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July 13, 2010

Mr. Timothy Larson
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau D
625 Broadway, 12th Floor
Albany, NY 12233-7016

RE: Onondaga Lake Bottom Subsite – Onondaga County, New York
Consent Decree 89-CV-815
Phase VI Pre-Design Investigation
Action Item Ops-4e
Work Plan Addendum 4 – Dredge Stability and Upwelling Geotechnical Borings

Dear Mr. Larson:

This letter presents a work plan for a geotechnical investigation to support the remedial design for the Onondaga Lake project.

1.0 OBJECTIVES

Data generated under this work plan will be used to support the dredge and isolation cap design efforts and advance the overall project schedule. The activities described consist of:

- Advancement of two borings in Remediation Area C, four borings in Remediation Area E, and one boring in Remediation Area A to a depth of approximately 60 ft. to evaluate stratigraphy and collect soil samples to evaluate dredge stability in these areas. Dredge stability evaluations will be provided in the Capping Intermediate Design submittal.
- Advancement of six borings in Remediation Areas A, B, C, and D to determine the thickness of the underlying silt and clay unit and collect samples for hydraulic conductivity testing to support groundwater upwelling evaluations. In addition to the six borings previously mentioned, the two dredge stability borings in Remediation Area C will also be advanced through the silt and clay unit to collect samples for hydraulic conductivity testing.
- Geotechnical laboratory testing on selected sediment samples collected during the investigation.

Investigation activities will be conducted in accordance with the *Onondaga Lake Pre-Design Investigation: Standard Operating Procedures* (SOPs) (Parsons, 2005a) and the *Onondaga Lake Pre-Design Investigation: Phase VI Work Plan* (Parsons, 2010). Sample locations may be modified in the field to afford access to each sample location after consultation with New York State Department of Environmental Conservation (NYSDEC).

2.0 HEALTH AND SAFETY

Parsons' Project Safety Plan (Appendix C to the Phase I Work Plan [Parsons, 2005b] and updated for 2010) prepared for previous investigation activities will be used for this investigation. If tasks are identified that fall outside the scope currently defined in the Project Safety Plan (PSP), a new Job Safety Analysis (JSA) will be completed before the task begins. Site subcontractors will also be required to submit a Subcontractor Safety Plan (SSP) for approval prior to the start of pre-design investigation (PDI) activities. Copies of the PSP, JSAs, and SSPs will be maintained at each work area.

3.0 FIELD ACTIVITIES AND LABORATORY PROCEDURES

3.1 Dredge Stability Borings

Remediation Area C

As shown on Figure 1, two boring locations (OL-SB-20218 and OL-SB-20210) are proposed within Remediation Area C to facilitate stability analyses for nearshore dredge slope stability. Borings will be advanced approximately 5 ft. into the silt and clay layer with 4-inch flush joint casing using either spin-and-wash or drive-and-flush methods from a barge mounted drill rig. Standard penetration testing (SPT) in accordance with ASTM D1586 will be performed continuously at location OL-SB-20218 and on 5-ft intervals (standard sampling) at OL-SB-20210. Samples will be logged and classified in the field; and representative samples will be selected and placed into appropriate containers for geotechnical index testing.

Thin walled tube samples will be used to collect undisturbed soil samples suitable for geotechnical laboratory tests including strength and density. These samples will be obtained using piston samplers (e.g., a GUS sampler), in accordance with ASTM D6519. A minimum of 22 inches of recovery is required for testing. If less than 22 inches of recovery is achieved, a second attempt will be made to collect the sample after washing down to the next sample interval. Undisturbed samples will be collected as described below:

- One tube within the 5 to 10 ft. interval (this should be in the Solvay waste)
- One tube within the 10 to 15 ft. interval (this should be in the marl)
- One tube within the top 5 ft. of the silt and clay layer

A summary of proposed geotechnical analyses for the dredge stability investigation is presented in Table 1. The number of proposed tests is less than the number of samples collected in an attempt to ensure that sufficient sample quantity is available to perform quality testing. Two CU tests were previously completed on Marl samples from Remediation Area C/SMU 2 (OL-STA-20016 from 10 – 12 ft and 14 – 16 ft) as part of the Phase I PDI. Therefore, additional CU testing within the Marl during this phase is not necessary to complete the dredge stability analyses. The samples to be tested will be determined based on field observations (e.g., recovery). The extra samples will be used as necessary if there are laboratory issues related to sample extrusion and/or testing.

