APPENDIX B: DESCRIPTION OF SEDIMENT MANAGEMENT UNITS

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SECTION B.1

INTRODUCTION OF SMU DESIGNATIONS

For the purposes of this Feasibility Study (FS), Onondaga Lake has been divided into eight sediment management units (SMUs) based on water depth, sources of water entering the lake, and physical, ecological and chemical risk drivers. SMUs 1 through 7 are located in the littoral zone of the lake (i.e., in water depths of 0 to 30 feet (ft) [0 to 9 meters (m)] and SMU 8 encompasses the profundal zone of the lake (i.e., in water depths greater than 30 ft [9 m]).

The eight SMUs are divided as follows:

- SMU 1: In-Lake Waste Deposit (ILWD)
- SMU 2: Causeway
- SMU 3: Wastebeds 1 Through 8
- SMU 4: Mouth of Ninemile Creek
- SMU 5: Northern Shore
- SMU 6: Ley Creek to 700 ft South of Onondaga Creek
- SMU 7: 700 ft South of Onondaga Creek to the ILWD
- SMU 8: Profundal Area

This appendix describes the physical, ecological, geological, geotechnical, and chemical properties of each SMU. Ecological characteristics described in this Appendix are based on the baseline ecological risk assessment (BERA) (TAMS, 2002a) and on surveys conducted during 1994 by Ringler *et al.*, (1995). Additional information regarding the habitat conditions in the lake can be found in Appendix M, habitat issues. Chemical, geological, and geotechnical properties described in this appendix are based on data presented in the remedial investigation (RI) (TAMS, 2002c) and the upwelling investigation (Parsons, 2003). Identification of potential sources of CPOIs and key risk concerns for each SMU is based on information provided in the baseline ecological risk assessment, human health risk assessment, and remedial investigation report (TAMS, 2002a, b, and c) and summarized in Section 1 of the FS report.

Tables B.1 through B.8 present the minimum, maximum, and average values for various geotechnical parameters from samples collected in each SMU. Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU.

Figure B.1 shows the locations of the eight SMUs. Figures B.2 through B.10 present aerial views of each SMU. Figure B.11 shows the bathymetry of Onondaga Lake. Figures B.12 through B.15 show views of habitat conditions and ecological characteristics. Figure B.16 shows potential sources of CPOIs to the lake. Figures B.17 through B.19 show where non-aqueous phase liquid has been identified in the lake. Figures showing CPOI concentrations throughout the lake can be found in Section 5 of the RI report (TAMS, 2002c).

SECTION B.2

SMU 1 – IN-LAKE WASTE DEPOSIT

SMU 1 is located at the southern end of Onondaga Lake and encompasses the ILWD. The ILWD was formed primarily through the precipitation of calcium carbonate from the overflow of dikes around Wastebed B and through discharges via the East Flume. Figure B.1 shows the location of SMU 1.

B.2.1 PHYSICAL PROPERTIES

SMU 1 has a surface area of approximately 84 acres. It extends approximately 3,850 ft (1,173 m) west from the mouth of Harbor Brook. At its widest point, it extends approximately 2,200 ft (671 m) into the lake. The water depth in SMU 1 ranges from 0 to 30 ft (0 to 9 m). Lake bathymetry (the depth measurements throughout the lake) indicates that the nearshore shelf (at water depths less than 13 ft [4 m]) is relatively broad and is bordered by a steeper offshore slope at water depths from 13 to 30 ft (4 to 9 m).

A geophysical survey indicated the presence of one target, located near the boundary of SMU 1 and SMU 2, which may be interpreted as either a sunken vessel or a "cultural artifact." The artifact was located approximately 4,200 ft from the eastern shoreline, and 1,000 ft from the southern shoreline. A pipe and diffuser were also identified approximately 500 ft east of the “cultural artifact.”

SMU 1 is located directly offshore of Wastebed B. The East Flume and the Harbor Brook flow into Onondaga Lake in SMU 1.

B.2.2 ECOLOGICAL PROFILE

Limited macrophyte cover is present in SMU 1; macrophyte beds in this SMU are located only on the borders of SMU 1 with SMU 2 (*Elodea canadensis)* and SMU 1 with SMU 7 (*Potamogeton pectinatus* near the mouth of Harbor Brook). Moderately to severely impaired benthic macroinvertebrate (BMI) communities are present in SMU 1. SMU 1 supports impaired fish nest densities of less than 100 nests/600 m^2. Oncolite volumes are generally low (less than 25 milliliters (mL)/0.06 m^2).

B.2.3 POTENTIAL SOURCES OF CHEMICALS OF POTENTIAL INTEREST

The RI identified multiple external sources for most of the CPOIs present in the lake. The following sources, shown on Figure B.16, are located in the vicinity of SMU 1:

- Harbor Brook/Wastebed B. Harbor Brook/Wastebed B is divided into four areas: the Lakeshore Area, the Penn-Can Property, the CSX Railroad Area, and Harbor Brook – Lower Reaches.

  - The Lakeshore Area, designated as Wastebed B, was used for the disposal of Solvay waste and dredging spoils.
  - Penn-Can Property. This area was used for the production and storage of asphalt products.
  - CSX Railroad Area. This area has been controlled by the railroad from 1900 until the present.
  - Harbor Brook – Lower Reaches. Harbor Brook flows adjacent to the Lakeshore Area, the Penn-Can Property, and the CSX Railroad Area before entering Onondaga Lake.
- Former Willis Avenue Area. This area includes the Former Willis Avenue Plant Area – Lakeshore Property, the East Flume, Tributary 5A, and the I-690 Storm Drainage System.

B.2.4 NON-AQUEOUS-PHASE LIQUID

NAPL is present within layers of the ILWD and is typically found in small brown nodules. As noted on Figure B.17, the NAPL is present along the shoreline and toward the outer edges of the deposit at depths up to 15 ft below the sediment surface.

The properties of the NAPL are difficult to quantify due to the small quantities present within the waste. NAPL observations are identified based primarily on 2-inch-diameter cores installed during various investigations. The NAPL did not appear to be present in continuous layers. Sheens were also noted on the lake surface at every location in this area during intrusive activities.

There are two main types of NAPL found in the lake: monochloro- and dichlorobenzene NAPL, and "coal-tar"-type NAPL. Available data indicate that the monochloro- and dichlorobenzene NAPL found in one sample location near Willis Avenue may be related to an onshore plume. However, NAPL found in other samples is consistent with direct deposition to the lake, rather than migration to the lake from onshore sources. There is no evidence of significant mobility of the NAPL residual in the lake, except during disturbance such as well placement, sediment coring and sample collection. Therefore, future significant migration of residual NAPL in the lake is unlikely. Additional discussion of NAPL is provided in Appendix H, capping issues.

B.2.5 SEDIMENT CHARACTERISTICS

B.2.5.1 Geological/Geotechnical Characteristics

This description is based on review of the following information:

- Logs for cores S309, S310, S311, and S312,
- Logs for borings B-76-1 and B-76-2,
- Logs for the Honeywell upwelling investigation borings,

- Geotechnical laboratory and field testing completed for the Honeywell upwelling investigation, and
- Geotechnical laboratory and field testing completed for the RI.

The subsurface sediments have been categorized into three general units:

- Surface sediments,
- Waste material, and
- Native sediments.

Table B.1 presents the minimum, maximum, and average values for various geotechnical parameters from samples collected in SMU 1. The geological/geotechnical characteristics of the surface sediments, waste material, and native sediment are briefly described below.

Surface Sediments

Surface sediments overlying the waste material were typically very high moisture content, low-strength organic silts. Some areas had some sand present. Some shells and wood fragments were also present. The thickness of the surface layer varied from 0 to 3 ft. The thicker deposits of this layer were observed furthest from shore; approaching the shore, in higher energy areas, the thickness tended to decrease.

Waste Material

The waste material was typically classified as very soft to soft calcareous material with some variations observed with depth and extent. In certain locations, the surface was a very hard calcite layer. With depth, harder layers were also occasionally observed, but were not continuous. The thickness of these layers tended to range from 3 to 24 inches.

The calcareous material varied from a granular texture (sand sized) to more of a silt/clay-sized fraction. Thin layers of fine to very fine sand were also occasionally observed in the material. The sand tended to be observed somewhat more in the upper layers of the unit. In some instances, the sand was a thin, distinct layer, sometimes mixed with the waste material at a 50/50 distribution.

Limited index test data were available for the waste material. Most of the index tests were completed on samples in the upper 5 to 6 ft of the unit. The material was commonly classified as ML and is non-plastic. Blow counts in the material were commonly 0 (weight of the rods). One sample had a blow count of 13 due to a harder calcite layer. Consolidation tests indicate that the material is overconsolidated. Moisture contents of the unit were typically 90 to 140 percent. Void ratios were commonly 2 to 3.5. The specific gravity varied between 2 and 2.6. Vane shear tests completed in the unit measured undrained shear strengths commonly in two ranges: 10 to 20 pounds per square foot (psf) and 30 to over 50 psf. The harder calcite layers had measured undrained shear strengths of 1,900 psf. Results from Atterberg limits tests indicated that the material is non-viscous and non-plastic.

The thickness of the unit, as observed in borings B-76-1 and B-76-2, was approximately 48 feet thick.

Native Sediments

The native sediment below the waste material is silt and clay. Blow counts and index tests were not available for this unit.

B.2.5.2 Chemical Characteristics

Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU[1].

B.2.5.3 Sediment Porewater Characteristics

Samples were collected from sediment porewater in 1992, 2000, and 2002. As described in the RI, the data collected during 1992 were not considered usable. In 2000, three porewater samples (S344, S402, and S405) were collected from SMU 1 and analyzed for mercury, methylmercury, sulfides, iron, and manganese. In 2002, porewater samples were collected from 12 locations in SMU 1 and analyzed for volatile organic compounds (VOCs), PAHs and other semivolatile organic compounds (SVOCs), metals, and various geochemical and water quality parameters.

In all three samples collected in SMU 1 in 2000, the porewater concentrations of dissolved total mercury and methylmercury in the 0 to 4 centimeter (cm) interval were higher than in the overlying water. Results from this sampling event are presented on Figures 5-137, 5-140, and 5-141 of the RI (TAMS, 2002c). Mercury and methylmercury concentrations in porewater generally increased with increasing depth. Porewater sulfide concentrations were consistently higher than corresponding concentrations in the overlying water. Sulfide concentrations in porewater generally increased with increasing depth. Porewater iron concentrations were consistently higher than corresponding concentrations in the overlying water. Iron did not exhibit consistent trends with increasing core depth. Porewater manganese concentrations were not consistently higher or lower than corresponding concentrations in the overlying water. Manganese concentrations in porewater generally decreased with increasing depth.

