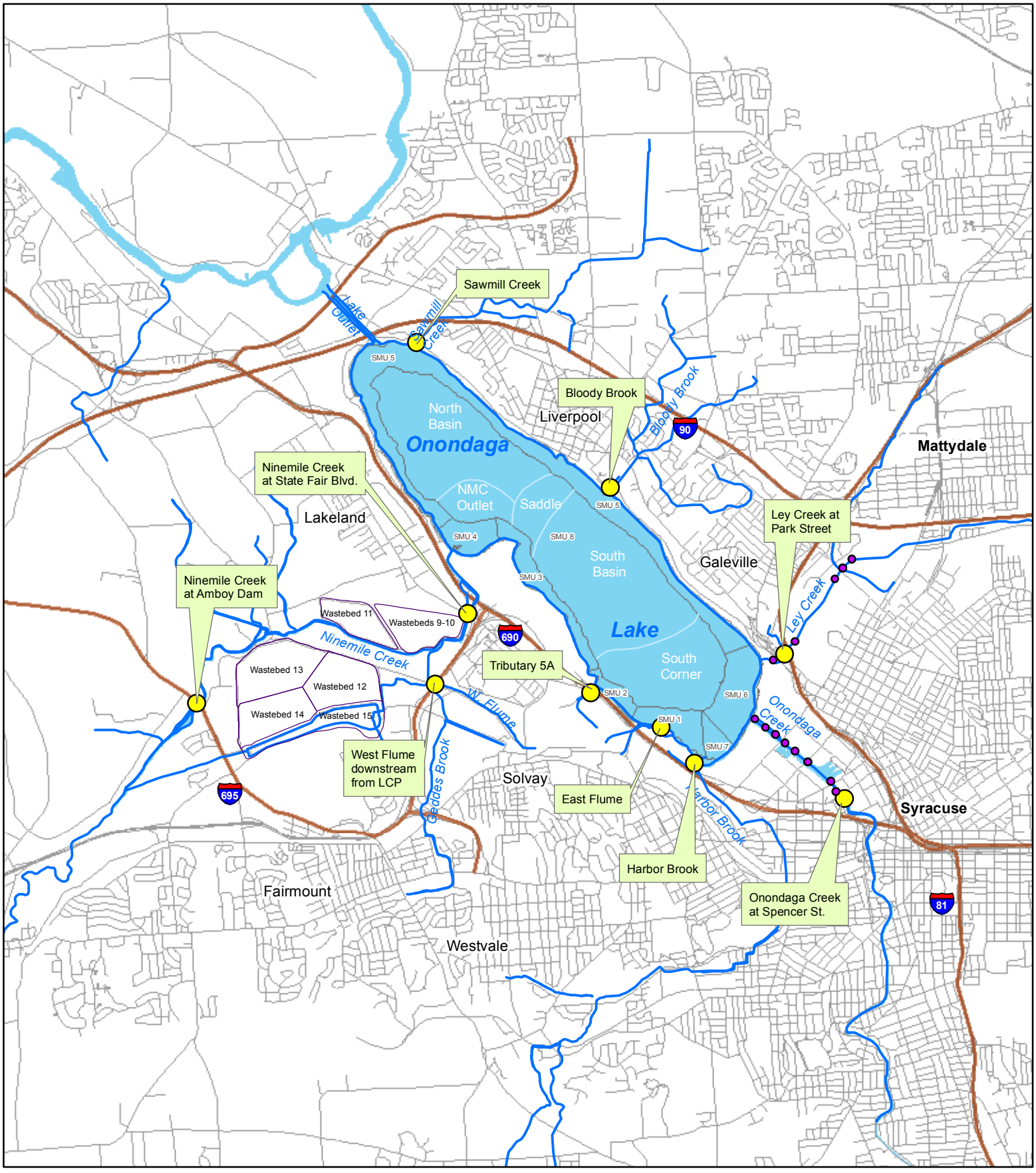

2009 Surface Water Sampling Location (Actual)

2009 Sediment Sampling Location (Actual)

NYSDEC SMU 8 DEMARCATION

River or Brook

Major Road

Minor Road

SMU Boundaries

0 2,000 4,000 8,000 12,000 Feet

Revised: 12/03/2009

Figure 1

Honeywell

Onondaga Lake
Syracuse, New York

2009 Baseline Monitoring
Tributary Sampling Locations

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TABLE 1

SUMMARY OF 2009 BOOK 3 SAMPLING ACTIVITIES

Medium	Number of Locations	Number of Sampling Events	Total Number of Field Samples	Analytes
Ninemile Creek surface water	2	16 (biweekly) plus ~3 (storm events)	32 (biweekly) plus ~36 (storm events[1])	Total mercury and methylmercury (unfiltered), TSS, 12 water samples for dissolved total mercury, and *in situ* measurements of turbidity at the State Fair Boulevard location
Ninemile Creek surface water	2	4	8	PCB aroclors and dioxins-furans
Onondaga Creek surface water	1	16 (biweekly) plus ~3 (storm events)	16 (biweekly) plus ~18 (storm events[1])	Total mercury and methylmercury (unfiltered), TSS, and six water samples for dissolved total mercury.
Onondaga Creek surface water	1	4	4	PCB aroclors and dioxins-furans
Ley Creek sediment	Up to 4 locations, 2 to 4 depth intervals	1	Up to 16	VOCs, SVOCs, PCB Aroclors, PCB congeners (in subset), eight metals, TPH, percent solids, TOC, and grain size (in subset)
Onondaga Creek sediment	Up to 10 locations, 2 to 4 depth intervals	1	Up to 40	VOCs, SVOCs, PCB Aroclors (PCB congeners in subset), eight metals, TPH, percent solids, TOC, and grain size (in subset)
Surface water from Ley Creek, Harbor Brook, Tributary 5A, East Flume, West Flume, Bloody Brook, and Sawmill Creek	7	4	28	Total mercury and methylmercury (unfiltered), TSS, PCB aroclors, and dioxins-furans

Note - [1]Based on three storm events and six samples per storm event per location.

APPENDIX A

STANDARD OPERATING PROCEDURES (SOPs)

UFI No. 315: YSI Sonde Calibration and Maintenance

UFI No. 318: *In situ* Deployment of YSI Sondes

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN (QAPP)