Once sampling has extended 5 ft. into the silt/clay, sampling will then continue through the silt and clay unit to support upwelling rate determinations, as described in Section 3.2. The casing will be installed and sealed with bentonite prior to commencement of drilling through the casing to protect the deep zone from potential impacts from the shallow zone. Following casing installation, mud-rotary drilling techniques will be used to advance the boreholes through the silt and clay unit into the underlying silt and fine sand unit. Samples will be collected on 5-ft. intervals; and undisturbed samples will be collected starting 10 ft. into the silt and clay unit and on 10-ft. intervals thereafter at each location. Following collection of all samples, up to four samples from each location will be selected for hydraulic conductivity analysis in accordance with ASTM D5084. Index testing will also be performed on undisturbed samples selected for hydraulic conductivity analysis. A summary of proposed geotechnical analyses for the upwelling investigation samples is presented in Table 2.

Remediation Area E

As shown on Figure 2, four boring locations (OL-SB-60298 through OL-SB-60301) are proposed within Remediation Area E to facilitate analyses for dredge slope stability and global stability (to address the additional loading associated with the proximity of the CSX railroad to Remediation Area E). Borings will be advanced either 5 ft. into the silt and clay layer or to 60 ft., whichever is greater, with 4-inch flush joint casing using either spin-and-wash or drive-and-flush methods from a barge mounted drill rig. If the silt and clay unit is encountered above 60 ft., the casing will be seated approximately 5 ft. into the silt and clay unit, and mud rotary techniques will be used to advance the borehole to terminal depth. SPT will be performed in accordance with ASTM D1586, continuously at location OL-SB-60300 and on 5 ft. intervals (standard sampling) at OL-SB-60298, OL-SB-60299, and OL-SB-60301. Samples will be logged and classified in the field; and representative samples will be selected and placed into appropriate containers for geotechnical index testing.

Thin walled tube samples will be used to collect undisturbed soil samples suitable for geotechnical laboratory tests including strength, consolidation, and density. These samples will be obtained using piston samplers (e.g., a GUS sampler), in accordance with ASTM D6519. A minimum of 22 inches of recovery is required for testing. If less than 22 inches of recovery is achieved, a second attempt will be made to collect the sample after washing down to the next

sample interval. Five undisturbed samples will be collected from each location as described below.

- One tube within the 0 to 5 ft. interval (this should be in the marl)
- One tube within the 5 to 10 ft. interval (this should be in the marl)
- One tube within the 30 to 40 ft. interval (this should be in the marl)
- One tube within the 40 to 50 ft. interval (this should be in the marl)
- One tube within the 50 to 60 ft. interval. If the sample is in the silt and clay, the boring is complete; otherwise, split-spoon sampling will continue until the silt and clay unit is encountered and an additional Shelby tube will be collected from the top 5 ft. of the silt and clay unit.

A summary of proposed geotechnical analyses for the disturbed and undisturbed samples is presented in Table 1. The number of proposed tests is less than the number of samples collected in an attempt to ensure that sufficient sample quantity is available to perform quality testing. As part of the Phase V PDI, seven 3-point CU tests (OL-SB-60254 from 25-27 ft; OL-SB-60255 from 20-22 ft; OL-SB-60256 from 49-51 ft; OL-SB-60257 from 39-41 ft; OL-SB-60258 from 18-20 ft; OL-SB-60259 from 16-18 ft; OL-SB-60229 from 0-3 ft), one 2-point CU test (OL-ST-60235 from 0-3 ft), and one 1-point CU test (OL-ST-60233 from 0-3 ft) were performed on the Marl in Remediation Area E/SMU 6. Therefore, additional strength data beyond what we are proposing are not required to complete the stability analyses.