The 2002 samples were all collected between 3.5 and 4.5 ft deep and therefore did not indicate increasing or decreasing concentration trends with depth. Several VOCs were present in these samples at concentrations up to 3,200 micrograms per liter (µg/L). However, it should be noted that the VOC results from this investigation might be unusable due to the sample collection methods. PAHs were present at concentrations up to 1,642 µg/L, while other SVOCs were present at concentrations up to 5,400 µg/L. Mercury ranged from 0.122 µg/L to 749 µg/L (total) and from 0.0015 µg/L to 748 µg/L (dissolved). Methylmercury ranged from 0.000439 µg/L to 2.36 µg/L.

[1] CPOIs potentially released from the ILWD include BTEX, chlorinated benzenes, PAHs, PCBs, and PCDD/PCDFs. With the exception of chlorinated benzenes, all of these contaminants also have other sources to the lake that are not related to former Honeywell operations.

B.2.6 SURFACE WATER CHARACTERISTICS

The following subsections summarize the occurrence of CPOIs in surface water in SMU 1. Surface water samples were taken from one location (W50) in SMU 1 in 1999 and from several locations in 2001.

Mercury and Other Metals

Mercury concentrations ranged from 4.89 to 49.4 nanograms per liter (ng/L) (total, unfiltered) in surface water in 2001. Mercury was measured at 12.2 ng/L (unfiltered) and 1.80 ng/L (dissolved) in 1999. Methylmercury was measured at 0.984 ng/L (unfiltered) and 0.366 ng/L (dissolved) in 1999.

Several other metals were also detected in surface water in SMU 1.

Benzene, Toluene, Ethylbenzene, and Xylenes

Benzene and toluene were detected at 6.3 µg/L and 0.16 µg/L, respectively, in SMU 1.

Chlorinated Benzenes

Three chlorinated benzene CPOIs (1,2-dichlorobenzene, 1,4-dichlorobenzene, and chlorobenzene) were detected at 3.2 µg/L, 3.4 µg/L, and 12 µg/L, respectively, in SMU 1.

Other Organic CPOIs

Two other organic CPOIs (chloroform and bromodichloromethane) were detected at 0.84 µg/L and 0.24 µg/L, respectively, in SMU 1.

Other Analytes

Several potential stressor compounds, including chloride, nitrogen, phosphorous, sulfide, dissolved oxygen, and water transparency, were monitored in surface water. Descriptions of the monitoring data are presented in the RI.

B.2.7 PRIMARY RISK CONCERNS

The primary risk concerns and associated CPOIs and stressors in SMU 1 are as follows:

- Sediment toxicity to benthic macroinvertebrates: Mercury, ethylbenzene, xylenes, chlorobenzene, dichlorobenzenes, trichlorobenzenes, PAHs, total PCBs.
- Sediment exposure to humans by wading: Arsenic, PAHs, PCDD/PCDFs, hexachlorobenzene.
- Exposure of fish to mercury and other CPOIs and subsequent human and wildlife consumption of fish.
- Benthic macroinvertebrate/insect consumption by wildlife: PAHs, barium, chromium, mercury, methylmercury, selenium.
- Moderately to severely impaired benthic community: Sediment toxicity, limited macrophyte cover.

SECTION B.3

SMU 2 – CAUSEWAY

SMU 2, the causeway, is located in the southeast portion of the lake offshore from the causeway formerly used for loading and unloading materials. Figure B.1 shows the location of SMU 2.

B.3.1 PHYSICAL PROPERTIES

The causeway extends approximately 3,025 ft (922 m) along the southern shore of the lake, from the ILWD to Wastebed 1. At its widest point, it extends approximately 550 ft (168 m) into the lake. The water depth in SMU 2 ranges from 0 to 30 ft (0 to 9 m). Lake bathymetry indicates that the nearshore shelf is relatively broad, except near the mouth of Tributary 5A, where it becomes steeper (i.e., greater than 15 percent slope). The I-690 drains exit into this SMU.

A geophysical survey indicated the presence of one "cultural artifact" located near the boundary of SMU 1 and SMU 2. The artifact is located approximately 4,200 ft from the eastern shoreline, and 1,000 ft from the southern shoreline. A pipe and diffuser were also identified approximately 500 ft east of the "cultural artifact". In addition, a mound of unknown material was identified in SMU 2. The mound, which has a radius of approximately 500 ft, is located approximately 6,600 ft from the eastern end of the lake, next to the shoreline. Some debris was also identified in and around the mound.

B.3.2 ECOLOGICAL PROFILE

Limited macrophyte cover is present in SMU 2; four major macrophyte species are found in this SMU, including *Heteranthera dubia, Elodea canadensis, Potamogeton crispus,* and *Ceratophyllum demersum*. Moderately to severely impaired BMI communities are present in SMU 2. Portions of SMU 2 near the mouth of Tributary 5A support 100 to 300 nests/600 m^2 of fish nests; the remainder of the SMU supports impaired fish nest densities of less than 100 nests/600 m^2. Oncolite volumes are low (less than 25 mL/0.06 m^2) in the part of SMU 2 that borders SMU 1, and high (greater than 300 mL/0.06 m^2) in the part of SMU 2 that borders SMU 3.

B.3.3 POTENTIAL SOURCES OF CHEMICALS OF POTENTIAL INTEREST

The RI identified multiple external sources for most of the CPOIs present in the lake. The following sources, which are shown on Figure B.16, are located in the vicinity of SMU 2:

- Semet Residue Ponds. The Semet Residue Ponds include five ponds and two containment areas.

- Former Willis Avenue Area. This area includes the Former Willis Avenue Plant Area – Lakeshore Property, the East Flume, Tributary 5A, and the I-690 Storm Drainage System.

B.3.4 NON-AQUEOUS PHASE LIQUID

As shown on Figure B.18, stained fill material was observed at the TR02-A boring location, which was conducted as part of the upwelling investigation (Parsons, 2003). The 0 to 10.5-ft depth interval at this location contained black impacted fill material that was granular in nature (slag, brick, wood, etc.) and was likely placed during the construction of the causeway in the 1970s.

The stained fill material may be a result of NAPL in this area. The source of the contamination at this location is unknown at this time, but may be related to the dense NAPL (DNAPL) (chlorobenzene) plume from the Willis Avenue Site or from storm drains in the area.

B.3.5 SEDIMENT CHARACTERISTICS

B.3.5.1 Geological/Geotechnical Characteristics

This description is based on review of the following information:

- 8-meter depth core log S307 collected for the RI,
- 5-meter depth core logs TR02-A from the upwelling investigation,
- 2-meter depth cores collected for the RI, and
- Lab and field testing from 2 meter and 5-meter cores.

The logs provided described the following unit:

- Surface sediments,
- Debris fill, and
- Waste material.

Table B.2 presents the minimum, maximum, and average values for various geotechnical parameters from samples collected in SMU 2. The geological/geotechnical characteristics of the surface sediments, debris fill, and waste material are briefly described below:

Surface Sediments

The upper 6 ft of SMU 2 is described in the 2-meter depth cores collected for the RI. In general, this material consists of greenish gray sand and silt, with yellow and black streaking noted in various depth intervals, and occasional shell fragments. Greater amounts of sand were encountered near shore at locations S434 and S330. The surficial sediments consist of black and brown, non-plastic organic silt at the southern end of SMU 2 near S338 and S339. This silt material is classified as OL, with moisture content ranging from 135 to 241 percent, and specific

gravity of 2.50 to 2.54. Vane shear test results on the organic silt indicate minimal strength in the upper 3 ft (S338 and S339). At a depth of 6 ft in these locations, peak vane shear strengths ranged from 138 to 512 psf, and remolded strengths ranged from 22 to 28 psf.

Debris Fill

The upper 10.5 ft of core TR02-A consists of black, fine to coarse sand and gravel, with wood debris, brick fragments and other debris. This material was placed during construction of the causeway, which runs along the shoreline. This location was impacted with chlorobenzene (high sediment and porewater concentrations), most likely from the adjacent plume on the Willis Avenue property. The extent of the chlorobenzene plume (into the lake) has not been defined at this time.

Waste Material

Waste material was identified below the surface sediments at 10.5 ft below the sediment surface at the eastern end of SMU 2 (TR02-A). The matrix consists of soft to firm, gray, green, and white non-plastic silt (ML) Solvay waste with occasional granular material. The bottom of the Solvay waste was not encountered at the TR02-A location.

B.3.5.2 Chemical Characteristics

Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU.

B.3.5.3 Sediment Porewater

In 2002, porewater samples were collected from one location in SMU 2 and analyzed for VOCs, PAHs and other SVOCs, metals, and various geochemical and water quality parameters. The 2002 samples were all collected at 4.5 ft deep and therefore did not indicate increasing or decreasing concentration trends with depth. Several VOCs were present in these samples at concentrations up to 34,000 µg/L. However, it should be noted that the VOC results from this investigation might be unusable due to the sample collection methods. PAHs were present at concentrations up to 63.2 µg/L, while other SVOCs were present at concentrations up to 1,000 µg/L. Mercury ranged from 0.528 µg/L to 0.696 µg/L (total) and from 0.208 µg/L to 0.702 µg/L (dissolved). Methylmercury ranged from 0.012 µg/L to 0.0124 µg/L.

B.3.6 SURFACE WATER CHARACTERISTICS

The following subsections summarize the occurrence of CPOIs in surface water in SMU 2. Surface water samples were taken from one location (W51) in SMU 2 in 1999.

Mercury and Other Metals

Mercury was measured at 11ng/L (unfiltered) and 1.71 ng/L (dissolved). Methylmercury concentrations were 0.803 ng/L (unfiltered) and 0.346 ng/L (dissolved).

Several other metals were also detected in surface water in SMU 2.

Chlorinated Benzenes

Two chlorinated benzene CPOIs were detected in SMU 2. 1,2-dichlorobenzene was detected at a concentration of 0.11 µg/L, and 1,4-dichlorobenzene was detected at a concentration of 0.31 µg/L.

Other Organic CPOIs

Two other organic CPOIs (chloroform and bromodichloromethane) were detected at 0.85 µg/L and 0.22 µg/L, respectively.

Other Analytes

Several potential stressor compounds, including chloride, nitrogen, phosphorous, sulfide, dissolved oxygen, and water transparency, were monitored in surface water. Descriptions of the monitoring data are presented in the RI.

B.3.7 PRIMARY RISK CONCERNS

The primary risk concerns and associated CPOIs and stressors in SMU 2 are as follows:

- Sediment toxicity to benthic macroinvertebrates: Mercury, ethylbenzene, xylenes, chlorobenzene, dichlorobenzenes, trichlorobenzenes, PAHs, total PCBs.
- Sediment exposure to humans by wading: Arsenic, PAHs, PCDD/PCDFs, hexachlorobenzene.
- Exposure of fish to mercury and other CPOIs and subsequent human and wildlife consumption of fish.
- Benthic macroinvertebrate/insect consumption by wildlife: PAHs, barium, chromium, mercury, methylmercury, selenium.
- Moderately to severely impaired benthic community: Sediment toxicity, limited macrophyte cover.

SECTION B.4

SMU 3 – WASTEBEDS 1 THROUGH 8

SMU 3 is located along the southern shore of Onondaga Lake. Figure B.1 shows the location of SMU 3.

B.4.1 PHYSICAL PROPERTIES

SMU 3 is located offshore of Wastebeds 1 through 8 and extends approximately 8,000 ft (2,438 m) west from SMU 2. At its widest point, it extends approximately 825 ft (251 m) into the lake. The water depth in SMU 3 ranges from 0 to 30 ft (0 to 9 m). Lake bathymetry indicates that the shelf is relatively steep in the southern part of SMU 3, becoming broader to the north.

B.4.2 ECOLOGICAL PROFILE

Limited macrophyte cover is present in most of SMU 3; several major macrophyte species, including *Ceratophyllum demersum, Elodea canadensis,* and *Potamogeton pectinatus,* are located in this SMU. The *Heteranthera dubia* bed in SMU 4 extends into SMU 3. Slightly to moderately impaired BMI communities are present throughout much of SMU 3. Portions of SMU 3 near the mouth of Tributary 5A support fish nest densities of 100 to 300 nests/600 m^2 of fish nests; the remainder of the SMU supports impaired fish nest densities of less than 100 nests/600 m^2. Oncolite volume ranges from low (less than 0.25 mL/0.06 m^2) to moderately high (100-300 mL/0.06 m^2) in SMU 3.

B.4.3 POTENTIAL SOURCES OF CPOIS

SMU 3 lies along Wastebeds 1 through 8, which were used to dispose waste from the manufacture of soda ash via the Solvay process.

B.4.4 NON-AQUEOUS PHASE LIQUID

NAPL has not been encountered in SMU 3.

B.4.5 SEDIMENT CHARACTERISTICS

B.4.5.1 Geological/Geotechnical Characteristics

This description is based on review of the following information:

- 2-meter depth cores S324 for the RI, and
- 30-cm depth cores S-362, S363, S364 and S365 collected for the RI.

The logs provided described the following unit:

- Surface sediments.

Table B.3 presents the minimum, maximum, and average values for various geotechnical parameters from samples collected in SMU 3. The geological/geotechnical characteristics of the surface sediments are briefly described below.

The upper 6 ft of SMU 3 generally consists of dark gray silt with pale yellow and green colors at various depth intervals. Organic debris and white, calcareous material were noted at a depth of about 9 inches in S365. The upper 6 inches of S363 was noted to be brown to gray sand.

B.4.5.2 Chemical Characteristics

Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU.

B.4.5.3 Sediment Porewater

Porewater samples were not collected from SMU 3 during the 1992, 2000, or 2002 investigations.

B.4.6 SURFACE WATER CHARACTERISTICS

The following subsections summarize the occurrence of CPOIs in surface water in SMU 3. Surface water samples were taken from one location (W52) in SMU 3 in 1999.

Mercury and Other Metals

Mercury concentrations ranged from 2.33 to 7.51 ng/L (unfiltered) and from 2.63 to 2.92 ng/L (dissolved) in surface water. Methylmercury concentrations ranged from 0.816 to 1.49 ng/L (unfiltered) and from 0.259 to 1.01 ng/L (dissolved).

Several other metals were also detected in surface water in SMU 3.

Benzene, Toluene, Ethylbenzene, and Xylenes

BTEX compounds were not detected in surface water in SMU 3.

Chlorinated Benzenes

One chlorinated benzene CPOI (1,4-dichlorobenzene) was detected in SMU 3 at a concentration of 0.16 µg/L.

Other Organic CPOIs

One other organic CPOI (chloroform) was detected in SMU 3 at a concentration of 0.22 µg/L.

Other Analytes

Several potential stressor compounds, including chloride, nitrogen, phosphorous, sulfide, dissolved oxygen, and water transparency, were monitored in surface water. Descriptions of the monitoring data are presented in the RI.

B.4.7 PRIMARY RISK CONCERNS

The primary risk concerns and associated CPOIs and stressors in SMU 3 are as follows:

- Sediment toxicity to benthic macroinvertebrates in some areas: Mercury, ethylbenzene, xylenes, dichlorobenzenes, total PCBs.
- Impaired habitat conditions: Calcitic sediments, unstable shoreline, limited macrophyte cover except at the border of SMUs 3 and 4.
- Slightly to moderately impaired benthic community: Sediment toxicity in some areas, limited macrophyte cover.

SECTION B.5

SMU 4 – MOUTH OF NINEMILE CREEK

SMU 4 is located along the southern shore of Onondaga Lake and includes the delta where Ninemile Creek discharges into the lake. Figure B.1 shows the location of SMU 4.

B.5.1 PHYSICAL PROPERTIES

SMU 4 extends approximately 3,300 ft (1,006 m) along the southern shore of the lake. At its widest point, it extends approximately 1,375 ft (419 m) into the lake. The water depth in SMU 4 ranges from 0 to 30 ft (0 to 9 m). Lake bathymetry indicates that the shelf is relatively steep in the northern part of SMU 4, becoming broader to the south.

One of the major tributaries to Onondaga Lake is Ninemile Creek, which is located along the southern shoreline of SMU 4. The mouth of the creek drives the depositional processes along the central portion of this SMU by discharging fine- and coarse-grained material to the lake. The sediment load from the creek dictates the bathymetry and water depth in the central portion of this SMU.

The geophysical survey indicated the presence of a sunken barge in SMU 4, approximately 2,000 ft northeast of Ninemile Creek.

B.5.2 ECOLOGICAL PROFILE

Several major macrophyte species, including *Elodea canadensis, Heteranthera dubia,* and *Potamogeton pectinatus*, are located in SMU 4. Moderately impaired BMI communities are present throughout much of SMU 4. The northern portion of SMU 4 supports fish nest densities of 100 to 300 fish nests/600 m^2. The southern portion of this SMU supports impaired fish nest densities of less than 100 nests/600 m^2. Oncolite volume is low (less than 25 mL/0.06 m^2) throughout much of SMU 4, but is high (greater than 300 mL/0.06 m^2) at the northern end of this SMU.

B.5.3 POTENTIAL SOURCES OF CPOIS

The RI identified multiple external sources for most of the CPOIs present in the lake. The following sources, shown on Figure B.16, are located in the vicinity of SMU 4:

- LCP Bridge Street Site and West Flume. The LCP Bridge Street site is located along the West Flume and consists of 20 acres of land used for various industrial activities. The West Flume discharges into Geddes Brook, which discharges into Ninemile Creek.

- Geddes Brook/Ninemile Creek Area. This area includes the Geddes Brook/Ninemile Creek site, and the Mathews Avenue Landfill site.
  - Geddes Brook/Ninemile Creek site. Geddes Brook discharges into Ninemile Creek, which flows adjacent to Wastebeds 5, 6, and 8 through 15 before entering Onondaga Lake in SMU 4.
  - Mathews Avenue Landfill site. The landfill, no longer in operation, was a construction/demolition debris disposal site.
- Wastebeds 9 through 15. Waste was disposed in Wastebeds 9 through 15 between 1944 and 1986.

B.5.4 NON-AQUEOUS PHASE LIQUID

NAPL has not been encountered in SMU 4.

B.5.5 SEDIMENT CHARACTERISTICS

B.5.5.1 Geological/Geotechnical Characteristics

This description is based on review of the following information:

- 8-meter depth core logs S301, S304, S305, and S306 collected for the RI;
- 5-meter depth core logs TR01-A, TR01-B, and TR01-C from the upwelling investigation;
- 30-centimeter depth core logs S358, S359, and S360 collected for the RI, and
- Lab and field testing from 5-meter cores.

The subsurface sediments have been categorized into three general units:

- Surface sediments,
- Calcareous material, and
- Waste material.

Table B.4 presents the minimum, maximum, and average values for various geotechnical parameters from samples collected in SMU 4. The geological/geotechnical characteristics of the surface sediments, calcareous material, and waste material are briefly described below.

Surface Sediments

The upper 1 ft of SMU 4, as described in the 30-centimeter, 5-meter, and 8-meter depth cores, consists of brown sand, dark gray and black non-plastic silt (ML), and dark gray silty sand. Below this interval, the surface sediments consist of soft black silt with zones of fine sand. The moisture content of this material ranged from 73 to 84 percent, with maximum dry density ranging from 74 to 84 pcf. Peak vane shear strengths were measured in the field to range from 260 to 390 psf, and the remolded vane shear strength was measured to be 130 psf. In S304 and

S306, the surface sediments were saturated fine to medium sands ranging in thickness from 2 to 10 ft, with interbeds of organic silt.

This area displays the physical characteristics typical of a stream delta. Grain size decreases with distance from the mouth of Ninemile Creek. Many of the cores identify stratification of fine- and coarse-grained materials, resulting from varying high- and low-energy discharge events.

Calcareous Material

At location TR01-A, gray, silty sand (SM) calcareous material (marl) was encountered at a depth of 0.6 ft and extended to the bottom of the boring (15 ft). Shells were present throughout the upper portions of this layer, decreasing in numbers by the 8-ft interval. No shells were encountered at the 10-ft depth. The moisture content ranged from 73 to 82 percent, with a maximum dry density of 79 pcf. The marl was heavily overconsolidated, with a measured void ratio of 1.64. The peak vane shear strength was measured in the field to be 1940 psf, and the remolded strength was measured to be 130 psf.

This layer was also encountered in S304 at a depth ranging from 4 to 24 ft (bottom of boring), and in S305 at a depth of 1 to 21 ft.

Waste Material

Waste material was identified below the surface sediments at a depth of 10 ft in location TR01-C. The matrix consists of black and gray silt, very fine sand, and Solvay waste. The bottom of the Solvay waste was not encountered in TR01-C. Solvay waste was also identified in a 2-inch thick lens at a depth of 21 ft in S305.

B.5.5.2 Chemical Characteristics

Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU.