Field observations during drilling (e.g., blow counts, material descriptions, layer thicknesses, etc.) will be used to select which samples will be submitted for analysis. The extra samples will be used as necessary if there are laboratory issues related to sample extrusion and/or testing.

Remediation Area A

As shown on Figure 3, one boring location (OL-SB-40300) is proposed within Remediation Area A to facilitate stability analyses for nearshore dredge slope stability. The boring will be advanced approximately 5 ft. into the silt and clay layer with 4-inch flush joint casing using either spin-and-wash or drive-and-flush methods from a barge mounted drill rig. Standard penetration testing (SPT) in accordance with ASTM D1586 will be performed on 5-ft intervals (standard sampling) at OL-SB-40300. Samples will be logged and classified in the field; and representative samples will be selected and placed into appropriate containers for geotechnical index testing.

Thin walled tube samples will be used to collect undisturbed soil samples suitable for geotechnical laboratory tests including strength and density. These samples will be obtained using piston samplers (e.g., a GUS sampler), in accordance with ASTM D6519. A minimum of

22 inches of recovery is required for testing. If less than 22 inches of recovery is achieved, a second attempt will be made to collect the sample after washing down to the next sample interval. Undisturbed samples will be collected as described below:

- Two tubes within the marl unit, assuming the marl unit marl is 20 ft thick
- Two tubes within the top 10 ft of the silt and clay layer

A summary of proposed geotechnical analyses for the dredge stability investigation is presented in Table 1.

Once sampling has extended 5 ft. into the silt/clay, sampling will then continue through the silt and clay unit to support upwelling rate determinations, as described in Section 3.2. The casing will be installed and sealed with bentonite prior to commencement of drilling through the casing to protect the deep zone from potential impacts from the shallow zone. Following casing installation, mud-rotary drilling techniques will be used to advance the boreholes through the silt and clay unit into the underlying silt and fine sand unit. Samples will be collected on 5-ft. intervals; and undisturbed samples will be collected starting 10 ft. into the silt and clay unit and on 10-ft. intervals thereafter at each location. Following collection of all samples, up to four samples from each location will be selected for hydraulic conductivity analysis in accordance with ASTM D5084. Index testing will also be performed on undisturbed samples selected for hydraulic conductivity analysis. A summary of proposed geotechnical analyses for the upwelling investigation samples is presented in Table 2.

3.2 Upwelling Borings

As shown on Figures 1 and 3, six boring locations (OL-SB-20211, OL-SB-10190, OL-SB-10191, OL-SB-30171, OL-SB-30172, and OL-SB-40300) are proposed within Remediation Areas A, B, C, and D to support upwelling rate determinations for the isolation cap design. As noted above in Section 3.1, sampling at locations OL-SB-20218, OL-SB-20210, and OL-SB-40300 will continue through the silt and clay unit to obtain hydraulic conductivity data after dredge stability sampling has been completed.

Borings will be advanced with 4-inch flush joint casing using either spin-and-wash or drive-and-flush methods from a barge mounted drill rig. SPT will be performed in accordance with ASTM D1586, on 5-ft. intervals (standard sampling) until the silt and clay unit is encountered. Once sampling has extended 5 ft. into the silt and clay, the casing will be set to protect the deep zone from potential impacts from the shallow zone. The casing will be installed and sealed with bentonite prior to commencement of drilling through the casing. Following casing installation, mud-rotary drilling techniques will be used to advance the boreholes to the terminal depth. Standard sampling will continue through the silt and clay unit until the silt and fine sand unit is encountered.

Thin walled tubes will be used to collect undisturbed soil samples suitable for hydraulic conductivity (ASTM D5084) and index testing once split spoon sampling identifies clayey material (i.e., clayey marl, clayey trans-marl, or the silt and clay unit). These samples will be obtained using piston samplers (e.g., a GUS sampler), in accordance with ASTM D6519. A minimum of 22 inches of recovery is required for testing. If less than 22 inches of recovery is achieved, a second attempt will be made to collect the sample after washing down to the next sample interval. Undisturbed samples will be collected starting upon encountering clayey material and on 10-ft. intervals thereafter at each location. Following collection of all samples at a specific location, up to four will be selected for analysis to ensure a representative data set for that location. The selection of sample intervals for geotechnical analysis will be made in consultation with DEC. A summary of proposed geotechnical analyses for the upwelling investigation samples is presented in Table 2.