B.5.5.3 Sediment Porewater

Samples were collected from sediment porewater in 1992, 2000, and 2002. As described in the RI, the data collected during 1992 were not considered usable. In 2000, one porewater sample (S305) was collected from SMU 4 and analyzed for mercury, methylmercury, sulfides, iron, and manganese. Results from this sampling event are presented on Figure 5-136 of the RI (TAMS, 2002c). In 2002, porewater samples were collected from three locations in SMU 4 and analyzed for VOCs, PAHs and other SVOCs, metals, and various geochemical and water quality parameters.

In the samples collected in 2000, porewater concentrations of dissolved total mercury, methylmercury, sulfides, iron, and manganese in the 0 to 4 cm interval were higher than in the overlying water. Mercury, methylmercury, and sulfide concentrations in porewater decreased

with increasing depth, while iron concentrations increased with increasing depth. Manganese did not exhibit a consistent trend with increasing core depth.

The 2002 samples were all collected at 4.5 ft deep and therefore did not indicate increasing or decreasing concentration trends with depth. Several VOCs were present in these samples at concentrations up to 7.4 µg/L. However, it should be noted that the VOC results from this investigation might be unusable due to the sample collection methods. No PAHs were detected in SMU 4. Other SVOCs were present at concentrations up to 28 µg/L. Mercury ranged from 0.0161 µg/L to 36.2 µg/L (total) and from 0.0048 µg/L to 0.0412 µg/L (dissolved). Methylmercury ranged from 0.000801 µg/L to 0.0133 µg/L.

B.5.6 SURFACE WATER CHARACTERISTICS

The following subsections summarize the occurrence of CPOIs in surface water in SMU 4. Surface water samples were taken from one location (W53) in SMU 4 in 1999.

Mercury and Other Metals

Mercury concentrations ranged from 9.81 to 26.2 ng/L (unfiltered) and from 4.11 to 7.83 ng/L (dissolved) in surface water. Methylmercury concentrations ranged from 0.815 to 0.822 ng/L (unfiltered) and from 0.216 to 0.250 ng/L (dissolved).

Several other metals were also detected in surface water in SMU 4.

Benzene, Toluene, Ethylbenzene, and Xylenes

BTEX compounds were not detected in surface water in SMU 4.

Chlorinated Benzenes

One chlorinated benzene CPOI (1,4-dichlorobenzene) was detected in SMU 4 at a concentration of 0.18 µg/L.

Other Organic CPOIs

One other organic CPOI (chloroform) was detected in SMU 4 at a concentration of 0.16 µg/L.

Other Analytes

Several potential stressor compounds, including chloride, nitrogen, phosphorous, sulfide, dissolved oxygen, and water transparency, were monitored in surface water. Descriptions of the monitoring data are presented in the RI.

B.5.7 PRIMARY RISK CONCERNS

The primary risk concerns and associated CPOIs and stressors in SMU 4 are as follows:

- Moderately impaired benthic community: Limited macrophyte cover in some areas.
- Exposure of fish to mercury and other CPOIs and subsequent human and wildlife consumption of fish.

SECTION B.6

SMU 5 – NORTHERN SHORE

SMU 5 includes the littoral zone along the northern shore of the lake. Sawmill Creek and Bloody Brook discharge into SMU 5. The Seneca River, the main discharge point for Onondaga Lake, is also located within SMU 5 at the northwestern end of the lake. Figure B.1 shows the location of SMU 5.

B.6.1 PHYSICAL PROPERTIES

SMU 5 extends approximately 30,000 ft (9,144 m) around the northern shore from the Ninemile Creek delta to the Ley Creek delta. At its widest point, it extends approximately 1,375 ft (419 m) into the lake. The water depth in SMU 5 ranges from 0 to 30 ft (0 to 9 m). Lake bathymetry indicates that the nearshore shelf (at water depths less than 13 ft [4 m]) is relatively broad and is bordered by a steep offshore slope at water depths from 13 to 30 ft (4 to 9 m).

The geophysical survey indicated the presence of a pipe or outfall in SMU 5. The structure is located in the approximate middle of the lake's northern shoreline. In addition, a "cultural artifact" was identified approximately 4,500 ft west of the pipe.

B.6.2 ECOLOGICAL PROFILE

Major macrophyte species in SMU 5 include *Heteranthera dubia, Elodea canadensis, Potamogeton pectinatus,* and *Myriophyllum spicatum*, which are found throughout SMU 5. Macrophyte cover is limited in some parts of this SMU. Slightly to moderately impaired BMI communities are present in SMU 5. The abundance of fish nests in nearshore habitats is greatest (greater than 300 nests/600 m^2) along the northwestern shoreline in a portion of SMU 5 bordering SMU 4. Portions of the nearshore zone near the mouth of Bloody Brook, near the mouth of Sawmill Creek, and near the lake outlet support 100 to 300 nests/600 m^2. The remainder of the shoreline supports impaired fish nest densities of less than 100 nests/600 m^2. High oncolite concentrations (greater than 300 mL/0.06 m^2) are found in several locations throughout SMU 5.

B.6.3 POTENTIAL SOURCES OF CPOIS

The RI identified multiple external sources for most of the CPOIs present in the lake. The following source, shown on Figure B.16, is located in the vicinity of SMU 5:

- Bloody Brook Area. Bloody Brook runs through the industrial complex operated by Lockheed Martin, some suburbs, and some major transportation rights of way, discharging into the middle of the northern side of the lake.

B.6.4 NON-AQUEOUS PHASE LIQUID

NAPL has not been encountered in SMU 5.

B.6.5 SEDIMENT CHARACTERISTICS

B.6.5.1 Geological/Geotechnical Characteristics

This description is based on review of the following information:

- 30-centimeter depth core logs S357, S370, S371, S372, S373, and S374 collected for the RI.

The logs provided describe the following unit:

- Surface Sediments.

Table B.5 presents the minimum, maximum, and average values for various geotechnical parameters from samples collected in SMU 5. The geological/geotechnical characteristics of the surface sediments are briefly described below.

At location S370, the upper 1 ft of SMU 5 consists of brown, medium-to-fine sand, underlain by light gray silt at a depth of 8 inches, with trace shells and varying amounts of aquatic vegetation. At locations S371 and S373 on the north side of Onondaga Lake, the surface sediments consist of olive brown silt overlying sand and silt.

B.6.5.2 Chemical Characteristics

Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU.

B.6.5.3 Sediment Porewater

Porewater samples were not collected from SMU 5 during the 1992 or 2000 investigations.

B.6.6 SURFACE WATER CHARACTERISTICS

The following subsections summarize the occurrence of CPOIs in surface water in SMU 5. Surface water samples were taken from four locations (W54, W57, and W58) in SMU 5 in 1999.

Mercury and Other Metals

Mercury concentrations in SMU 5 had a range of 4.84 to 14.3 ng/L for unfiltered mercury and 1.23 to 2.81 ng/L for dissolved mercury. Methylmercury concentrations ranged from 0.606 to 2.41 ng/L for unfiltered and 0.147 to 0.860 ng/L for dissolved.

Several other metals were also detected in surface water in SMU 5.

Benzene, Toluene, Ethylbenzene, and Xylenes

BTEX compounds were not detected in surface water in SMU 5.

Chlorinated Benzenes

One chlorinated benzene CPOI (1,4-dichlorobenzene) was detected in SMU 5. Concentrations ranged from non-detect to 0.19 µg/L.

Other Organic CPOIs

Chloroform was detected in surface water in SMU 5. The concentration of chloroform ranged from 0.13 µg/L to 0.36 µg/L.

Other Analytes

Several potential stressor compounds, including chloride, nitrogen, phosphorous, sulfide, dissolved oxygen, and water transparency, were monitored in surface water. Descriptions of the monitoring data are presented in the RI.

B.6.7 PRIMARY RISK CONCERNS

The primary risk concerns and associated CPOIs and stressors in SMU 5 are as follows:

- Slightly impaired habitat conditions in some areas: Oncolites and limited macrophyte cover in some areas.
- Slightly to moderately impaired benthic communities: Limited macrophyte cover in some areas.

SECTION B.7

SMU 6 – LEY CREEK TO 700 FT SOUTH OF ONONDAGA CREEK

SMU 6, the Ley Creek to 700 ft South of Onondaga Creek Littoral Area, includes the deltas where Ley Creek and Onondaga Creek discharge into Onondaga Lake.

Figure B.1 shows the location of SMU 6.

B.7.1 PHYSICAL PROPERTIES

SMU 6 extends approximately 4,950 ft (1,509 m) along the eastern end of Onondaga Lake, from the Ley Creek delta to approximately 700 ft south of Onondaga Creek. At its widest point, it extends approximately 1,925 ft (587 m) north into the lake. The water depth in SMU 6 ranges from 0 to 30 ft (0 to 9 m). Lake bathymetry indicates that the nearshore shelf is relatively broad.

The geophysical survey indicated the presence of two pipes or outfalls in SMU 6. One structure is located next to Ley Creek, while the second is located at the southern end of the SMU, near Onondaga Creek. These pipes and outfalls are located approximately 1,000 ft from the shoreline.

B.7.2 ECOLOGICAL PROFILE

Five macrophyte species are located in SMU 6, including *Heteranthera dubia, Elodea canadensis, Potamogeton pectinatus, Myriophyllum spicatum,* and *Ceratophyllum demersum.* Moderately to severely impaired BMI communities are present in SMU 6. SMU 6 supports impaired fish nest densities of less than 100 nests/600 m^2. Oncolite concentrations in SMU 6 are low (less than 25 mL/0.06 m^2).

B.7.3 POTENTIAL SOURCES OF CPOIS

The RI identified multiple external sources for most of the CPOIs present in the lake. The following sources, shown on Figure B.16, are located in the vicinity of SMU 6:

- Ley Creek Area. This area contains the GM Former Inland Fisher Guide Facility and Ley Creek Deferred Media site, the GM Ley Creek Dredgings site, the Town of Salina Landfill, and the GM Old Ley Creek Channel site.
- Onondaga Creek Area. This area includes the Niagara Mohawk – Erie Boulevard MGP site, the Niagara Mohawk – Hiawatha Boulevard MGP site, the Roth Steel site, and the American Bag and Metal site.
- Oil City Area. This location was used as a bulk storage and transfer facility for numerous industries.

B.7.4 NON-AQUEOUS PHASE LIQUID

NAPL has not been encountered in SMU 6.

B.7.5 SEDIMENT CHARACTERISTICS

B.7.5.1 Geological/Geotechnical Characteristics

This description is based on review of the following information:

- 8-meter depth core logs S316, S317, S318, S319, S320, S321, S322, and S323 collected for the RI.

The logs provided describe the following unit:

- Surface Sediments.

Table B.6 presents the minimum, maximum, and average values for various geotechnical parameters from samples collected in SMU 6. The geological/geotechnical characteristics of the surface sediments are briefly described below.

Surface sediments consist of black and gray silt and clay, with organics, wood pieces, trace sand, and occasional sand interbeds throughout the depth of the core. At location S319, the majority of the silt was described as black, highly saturated, and organic, with similar material encountered at varying elevations in S321, S322, and S323 within the northern half of SMU 6. Observations from deeper intervals noted gravel in S320 at a depth of 11 to 12 ft below the sediment surface.

At location S318, a 2-ft thick sand layer was encountered near the surface. At location S316, surface sediments were described as dark brown, saturated fine-to-medium sand with trace silt, gravel and root fibers to a depth of 19 ft. Below 19 ft in S316, dark brown, stiff sand and silt were encountered to the bottom of the exploration.

B.7.5.2 Chemical Characteristics

Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU.

B.7.5.3 Sediment Porewater

Porewater samples were not collected from SMU 6 during the 1992 or 2000 investigations.

B.7.6 SURFACE WATER CHARACTERISTICS

No surface water data were collected in SMU 6.

B.7.7 PRIMARY RISK CONCERNS

The primary risk concerns and associated CPOIs and stressors in SMU 6 are as follows:

- Sediment toxicity to benthic macroinvertebrates: Mercury, ethylbenzene, xylenes, dichlorobenzenes, PAHs, total PCBs.
- Sediment exposure to humans by wading: Arsenic, PAHs, PCDD/PCDFs, hexachlorobenzene.
- Exposure of fish to mercury and other CPOIs and subsequent human and wildlife consumption of fish.
- Benthic macroinvertebrate/insect consumption by wildlife: PAHs, barium, chromium, mercury, methylmercury, selenium.
- Impaired habitat conditions: Limited macrophyte cover.

SECTION B.8

SMU 7 – 700 FT SOUTH OF ONONDAGA CREEK TO THE ILWD

SMU 7 is located at the southern corner of Onondaga Lake and includes the littoral zone located between SMU 1 and SMU 6. SMU 7 is located between Harbor Brook to the west and the Onondaga Creek delta to the east.

Figure B.1 shows the location of SMU 7.

B.8.1 PHYSICAL PROPERTIES

SMU 7 extends approximately 1,375 ft (419 m) along the shore of the lake. At its widest point, it extends approximately 2,200 ft (671 m) into the lake. The water depth in SMU 7 ranges from 0 to 30 ft (0 to 9 m). Lake bathymetry indicates that the shelf is relatively broad near the shore, becoming slightly steeper at a water depth greater than 13 ft (4 m).

B.8.2 ECOLOGICAL PROFILE

One major macrophyte bed, consisting mainly of *Potamogeton pectinatus*, is located in SMU 7. Moderately to severely impaired BMI communities are present in SMU 7. SMU 7 supports impaired fish nest densities of less than 100 nests/600 m^2. Oncolite concentrations in SMU 7 are low (less than 25 mL/0.06 m^2).

B.8.3 POTENTIAL SOURCES OF CPOIS

The RI identified multiple external sources for most of the CPOIs present in the lake. The following source, shown on Figure B.16, is located in the vicinity of SMU 7:

- Harbor Brook. Harbor Brook flows adjacent to the Lakeshore Area, the Penn-Can Property, and the CSX Railroad Area before entering Onondaga Lake.

B.8.4 NON-AQUEOUS PHASE LIQUID

As shown on Figure B.19, NAPL was observed in one boring in SMU 7. In addition, sheen was consistently noted at the water surface during installation of borings in 2002 for the upwelling investigation (Parsons, 2003).

B.8.5 SEDIMENT CHARACTERISTICS

B.8.5.1 Geological/Geotechnical Characteristics

This description is based on review of the following information:

- 8-meter depth core logs S313, S314 and S315 collected for the RI,

- 5-meter depth core logs TR05-C, TR05-D, TR06-A, TR06-B, and TR06-C from the upwelling investigation,
- 2-meter depth core logs S352 and S353 collected for the RI, and
- Lab and field testing from 2-meter, 5-meter, and 8-meter depth cores.

The subsurface sediments have been categorized into three general units:

- Surface sediments,
- Calcareous material, and
- Waste material.

Table B.7 presents the minimum, maximum, and average values for various geotechnical parameters from samples collected in SMU 7. The geological/geotechnical characteristics of the surface sediments, calcareous material, and waste material are briefly described below.

Surface Sediments

The surface sediments in SMU 7 are described as very soft to loose, gray and black, non-plastic, laminated silt and silty sand (ML-SM), with some areas of fine sand and shells. In the 8-meter depth cores, surface sediments consisted of saturated, dark gray and black, organic silt, as well as light gray silt with debris and organics interspersed. The moisture content ranged from 84 to 123 percent, with maximum dry density ranging from 71 to 80 pcf. Field peak vane shear strengths ranged from 9 to 259 psf, and remolded strengths ranged from 1 to 35 psf. Surface sediments in the 2-meter depth cores near the shore in SMU 7 consisted of dark to light, gray, silty sand with shells and organics. Field peak vane shear strengths ranged from 14 to 48 psf, and remolded strengths ranged from 0 to 5 psf, with a single measurement of remolded strength of 130 psf in TR06-A.

Calcareous Material

At locations TR06-A and TR06-B, dark gray silt and clay, overconsolidated calcareous material (marl) was encountered from 1.5 to 10.2 ft, extending to the bottom of each boring (approximately 15 ft). Shells were present throughout this layer, with some organics noted. The moisture content was measured to be 84 percent, with a void ratio of 2.24.

Waste Material

Waste material was identified below the surface sediments in variable layers at four locations (TR05-C and D). The interbedded layers of waste in this area are a result of large discharge events of waste material near the center of the ILWD. When large volumes of waste were discharged or overflowed to the lake, the waste flowed out toward the edge of the ILWD and was interbedded with the black organic silt/sand. The depths of the waste material ranged from 13.0 to 14.7 ft in TR05-C to 12 to 14 ft at TR05-D. The moisture content of the waste material was 54 percent, with a maximum dry density of 78 pcf. The peak vane shear strength

was 181 psf, and the remolded strength was less than 130 psf. The top of the Solvay waste was encountered at depths ranging from 12 to 13 ft, while the bottom of the Solvay waste was encountered at depths ranging from 14 to 14.7 ft. The material was classified as ML.

B.8.5.2 Chemical Characteristics

Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU.

B.8.5.3 Sediment Porewater

In 2002, porewater samples were collected from five locations in SMU 7 and analyzed for VOCs, PAHs and other SVOCs, metals, and various geochemical and water quality parameters. The 2002 samples were all collected at 4.5 ft deep and therefore did not indicate increasing or decreasing concentration trends with depth. Several VOCs were present in these samples at concentrations up to 180 µg/L. However, it should be noted that the VOC results from this investigation might be unusable due to the sample collection methods. PAHs were present at concentrations up to 126.2 µg/L, while other SVOCs were present at concentrations up to 12 µg/L. Mercury ranged from 0.0835 µg/L to 5.57 µg/L (total) and from 0.005 µg/L to 0.0323 µg/L (dissolved). Methylmercury ranged from 0.00225 µg/L to 0.0561 µg/L.

B.8.6 SURFACE WATER CHARACTERISTICS

The following subsections summarize the occurrence of CPOIs in surface water in SMU 7. Surface water samples were taken from one location (W55) in SMU 7 in 1999.

Mercury and Other Metals

Mercury was measured at 103 ng/L (unfiltered) and 1.82 ng/L (dissolved) in 1999. Methylmercury was measured at 1.09 (unfiltered) and 0.347 ng/L (dissolved) in 1999.

Several other metals were also detected in surface water in SMU 7.

Benzene, Toluene, Ethylbenzene, and Xylenes

Benzene and xylenes were detected at 0.11 µg/L and 0.33 µg/L, respectively, in SMU 7.

Chlorinated Benzenes

Three chlorinated benzene CPOIs (1,2-dichlorobenzene, 1,4-dichlorobenzene, and chlorobenzene) were detected at 0.17 µg/L, 0.53 µg/L, and 0.51 µg/L, respectively, in SMU 7.

Other Organic CPOIs

Two other organic CPOIs (chloroform and bromodichloromethane) were detected at 0.59 µg/L and 0.17 µg/L, respectively, in SMU 7.

Other Analytes

Several potential stressor compounds, including chloride, nitrogen, phosphorous, sulfide, dissolved oxygen, and water transparency, were monitored in surface water. Descriptions of the monitoring data are presented in the RI.

B.8.7 PRIMARY RISK CONCERNS

The primary risk concerns and associated CPOIs and stressors in SMU 7 are as follows:

- Sediment toxicity to benthic macroinvertebrates: Mercury, ethylbenzene, xylenes, chlorobenzene, dichlorobenzenes, trichlorobenzenes, PAHs, total PCBs.
- Sediment exposure to humans by wading: Arsenic, PAHs, PCDD/PCDFs, hexachlorobenzene.
- Exposure of fish to mercury and other CPOIs and subsequent human and wildlife consumption of fish.
- Benthic macroinvertebrate/insect consumption by wildlife: PAHs, barium, chromium, mercury, methylmercury, selenium.
- Impaired habitat conditions: Limited macrophyte cover.

SECTION B.9

SMU 8 – PROFUNDAL AREA

SMU 8 includes the profundal zone of Onondaga Lake, where the water depth is greater than 9 m. Figure B.1 shows the location of SMU 8.

B.9.1 PHYSICAL PROPERTIES

SMU 8 encompasses the entire area where the water depth is 30 ft (9 m) or greater. It is approximately 22,000 ft (6,706 m) long and is approximately 5,225 ft (1,593 m) wide at its widest part. SMU 8 has two basins, northern and southern, which are separated by a slight ridge approximately 56 ft (17 m) deep. The maximum depths of the northern and southern basins are 61.7 ft (18.8 m) and 65.3 ft (19.9 m), respectively. Lake bathymetry indicates that the profundal nearshore shelf is relatively steep, becoming broader towards the center of the lake.

The geophysical survey indicated the presence of a mound of unknown material in SMU 8. The mound, which has dimensions of approximately 900 ft by 300 ft, is located approximately 1,200 ft south of Onondaga Creek and 2,500 ft offshore. A "cultural artifact" was also noted in the alignment of Onondaga Creek, approximately 5,000 ft offshore.