3.3 Investigation Derived Wastes (IDW) and Grouting

Drill cuttings that are carried to the surface will be initially contained in the re-circulation tub and transferred to 55-gallon drums as needed. IDW will be transported to a Honeywell program accumulation point prior to demobilization from the site. Each borehole will be grouted with cement-bentonite grout, and all casing will be removed at the completion of drilling and sampling activities. Sample locations may be modified in the field to afford access to each sample location.

Please feel free to contact Tom Abrams at 315-552-9670 or me if you have any questions.

Sincerely,

John P. McAuliffe TCT

John P. McAuliffe, P.E.
Program Director, Syracuse

cc: Tim Larson, NYSDEC (5 bound, 1 unbound, 1 PDF & Orig)
Bob Nunes, USEPA (5 bound, 1 PDF)
Mike Spera, AECOM (2 bound, 2 PDF & Orig)
Bob Montione, AECOM (2 bound, 2 PDF & Orig)
Mark Sergott, NYSDOH (1 bound, 1 PDF)
Geoff Laccetti, NYSDOH (Cover Ltr Only)
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Tom Biel, NYSDEC (1 bound)
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Norman Spiegel, Env. Protection Bureau (Cover Ltr Only)
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Heidi Kuhl, Onondaga Nation (electronic copy)
Fred Kirschner, AESE, Inc. (electronic copy)
William Hague, Honeywell (1 PDF)
Brian Israel, Esq., Arnold & Porter (1 PDF)
Steve Miller, Parsons (1 PDF)
Ed Glaza, Parsons (1 bound)
Tom Abrams, Parsons (1 bound)

Cited References

Parsons. 2005a. *Onondaga Lake Pre-Design Investigation: Standard Operating Procedures*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

Parsons, 2005b, Onondaga Lake Pre-Design Investigation: Phase I Work Plan and Appendices. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

Parsons. 2010. *Onondaga Lake Pre-Design Investigation: Phase VI Work Plan*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

Table 1
Dredge Stability
Geotechnical Analyses

			Undisturbed Samples (GUS Samples)																		Disturbed Samples (Split Spoons)		
			Water Content (ASTM D2216)[1]			Atterberg Limits (ASTM D4318)[1]			Grain Size with Hydrometer (ASTM D422)[1]			Bulk Density (ASTM D2937)[1]			UU Tests (ASTM D2850)		3-pt. CU Tests (ASTM D4767)		Consolidation (ASTM D2435)		Water Content (ASTM D2216)	Atterberg Limits (ASTM D4318)	Grain Size with Hydrometer (ASTM D422)
Description	**Map Symbol**	**Station ID**	**SOLW[4]**	**Marl**	**Silt and Clay**	**SOLW[4]**	**Marl**	**Silt and Clay**	**SOLW[4]**	**Marl**	**Silt and Clay**	**SOLW[4]**	**Marl**	**Silt and Clay**	**SOLW[4]**	**Marl**	**Marl**	**Silt and Clay**	**Marl**	**Silt and Clay**			
Remediation Area A Stability Borings		OL-SB-40300[2]	0	2	2	0	2	2	0	2	2	0	2	2	0	1	1	2	0	0	0	0	0
Remediation Area C Stability Borings		OL-SB-20218[2]	1	2	1	1	2	1	1	2	1	1	2	1	1	2	0	1	0	0	3	3	3
		OL-SB-20210[2]																					
Remediation Area E Stability Borings		OL-SB-60298[3]	0	6	1	0	6	1	0	6	1	0	6	1	0	3	3	1	3	1	7	7	7
		OL-SB-60299[3]																					
		OL-SB-60300[3]																					
		OL-SB-60301[3]																					

Notes:

* The number of proposed tests is less than the number of samples collected in an attempt to ensure that sufficient sample quantity is available to perform quality testing. The samples to be tested will be determined based on field observations (e.g., recovery). The extra samples will be used as necessary if there are laboratory issues related to sample extrusion and/or testing.