B.9.2 ECOLOGICAL PROFILE

There are no macrophyte beds in SMU 8 because of its depth and limited light.

B.9.3 POTENTIAL SOURCES OF CPOIS

The RI identified multiple external sources for most of the CPOIs present in SMU 8. The sources are discussed in the previous sections describing SMUs 1 through 7.

B.9.4 NON AQUEOUS-PHASE LIQUID

NAPL has not been encountered in SMU 8.

B.9.5 SEDIMENT CHARACTERISTICS

B.9.5.1 Geological/Geotechnical Characteristics

This description is based on review of the following information:

- 8-meter depth core logs S302 and S303 collected for the RI;
- 2-meter depth core logs S327, S354, and S355 collected for the RI; and
- Lab and field testing from 8-meter cores.

The logs provided describe the following unit:

- Surface Sediments.

Table B.8 presents the minimum, maximum, and average values for various geotechnical parameters from samples collected in SMU. The geological/geotechnical characteristics of the surface sediments are briefly described below.

SMU 8 surface sediments consist of soft, gray and black, low-plasticity organic silt (OL) and gray-brown clay with scattered organics, roots, and grass. Results from one sample indicated a moisture content of 73 percent and a specific gravity of 2.63. Peak vane shear strengths ranged from 3 to 59 psf, while remolded strengths ranged from 0 to3.5 psf.

B.9.5.2 Chemical Characteristics

Tables B.9 through B.16 summarize average CPOI concentrations in sediment by SMU.

B.9.5.3 Sediment Porewater

Samples were collected from sediment porewater in 1992 and 2000. As described in the RI, the data collected during 1992 were not considered usable. In 2000, three porewater samples (S303, S354, and S355) were collected from SMU 8 and analyzed for mercury, methylmercury, sulfides, iron, and manganese. Results from this sampling event are presented on Figures 5-135, 5-138, and 5-139 of the RI (TAMS, 2002c).

In all three samples collected in SMU 8, the porewater concentrations of dissolved total mercury, methylmercury, sulfides, iron, and manganese in the 0 to 4 cm interval were higher than in the overlying water.

In the sample (S303) collected in the northern basin, concentrations of mercury and methylmercury decreased from 0 to 4 cm to 4 to 8 cm, but increased from 4 to 8 cm to 106 to 110 cm. Sulfides and manganese decreased with increasing depth; iron did not exhibit a consistent trend with increasing depth.

In the two samples (S354 and S355) collected in the southern basin, concentrations of mercury and methylmercury decreased from 0 to 4 cm to 4 to 8 cm, and remained approximately the same from 4 to 8 cm to 106 to 110 cm. Sulfides decreased with increasing depth; iron and manganese did not exhibit consistent trends with increasing depth.

B.9.6 SURFACE WATER CHARACTERISTICS

The following subsections summarize the occurrence of CPOIs in surface water in SMU 8. Samples were taken at several depths from stations within the southern and northern basins (W1 and W2) in 1992 and 1999. Several samples were also collected from the southern basin in 2001.

Mercury and Other Metals

Mercury, methylmercury, and several other metals were detected in surface water in SMU 8. Section 1 of the FS and Chapter 5 of the RI contain several figures showing the distribution of mercury and methylmercury in the lake with depth.

Benzene, Toluene, Ethylbenzene, and Xylenes

BTEX compounds were not detected in SMU 8.

Chlorinated Benzenes

One chlorinated benzene CPOI (1,4-dichlorobenzene) was detected in the southern and northern basins of SMU 8.

Other Organic CPOIs

Two other organic CPOIs (bromodichloromethane and chloroform) were detected in SMU 8.

Other Analytes

Several potential stressor compounds, including chloride, nitrogen, phosphorous, sulfide, dissolved oxygen, and water transparency, were monitored in surface water. Descriptions of the monitoring data are presented in the RI.

B.9.7 PRIMARY RISK CONCERNS

The primary risk concerns and associated CPOIs and stressors in SMU 8 are as follows:

- Impaired benthic community: Anoxia
- Exposure of fish to mercury and other CPOIs and subsequent human and wildlife consumption of fish.

SECTION B.10

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APPENDIX B

TABLES

TABLE B.1
SMU 1 SUMMARY OF GEOTECHNICAL CHARACTERISTICS

	Minimum	Maximum	Average
Natural Moisture Content [a,b] (% dry weight)	48	153	101.0
Atterberg Limits [a, b]	Non-Viscous and Non-Plastic		
Grain Size: percent passing through number 200 sieve [a, b]	82	99.7	91.6
Total organic carbon content [a] (percent dry weight)	<1	3	NA
Fine grained fraction [a] (percent dry weight)	1	90	50-90
Oncolites [a] (mL/.06m^2)	No Data Available		
Calcium carbonate [a] (percent dry weight)	<60	80	60-80
In-Situ Vane Shear Test [a, b] (psf): remolded	0.0	129.3	<21.1
Peak[a]	0.0	1263.1	98.3
Undisturbed[b]	<129.3	1809.5	<458.9
Consolidation Testing: compression index [a,b] (C_c)	0.39	2.21	1.07
Standard Proctor: maximum dry density [b] (pcf)	67.4	85.5	75.8
Optimum moisture content [b] (%)	28	45	35.7
Specific Gravity [a]	2.02	2.56	2.36
Total Carbonate Content [a] (%)	32	35	33.5
Hydraulic Head Measurements [b] (ft AMSL): lake/upper piezometer	362.96	364.04	363.51
Average hydraulic gradient: lake/upper piezometer	-0.03	0.21	0.09
Hydraulic head measurements (ft AMSL): upper/lower piezometer	359.00	364.41	363.09
Average hydraulic gradient: upper/lower piezometer	-0.50	0.13	-0.04

Notes: N/A - Not Available.

Data presented are from the following reports:

[a] Onondaga Lake Remedial Investigation Report, TAMS, 2002c. Sample Locations S309, S310, S311, S312, S338, S339A, S340VS, S341, S341A, S342A, S343, S344, S346VS, S347, S348, S350, and S351A.

[b] Groundwater Upwelling Investigation for Onondaga Lake, Parsons, 2003. Sample Locations TR02B, TR02C, TR03A, TR03B, TR03C, TR03D, TR04A, TR04B, TR04C, TR04D, TR05A, and TR05B.

TABLE B.2
SMU 2 SUMMARY OF GEOTECHNICAL CHARACTERISTICS

	Minimum	Maximum	Average
Natural Moisture Content [a,b] (% dry weight)	135.2	241.3	188.3
Atterberg Limits [a, b]	Non-Viscous and Non-Plastic		
Grain Size: percent passing through number 200 sieve [a, b]	96.1%	98.9%	97.5%
Total organic carbon content [a] (percent dry weight)	< 1	3	NA
Fine grained fraction [a] (percent dry weight)	<1	>90	NA
Oncolites [a] (mL/.06m^2)	<100	>300	NA
Calcium carbonate [a] (percent dry weight)	<60	>80	NA
In-Situ Vane Shear Test [a, b] (psf): remolded	No Data Available		
Peak [a]	No Data Available		
Undisturbed[b]	No Data Available		
Consolidation Testing: compression index [a] (C_c)	NA	NA	2.82 [*]
Standard Proctor: maximum dry density [b] (pcf)	NA	NA	NA
Optimum moisture content [b] (%)	NA	NA	NA
Specific Gravity [a]	2.5	2.54	2.52
Total Carbonate Content [a] (%)	30	32	31
Hydraulic Head Measurements [b] (ft AMSL): lake/upper piezometer	NA	NA	363.57
Average hydraulic gradient: lake/upper piezometer	NA	NA	0.10
Hydraulic head measurements (ft AMSL): upper/lower piezometer	NA	NA	348.00
Average hydraulic gradient: upper/lower piezometer	NA	NA	-1.55

Notes: NA - Not Available.

Data presented are from the following reports:

[a] Onondaga Lake Remedial Investigation Report, TAMS, 2002c. Sample Locations S339.

[b] Groundwater Upwelling Investigation for Onondaga Lake, Parsons, 2003. Sample Location TR02A.

[*] Only one data point available.

TABLE B.3
SMU 3 SUMMARY OF GEOTECHNICAL CHARACTERISTICS

	Minimum	Maximum	Average
Natural Moisture Content	No Data Available		
Atterberg Limits	No Data Available		
Grain Size: percent passing through number 200 sieve	No Data Available		
Total organic carbon content (percent dry weight)	<1	2	NA
Fine grained fraction (percent dry weight)	<1	50	NA
Oncolites (mL/.06m^2)	<100	300	NA
Calcium carbonate (percent dry weight)	<60	>80	NA
In-Situ Vane Shear Test (psf): remolded	No Data Available		
Peak	No Data Available		
Undisturbed	No Data Available		
Consolidation Testing: compression index (C_c)	No Data Available		
Standard Proctor: maximum dry density (pcf)	No Data Available		
Optimum moisture content (%)	No Data Available		
Specific Gravity	No Data Available		
Total Carbonate Content (%)	No Data Available		
Hydraulic Head Measurements (ft AMSL): lake/upper piezometer	No Data Available		
Average hydraulic gradient: lake/upper piezometer	No Data Available		
Hydraulic head measurements (ft AMSL): upper/lower piezometer	No Data Available		
Average hydraulic gradient: upper/lower piezometer	No Data Available		

Notes: NA - Not Available.

Data presented are from the Onondaga Lake Remedial Investigation Report, TAMS, December 2002c.

TABLE B.4
SMU 4 SUMMARY OF GEOTECHNICAL CHARACTERISTICS

	Minimum	Maximum	Average
Natural Moisture Content [b] (% dry weight)	73	84	80
Atterberg Limits [b]	Non-Viscous and Non-Plastic		
Grain Size: percent passing through number 200 sieve [b]	32	77	58.3
Total organic carbon content [a] (percent dry weight)	1	2	NA
Fine grained fraction [a] (percent dry weight)	1	50	NA
Oncolites [a] (mL/.06m^2)	<100	<100	<100
Calcium carbonate [a] (percent dry weight)	<60	<60	<60
In-Situ Vane Shear Test [b] (psf): remolded	129.3	129.3	129.3
Peak	NA	NA	NA
Undisturbed	258.5	1938.8	861.7
Consolidation Testing: compression index [b] (C_c)	NA	NA	0.23
Standard Proctor: maximum dry density [b] (pcf)	74.4	84.1	79.2
Optimum moisture content [b] (%)	28	38	32
Specific Gravity [a]	No Data Available		
Total Carbonate Content [a] (%)	1	2	1.5
Hydraulic Head Measurements [b] (ft AMSL): lake/upper piezometer	363.47	363.92	363.69
Average hydraulic gradient: lake/upper piezometer	0.08	0.18	0.13
Hydraulic head measurements (ft AMSL): upper/lower piezometer	363.67	364.19	363.88
Average hydraulic gradient: upper/lower piezometer	0.01	0.03	0.02

Notes: NA - Not Available.

Data presented are from the following reports:

[a] Onondaga Lake Remedial Investigation Report, TAMS, 2002c. Sample Locations S301, S304, S305, S359, and S360.

[b] Groundwater Upwelling Investigation for Onondaga Lake, Parsons, 2003. Sample Locations TR01A, TR01B, and TR01C.

TABLE B.5
SMU 5 SUMMARY OF GEOTECHNICAL CHARACTERISTICS

	Minimum	Maximum	Average
Natural Moisture Content	No Data Available		
Atterberg Limits	No Data Available		
Grain Size: percent passing through number 200 sieve	No Data Available		
Total organic carbon content (percent dry weight)	No Data Available		
Fine grained fraction (percent dry weight)	No Data Available		
Oncolites (mL/.06m^2)	<100	>300	NA
Calcium carbonate (percent dry weight)	<60	>80	NA
In-Situ Vane Shear Test (psf): remolded	No Data Available		
Peak	No Data Available		
Undisturbed	No Data Available		
Consolidation Testing: compression index (C_c)	No Data Available		
Standard Proctor: maximum dry density (pcf)	No Data Available		
Optimum moisture content (%)	No Data Available		
Specific Gravity	No Data Available		
Total Carbonate Content (%)	No Data Available		
Hydraulic Head Measurements (ft AMSL): lake/upper piezometer	No Data Available		
Average hydraulic gradient: lake/upper piezometer	No Data Available		
Hydraulic head measurements (ft AMSL): upper/lower piezometer	No Data Available		
Average hydraulic gradient: upper/lower piezometer	No Data Available		

Notes: NA - Not Available.

Data presented are from the Onondaga Lake Remedial Investigation Report, TAMS, 2002c.

TABLE B.6
SMU 6 SUMMARY OF GEOTECHNICAL CHARACTERISTICS

	Minimum	Maximum	Average
Natural Moisture Content		No Data Available	
Atterberg Limits		No Data Available	
Grain Size: percent passing through number 200 sieve		No Data Available	
Total organic carbon content (percent dry weight)		No Data Available	
Fine grained fraction (percent dry weight)		No Data Available	
Oncolites (mL/.06m^2)	NA	<100	NA
Calcium carbonate (percent dry weight)	<60	>80	<60
In-Situ Vane Shear Test (psf): remolded		No Data Available	
Peak		No Data Available	
Undisturbed		No Data Available	
Consolidation Testing: compression index (C_c)		No Data Available	
Standard Proctor: maximum dry density (pcf)		No Data Available	
Optimum moisture content (%)		No Data Available	
Specific Gravity		No Data Available	
Total Carbonate Content (%)		No Data Available	
Hydraulic Head Measurements (ft AMSL): lake/upper piezometer		No Data Available	
Average hydraulic gradient: lake/upper piezometer		No Data Available	
Hydraulic head measurements (ft AMSL): upper/lower piezometer		No Data Available	
Average hydraulic gradient: upper/lower piezometer		No Data Available	

Notes: NA - Not Available.

Data presented are from the Onondaga Lake Remedial Investigation Report, TAMS, 2002c.

TABLE B.7
SMU 7 SUMMARY OF GEOTECHNICAL CHARACTERISTICS

	Minimum	Maximum	Average
Natural Moisture Content [a,b] (% dry weight)	74.3	157.8	110.2
Atterberg Limits [a, b]	Non-Viscous and Non-Plastic		
Grain Size: percent passing through number 200 sieve [a, b]	13	97.1	49.1
Total organic carbon content [a] (percent dry weight)	<1	>3	NA
Fine grained fraction [a] (percent dry weight)	1	>90	NA
Oncolites [a] (mL/.06m^2)	NA	NA	NA
Calcium carbonate [a] (percent dry weight)	<60	80	<60
In-Situ Vane Shear Test [a, b] (psf): remolded	0.7	129.3	<23.0
Peak[a]	1.7	207.7	50.2
Undisturbed[b]	<129.3	258.5	<172.4
Consolidation Testing: compression index [a, b] (C_c)	0.7	1.33	1.02
Standard Proctor: maximum dry density [b] (pcf)	70.7	79.5	74.9
Optimum moisture content [b] (%)	27	35	31.7
Specific Gravity [a]	2.21	2.46	2.34
Total Carbonate Content [a] (%)	17	23	20
Hydraulic Head Measurements [b] (ft AMSL): lake/upper piezometer	361.15	364.42	362.83
Average hydraulic gradient: lake/upper piezometer	-0.43	0.29	-0.06
Hydraulic head measurements (ft AMSL): upper/lower piezometer	363.22	364.64	363.80
Average hydraulic gradient: upper/lower piezometer	-0.04	0.24	0.10

Notes: NA - Not Available.

Data presented are from the following reports:

[a] Onondaga Lake Remedial Investigation Report, TAMS, 2002c. Sample Locations S314, S315, S351, and S352VS.

[b] Groundwater Upwelling Investigation for Onondaga Lake, Parsons, 2003. Sample Locations TR05C, TR05D, TR06A, TR06B, and TR06C.

TABLE B.8
SMU 8 SUMMARY OF GEOTECHNICAL CHARACTERISTICS

	Minimum	Maximum	Average
Natural Moisture Content (% dry weight)	NA	NA	72.8 *
Atterberg Limits	Non-Viscous and Non-Plastic		
Grain Size: percent passing through number 200 sieve	NA	NA	99.5 *
Total organic carbon content (percent dry weight)	<1	>3	NA
Fine grained fraction (percent dry weight)	1	>90	NA
Oncolites (mL/.06m^2)	No Data Available		
Calcium carbonate (percent dry weight)	<60	<60	<60
In-Situ Vane Shear Test (psf): remolded	0.0	3.5	0.8
Peak	2.8	58.9	27.4
Undisturbed	No Data Available		
Consolidation Testing: compression index (C_c)	No Data Available		
Standard Proctor: maximum dry density (pcf)	No Data Available		
Optimum moisture content (%)	No Data Available		
Specific Gravity	NA	NA	2.63 *
Total Carbonate Content (%)	NA	NA	35 *
Hydraulic Head Measurements (ft AMSL): lake/upper piezometer	No Data Available		
Average hydraulic gradient: lake/upper piezometer	No Data Available		
Hydraulic head measurements (ft AMSL): upper/lower piezometer	No Data Available		
Average hydraulic gradient: upper/lower piezometer	No Data Available		

Notes: NA - Not Available.

Data presented are from the Onondaga Lake Remedial Investigation Report, TAMS, 2002 (Sample Location S302).

* Only one data point available.

TABLE B.9
AVERAGE CONCENTRATION OF CPOIs BY SMU
ONONDAGA LAKE, SYRACUSE, NEW YORK
0-1 METER INTERVAL

Average concentration (area weighted) MG/KG	SMU						
	1	2	3	4	5	6	7
Benzene	2.235	2.632	0.497	0.006	0.004	0.108	1.143
Benzo[a]pyrene	0.609	2.344	0.056	0.080	0.105	2.145	2.386
Chlorobenzene	41.260	39.574	0.031	0.006	0.004	0.392	14.149
Chromium	129.771	771.799	41.080	18.361	34.936	111.264	108.050
Dichlorobenzenes (Sum)	49.356	6.331	0.036	0.027	0.038	0.550	40.511
Ethylbenzene	2.048	1.913	0.043	0.012	0.004	0.043	0.707
Fluorene	1.254	2.814	0.038	0.032	0.054	1.430	6.553
Lead	112.042	359.865	17.302	62.586	10.803	139.358	200.951
Naphthalene	42.240	274.811	0.420	0.075	0.137	3.230	29.142
Nickel	45.443	191.739	17.782	16.395	6.409	29.779	35.116
Phenanthrene	2.030	9.743	0.058	0.083	0.142	4.533	6.897
Polychlorinated biphenyls	1.813	0.793	0.258	0.368	0.250	1.052	1.755
Pyrene	1.145	3.733	0.108	0.185	0.211	3.401	4.824
TOC	63,361.550	62,568.197	33,525.317	40,118.792	37,622.063	30,853.797	50,121.422
Toluene	4.196	2.483	0.319	0.005	0.021	0.122	2.044
Total mercury	16.373	4.319	1.197	7.463	0.742	2.852	17.201
Vanadium	8.837	45.101	4.098	4.968	1.729	4.671	5.217
Xylene isomers (total)	28.961	17.527	0.565	0.089	0.004	0.155	10.482

TABLE B.10
AVERAGE CONCENTRATION OF CPOIs BY SMU
ONONDAGA LAKE, SYRACUSE, NEW YORK
1-2 METER INTERVAL

Average concentration (area weighted) MG/KG	SMU					
	1	2	3	4	6	7
Benzene	5.713	4.266	3.042	0.009	0.148	1.270
Benzo[a]pyrene	1.750	1.376	0.039	0.045	1.347	1.109
Chlorobenzene	23.257	17.589	0.010	0.028	0.585	11.664
Chromium	31.323	479.984	11.103	29.901	155.293	140.517
Dichlorobenzenes (Sum)	78.907	5.803	0.039	0.100	0.713	71.380
Ethylbenzene	3.337	2.107	0.010	0.026	0.387	1.315
Fluorene	5.415	2.953	0.039	0.025	1.276	6.050
Lead	75.447	338.418	5.638	72.018	136.755	217.313
Naphthalene	113.154	77.537	0.056	0.025	2.638	24.714
Nickel	26.291	77.856	10.240	25.800	38.300	41.182
Phenanthrene	10.131	9.216	0.039	0.070	5.827	5.156
Polychlorinated biphenyls	0.592	0.678	0.300	0.758	1.321	1.577
Pyrene	7.443	4.537	0.039	0.116	3.865	3.134
TOC	46,453.273	80,291.514	52,844.632	51,995.607	57,298.872	51,058.209
Toluene	10.655	4.497	0.136	0.003	0.089	3.095
Total mercury	9.876	3.043	0.066	38.669	2.877	23.879
Vanadium	7.160	24.920	10.104	11.490	11.046	4.675
Xylene isomers (total)	61.971	28.173	0.027	0.510	0.493	9.400

Notes:

There are no stations located in SMU5 at this depth interval.