1. Index testing for the undisturbed samples will be performed on samples selected for UU, CU, and/or consolidation testing.
2. Borings will continue through the silt and clay unit in conjunction with the upwelling investigation. Additional silt and clay sampling is described in Table 2 for this location.
3. Borings will extend approximately 5 ft into the Silt and Clay unit or 60 ft, whichever is greater.
4. Solvay waste may not be encountered at proposed locations within Remediation Area C.

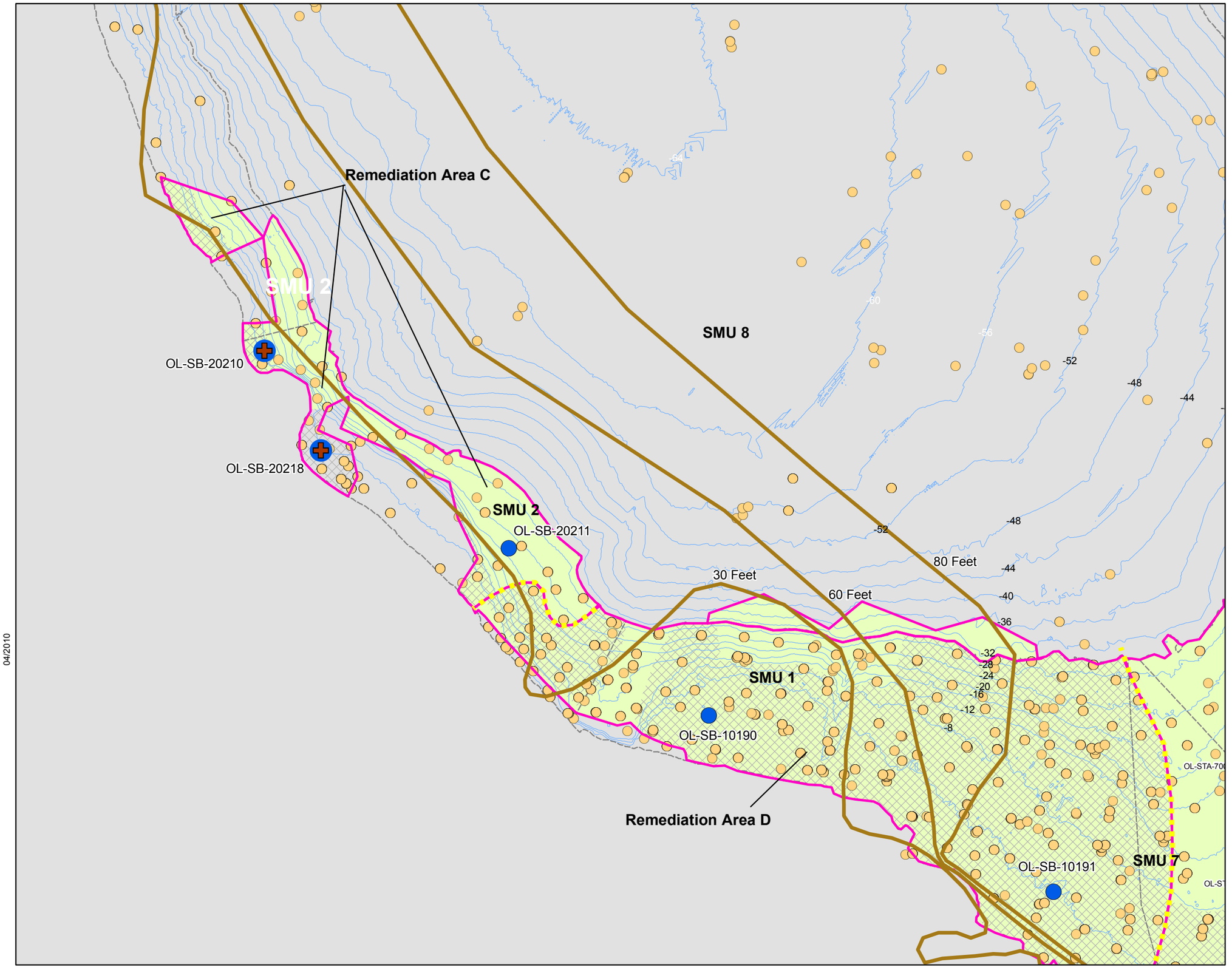
Table 2
Upwelling Investigation
Geotechnical Analyses

			Water Content (ASTM D2216)[1]	Atterberg Limits (ASTM D4318)[1]	Grain Size with Hydrometer (ASTM D422)[1]	Bulk Density (ASTM D2937)[1]	Hydraulic Conductivity (ASTM D5084)
Description	**Map Symbol**	**Station ID**	**Silt and Clay**	**Silt and Clay**	**Silt and Clay**	**Silt and Clay**	**Silt and Clay**
Remediation Area A Upwelling Borings		OL-SB-40300	4	4	4	4	4
Remediation Area B Upwelling Borings		OL-SB-30171	4	4	4	4	4
		OL-SB-30172	4	4	4	4	4
Remediation Area C Upwelling Borings		OL-SB-20218[2]	4	4	4	4	4
		OL-SB-20210[2]	4	4	4	4	4
		OL-SB-20211	4	4	4	4	4
Remediation Area D Upwelling Borings		OL-SB-10190	4	4	4	4	4
		OL-SB-10191	4	4	4	4	4

Notes:

* The number of proposed tests is less than the number of samples collected in an attempt to ensure that sufficient sample quantity is available to perform quality testing. The samples to be tested will be determined based on field observations (e.g., recovery). The extra samples will be used as necessary if there are laboratory issues related to sample extrusion and/or testing.

1. Index testing for the undisturbed samples will be performed on samples selected for hydraulic conductivity testing.
2. Silt and clay sampling at this location will be completed in conjunction with dredge stability sampling. Dredge stability sampling is described in Table 1 for this location.



04/2010

Proposed Phase VI PDI Sample Locations

- Dredge Stability Geotechnical Boring
- Hydraulic Conductivity Boring
- Dredge Stability Geotechnical and Hydraulic Conductivity Boring
- Silt and Clay Thickness Contours

Historical Sample Locations (RI to Phase V PDI)

- Historical Sediment Location
- Preliminary Potential Remediation Area- Final Delineation to be Determined
- Preliminary Dredge Area
- Preliminary Cap Area
- Extent of ILWD/ Remediation Area D Boundary
- SMU Boundary

NOTES

1. Bathymetry contours are in 4 foot intervals.
2. Water depth based on average lake elevation of 362.82 feet, NAVD88.
3. For map clarity, the location prefixes (OL-XX-) have been omitted on this figure.

0 120 240 480 720 960
Feet

FIGURE 1

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Areas C and D
Proposed Phase VI PDI
Dredge Stability and Upwelling
Geotechnical Borings