TABLE B.11
AVERAGE CONCENTRATION OF CPOIs BY SMU
ONONDAGA LAKE, SYRACUSE, NEW YORK
2-3 METER INTERVAL

Average concentration (area weighted) MG/KG	SMU					
	1	2	3	4	6	7
Benzene	8.116	0.290	0.000	0.008	0.015	0.574
Benzo[a]pyrene	1.611	0.824	0.031	0.036	1.179	2.858
Chlorobenzene	2.565	0.007	0.000	0.017	0.007	4.432
Chromium	21.516	11.040	13.700	50.336	22.790	143.710
Dichlorobenzenes (Sum)	23.308	0.031	0.031	0.108	0.078	2.655
Ethylbenzene	3.499	0.081	0.000	0.035	0.196	4.031
Fluorene	8.280	0.465	0.031	0.031	1.007	27.039
Lead	43.783	28.138	4.800	86.685	84.254	335.850
Naphthalene	315.016	1.917	0.031	0.031	2.622	111.432
Nickel	20.307	8.547	13.800	35.977	18.322	61.202
Phenanthrene	12.901	2.350	0.031	0.117	6.162	72.516
Polychlorinated biphenyls	1.298	0.552	0.300	0.631	0.284	2.186
Pyrene	3.889	2.442	0.031	0.164	3.755	21.955
TOC	60,312.596	62,618.231	63,399.999	54,850.675	67,918.029	62,085.211
Toluene	25.566	0.051	0.000	0.007	0.019	1.762
Total mercury	24.258	0.717	0.026	65.334	0.982	13.986
Vanadium	9.585	9.747	14.700	13.967	14.541	11.994
Xylene isomers (total)	81.123	0.499	0.000	0.848	0.299	13.141

Notes:

There are no stations in SMU 5 and one station in SMU 3 in this depth interval.

TABLE B.12
AVERAGE CONCENTRATION OF CPOIs BY SMU
ONONDAGA LAKE, SYRACUSE, NEW YORK
3-4 METER INTERVAL

Average concentration (area weighted) MG/KG	SMU					
	1	2	3	4	6	7
Benzene	4.073	0.007	0.000	0.001	0.027	0.050
Benzo[a]pyrene	0.402	0.030	0.032	0.056	3.434	1.130
Chlorobenzene	12.688	0.005	0.000	0.003	0.010	0.045
Chromium	24.573	11.375	17.400	60.986	18.602	114.958
Dichlorobenzenes (Sum)	4.571	0.030	0.032	0.101	0.377	0.067
Ethylbenzene	11.512	0.005	0.000	0.005	3.885	0.114
Fluorene	5.510	0.030	0.032	0.031	4.864	0.550
Lead	42.245	4.358	6.300	85.007	86.408	242.053
Naphthalene	78.342	0.030	0.032	0.031	13.161	2.076
Nickel	23.298	11.744	17.800	44.829	19.391	39.999
Phenanthrene	6.901	0.030	0.032	0.176	21.259	2.960
Polychlorinated biphenyls	0.317	3.288	0.300	1.001	0.301	0.692
Pyrene	1.915	0.030	0.032	0.256	11.353	2.913
TOC	53,692.652	60,627.337	60,099.999	67,043.436	62,897.964	71,920.936
Toluene	7.441	0.005	0.000	0.001	0.126	0.045
Total mercury	13.716	0.025	0.027	66.553	1.038	2.205
Vanadium	11.708	12.435	18.900	17.126	16.113	19.855
Xylene isomers (total)	136.207	0.005	0.000	0.117	6.329	0.516

Notes:
There are no stations located in SMU 5 and one station located in SMU 3 at this depth interval.

TABLE B.13
AVERAGE CONCENTRATION OF CPOIs BY SMU
ONONDAGA LAKE, SYRACUSE, NEW YORK
4-5 METER INTERVAL

Average concentration (area weighted) MG/KG	SMU					
	1	2	3	4	6	7
Benzene	2.634	0.004	0.000	0.001	0.005	0.044
Benzo[a]pyrene	0.575	0.025	0.031	0.062	0.584	2.907
Chlorobenzene	4.267	0.004	0.000	0.001	0.004	0.006
Chromium	28.977	11.243	19.600	53.019	15.833	31.546
Dichlorobenzenes (Sum)	4.736	0.025	0.031	0.031	0.030	1.068
Ethylbenzene	5.377	0.004	0.000	0.001	0.018	0.041
Fluorene	1.952	0.025	0.031	0.031	0.135	4.416
Lead	44.573	4.221	7.000	49.872	28.420	191.865
Naphthalene	43.792	0.025	0.031	0.031	0.155	5.984
Nickel	27.280	11.409	20.400	47.209	16.285	23.379
Phenanthrene	4.457	0.025	0.031	0.119	0.707	13.497
Polychlorinated biphenyls	0.506	0.300	0.300	0.443	0.300	0.436
Pyrene	1.365	0.025	0.031	0.187	0.996	6.387
TOC	41,697.627	34,235.560	54,999.999	70,137.824	97,858.635	66,585.492
Toluene	5.356	0.004	0.000	0.001	0.006	0.021
Total mercury	5.123	0.030	0.043	13.715	0.219	2.408
Vanadium	11.328	13.740	21.400	19.853	16.685	17.569
Xylene isomers (total)	52.707	0.004	0.000	0.001	0.037	0.196

Notes:
There are no stations located in SMU 5 and one station located in SMU 3 at this depth interval.

TABLE B.14
AVERAGE CONCENTRATION OF CPOIs BY SMU
ONONDAGA LAKE, SYRACUSE, NEW YORK
5-6 METER INTERVAL

Average concentration (area weighted) MG/KG	SMU					
	1	2	3	4	6	7
Benzene	1.713	0.004	0.000	0.001	0.004	0.011
Benzo[a]pyrene	0.410	0.024	0.031	0.054	0.385	1.700
Chlorobenzene	5.583	0.004	0.000	0.001	0.004	0.005
Chromium	25.601	9.500	17.200	49.817	15.356	18.345
Dichlorobenzenes (Sum)	2.646	0.024	0.031	0.041	0.033	0.065
Ethylbenzene	1.890	0.004	0.000	0.001	0.004	0.010
Fluorene	0.876	0.024	0.031	0.041	0.275	1.162
Lead	33.092	3.454	6.200	39.014	33.064	113.207
Naphthalene	35.325	0.024	0.031	0.041	0.576	0.718
Nickel	21.948	9.667	17.700	39.601	15.710	16.943
Phenanthrene	2.279	0.024	0.031	0.187	1.406	6.621
Polychlorinated biphenyls	0.409	0.300	0.300	0.178	0.281	0.622
Pyrene	1.083	0.024	0.031	0.270	1.240	5.703
TOC	32,713.708	26,283.796	65,399.999	81,614.793	58,854.346	58,853.673
Toluene	7.665	0.004	0.000	0.001	0.004	0.009
Total mercury	2.566	0.098	0.026	0.624	0.289	2.616
Vanadium	10.234	12.027	19.100	34.070	15.284	16.786
Xylene isomers (total)	28.863	0.004	0.000	0.001	0.004	0.052

Notes:
There are no stations located in SMU 5 and one station located in SMU 3 at this depth interval.

TABLE B.15
AVERAGE CONCENTRATION OF CPOIs BY SMU
ONONDAGA LAKE, SYRACUSE, NEW YORK
6-7 METER INTERVAL

Average concentration (area weighted) MG/KG	SMU					
	1	2	3	4	6	7
Benzene	1.284	0.004	0.000	0.001	0.004	0.004
Benzo[a]pyrene	0.668	0.027	0.028	0.038	0.029	0.333
Chlorobenzene	3.488	0.004	0.000	0.001	0.004	0.005
Chromium	22.536	9.400	17.100	37.619	14.999	13.927
Dichlorobenzenes (Sum)	2.370	0.027	0.028	0.038	0.029	9.419
Ethylbenzene	2.898	0.004	0.000	0.001	0.004	0.004
Fluorene	17.235	0.027	0.028	0.038	0.029	0.357
Lead	34.675	3.500	6.100	33.099	6.125	49.400
Naphthalene	64.228	0.027	0.028	0.038	0.029	8.633
Nickel	21.212	9.400	17.300	25.656	16.299	12.667
Phenanthrene	15.747	0.027	0.028	0.186	0.029	1.245
Polychlorinated biphenyls	0.556	0.300	0.300	0.222	0.265	0.300
Pyrene	3.866	0.027	0.028	0.254	0.029	1.042
TOC	44,398.017	50,999.996	66,399.999	67,746.772	57,783.005	40,325.013
Toluene	5.729	0.004	0.000	0.001	0.004	0.007
Total mercury	1.934	0.200	0.025	0.194	0.031	0.713
Vanadium	8.097	10.300	19.400	24.149	15.325	14.344
Xylene isomers (total)	44.434	0.004	0.000	0.001	0.004	0.006

Notes:
There are no stations located in SMU 5 and one station each in SMU 2 and SMU 3 at this depth interval.

TABLE B.16
AVERAGE CONCENTRATION OF CPOIs BY SMU
ONONDAGA LAKE, SYRACUSE, NEW YORK
7-8 METER INTERVAL

Average concentration (area weighted) MG/KG	SMU				
	1	3	4	6	7
Benzene	0.047	0.000	0.002	0.004	0.005
Benzo[a]pyrene	0.800	0.026	0.030	0.028	0.194
Chlorobenzene	0.007	0.000	0.002	0.004	0.005
Chromium	11.600	14.400	18.946	16.277	12.464
Dichlorobenzenes (Sum)	0.043	0.026	0.030	0.028	0.032
Ethylbenzene	0.210	0.000	0.002	0.004	0.005
Fluorene	1.900	0.026	0.030	0.028	0.060
Lead	24.800	5.000	14.765	6.750	29.002
Naphthalene	6.000	0.026	0.030	0.028	0.041
Nickel	8.900	13.700	16.220	17.936	11.971
Phenanthrene	5.300	0.026	0.104	0.028	0.342
Polychlorinated biphenyls	0.300	0.300	0.295	0.300	0.273
Pyrene	2.300	0.026	0.136	0.028	0.450
TOC	33,200.001	56,499.999	71,545.335	52,384.221	67,873.211
Toluene	0.500	0.000	0.002	0.004	0.005
Total mercury	1.000	0.022	0.203	0.024	0.417
Vanadium	12.300	17.000	19.990	17.219	12.419
Xylene isomers (total)	2.000	0.000	0.002	0.004	0.005

Notes:
There are no stations located in SMU 2 and SMU5 and one station each in SMU 1 and SMU 3 at this depth interval.

APPENDIX B

FIGURES