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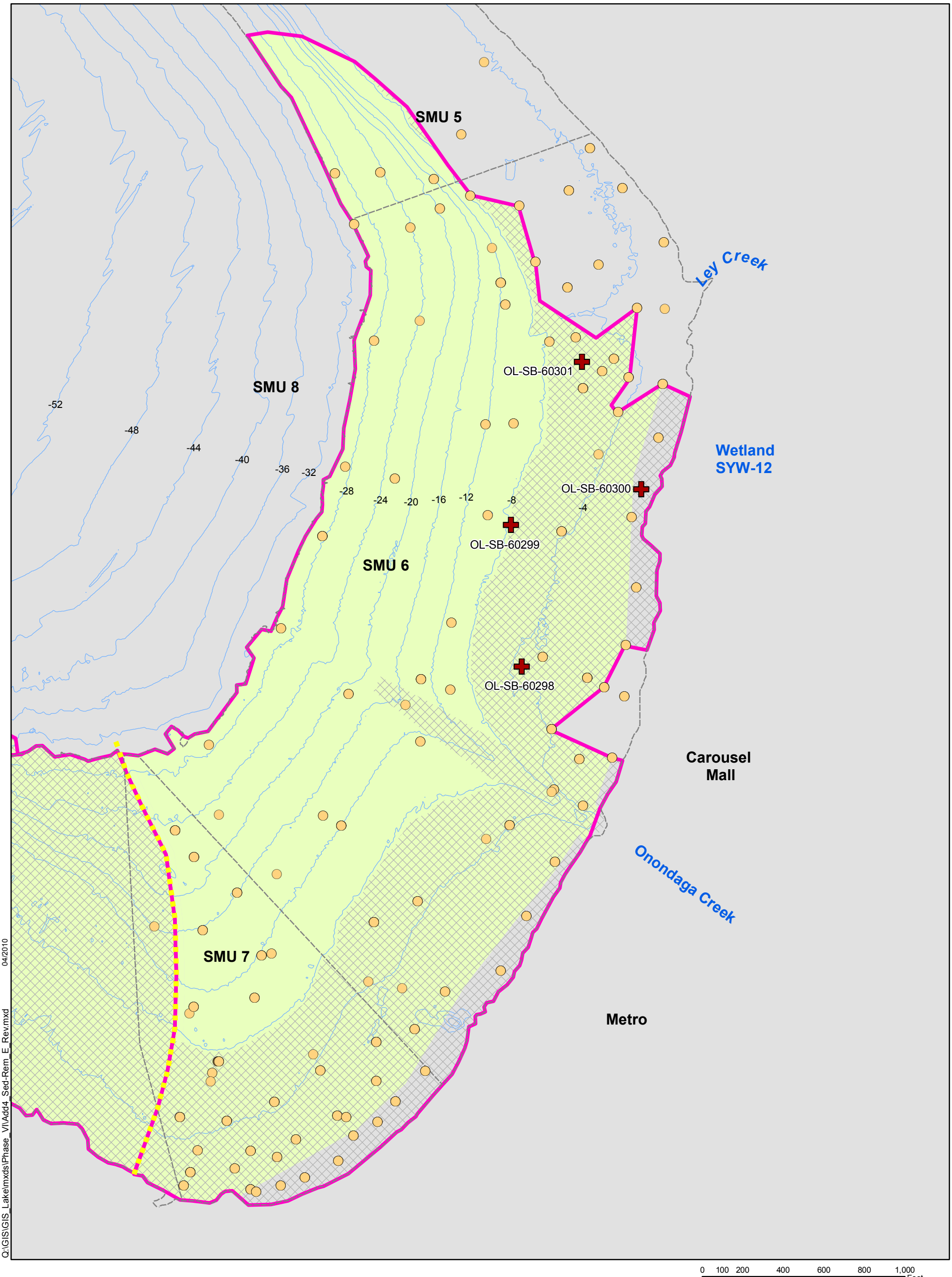
301 Plainfield Road, Suite 350, Syracuse, NY 13212 Phone:(315)451-9560



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Proposed Phase VI PDI Sample Locations

Dredge Stability Geotechnical Boring

Historical Sample Locations (RI to Phase IV PDI)

Historical Sediment Location

Preliminary Potential Remediation Area- Final Delineation to be Determined

Preliminary Dredge Area

Preliminary Cap Area

Extent of ILWD

SMU Boundary

NOTES

1. Bathymetry contours are in 4 foot intervals.
2. Water depth based on average lake elevation of 362.82 feet, NAVD88.
3. For map clarity, the location prefixes (OL-XX-) have been omitted on this figure.

0 100 200 400 600 800 1,000 Feet

FIGURE 2

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area E
Phase VI PDI Addendum 4
Dredge Stability Geotechnical Borings

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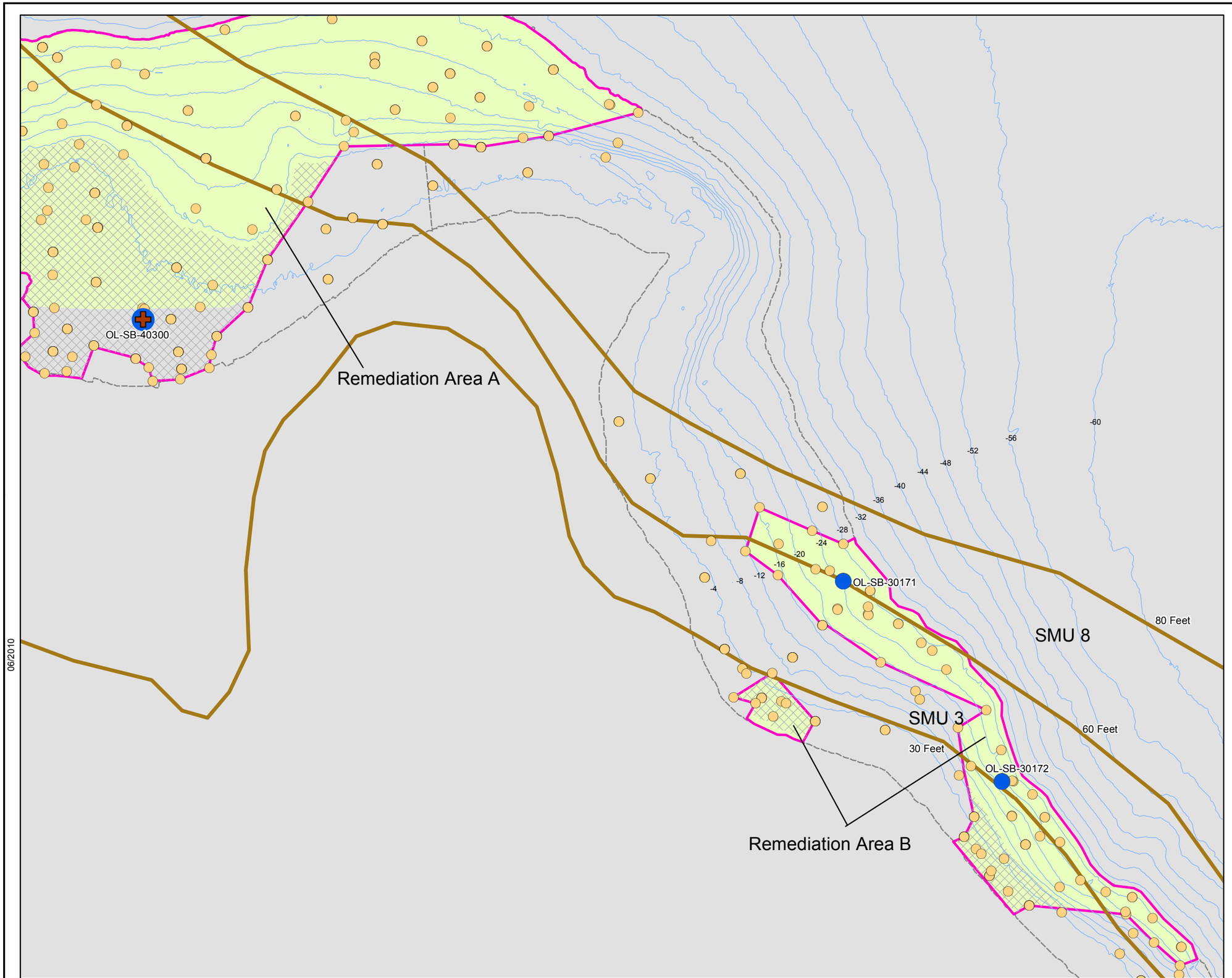

06/2010

Proposed Phase VI PDI Sample Locations

- Hydraulic Conductivity Boring
- Dredge Stability Geotechnical and Hydraulic Conductivity Boring
- Silt and Clay Thickness Contours

Historical Sample Locations (RI to Phase V PDI)

- Historical Sediment Location
- Preliminary Potential Remediation Area-Final Delineation to be Determined
- Preliminary Dredge Area
- Preliminary Cap Area
- SMU Boundary

NOTES

1. Bathymetry contours are in 4 foot intervals.

2. Water depth based on average lake elevation of 362.82 feet, NAVD88.

3. For map clarity, the location prefixes (OL-XX-) have been omitted on this figure.

0 240 480 960
Feet

FIGURE 3

Honeywell
Onondaga Lake
Syracuse, New York

Remediation Areas A & B
Proposed Phase VI PDI
Dredge Stability and Upwelling
Geotechnical Borings

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