ONONDAGA LAKE PRE-DESIGN INVESTIGATION: PHASE VI WORK PLAN

Onondaga County, New York

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LIST OF ACRONYMS

CPOIs	chemical parameters of interest
DOT	Department of Transportation
FS	feasibility study
GAC	granular activated carbon
JSA	job safety analysis
NYSDEC	New York State Department of Environmental Conservation
OCDWEP	Onondaga County Department of Water Environment Protection
PDI	pre-design investigation
PECQ	probable effect concentration quotient
PCB	polychlorinated biphenyls
PSP	Project Safety Plan
QA/QC	quality assurance / quality control
QAPP	Quality Assurance Project Plan
RI	remedial investigation
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SCA	sediment consolidation area
SMU	sediment management unit
SOP	standard operating procedure
SSP	Subcontractor's Safety Plan
SVOC	semivolatile organic compounds
TCLP	toxicity characterization leaching procedure
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
VOA	volatile organic analysis
VOC	volatile organic compounds

PHASE VI PRE-DESIGN INVESTIGATION WORK PLAN

1.0 INTRODUCTION

Honeywell continues to make great strides towards the Onondaga Lake remedy with the publication of this work plan. This work plan describes Phase VI of data collection and how field crews will collect new data related to the lake bottom. Sediment, groundwater, and porewater sampling will be conducted to support the Onondaga Lake design and to supplement existing data. The Phase VI Pre-Design Investigation (PDI) is structured similar to the Phase V effort conducted in 2009. Unless otherwise noted, all Phase VI field activities will be conducted in accordance with the procedures outlined in the Phase I-V PDI Work Plans and associated appendices (Parsons, 2005- 2009).

Onondaga Lake is a 4.6-mi^2 (2900-acre) lake located northwest of the City of Syracuse in central New York state. The lake, its tributaries, and the upland hazardous waste sites related to the lake have been identified as a federal Superfund site on the United States Environmental Protection Agency's (USEPA) National Priorities List (CERCLIS NYD986913580). The Remedial Investigation (RI) for the Onondaga Lake bottom subsite was completed in December 2002, the Feasibility Study (FS) was completed in November 2004, the Phase I PDI was completed in 2005, the Phase II PDI was completed in 2006, the Phase III PDI was completed in 2007, the Phase IV PDI was completed in 2008, and the Phase V PDI was completed in 2009. Additional information on the site can be found in the FS (Parsons, 2004) and the Record of Decision (ROD) issued by the New York State Department of Environmental Conservation (NYSDEC) and the USEPA on July 1, 2005 (NYSDEC and USEPA, 2005).

2.0 PROJECT OBJECTIVES

Additional information is required to complete and implement the in-lake remedial design. Since many of the details around the design have not been finalized, this work plan is intended to supplement the existing data set for cap and dredge extents, groundwater upwelling velocities, and porewater characterization. Activity-specific objectives covered by this work plan include the following:

1. Sediment Cores – Locations and depths selected to further assess proposed cap and dredge boundaries and dredge depth requirements
2. Groundwater Investigation – Locations selected to further assess upwelling rates along proposed cap boundaries, assess whether near-shore dredge to cleanup criteria areas can be capped instead, and to resample locations with upwelling rate uncertainty based on previous data
3. Porewater Investigation – Locations selected to increase porewater data density for use in chemical isolation layer modeling and within dredge areas

Any additional PDI required in 2010 beyond the scope of this work plan will be submitted to NYSDEC as addenda to this work plan. Phase VI work plan addenda currently in development or submitted after the initial preparation of this document include:

Work Plan	Anticipated Submittal	Field Activities
Granular Activated Carbon (GAC) Isotherm Evaluation	March 2010	May 2010
Siderite pH Column Studies	March 2010	May 2010
SMU 8 Probable Effect Concentration Quotient (PECQ) Sampling	April 2010	May 2010
Geotechnical Investigations	May 2010	May 2010

Phase IV field activities that may be conducted this year include collection of additional samples for total organic carbon (TOC) analysis from the wading pools installed during 2008 under the Addendum 1 Habitat Work Plan.

3.0 MOBILIZATION AND LOGISTICS

Health and Safety

Parsons ranks health and safety as its highest priority. Parsons Project Safety Plan (PSP) and our subcontractors' safety plans (SSP) prepared for previous PDI activities will be reviewed and updated as needed for use during this investigation and will be strictly followed by all personnel. Any task outside of the current scope defined in the PSP will have a new job safety analysis (JSA) completed before the task begins. Copies of the PSP and SSPs will be maintained at the support zone and on each vessel.

Site Facilities, Decontamination, and Waste Handling

The support zone and facilities established during the Phase V PDI will be used for the Phase VI investigation. All decontamination and waste management activities will be conducted in accordance with Phase I PDI Work Plan (Parsons, 2005).

4.0 SEDIMENT INVESTIGATION

The sediment sample locations proposed in this work plan will address the need for refining the boundary of capping and dredging areas as well as defining dredge depth requirements. Areas requiring remediation based on sediment criteria stated in the ROD include those where the mercury PEC exceeds 2.2 mg/kg or the mean PECQ is greater than 1. The proposed remediation areas were defined by drawing a line along "clean" sample locations where the mercury PEC is less than 2.2 mg/kg and the mean PECQ is less than 1. Remediation areas and associated sediment management units (SMUs) are shown on Figure 1. With the exception of

several shallow RI sample locations (i.e., 2 cm or less), exceedances at any sampled depth from previous PDIs and the RI investigations were considered for this boundary delineation approach.

4.1 Vibracores and Bulk Sediment

Sediment Cores

Sediment cores will be advanced in Remediation Areas A, B, C, and E (Figures 2 through 5) from a pontoon boat using a vibracore in accordance with the procedures outlined in the Phase I PDI Sampling and Analysis Plan (SAP) (Parsons, 2005b). Locations not accessible by barge will be sampled using a tripod vibracore setup in accordance with Standard Operating Procedure (SOP) 27 established during the Phase V PDI. The sampling intervals for these cores provide a higher resolution of contaminant concentrations for the initial design. The higher resolution is intended to better define depth of sediment requiring dredging due to exceedances of cleanup criteria and the need for capping. Proposed sample depths are based on collection of at least two intervals below criteria exceedance depths from previous sample locations in the vicinity of the proposed locations.

Sediment samples will be collected to depths ranging from 3 to 12 ft. using a vibracore. Cores will be sectioned into 1-ft. intervals and will be capped and sealed on the sampling vessel. The cores will be brought to the on-shore support zone where they will be processed for lithology. Sediment samples from these cores will be collected and shipped to the lab for chemical analysis. Sample intervals and analyses are presented on Table 1. A summary of the proposed sampling strategy is as follows:

Remediation Area A (refer to Figure 2)

- Near-shore locations were selected to further assess dredge depth requirements.
- Remaining sample locations were selected to refine the northern and eastern end of the proposed cap boundary.

Remediation Area B (refer to Figure 3)

- Locations have been selected to potentially refine the cap boundary.

Remediation Area C (refer to Figure 4)

- Locations were selected to further assess benzene concentrations in OL-VC-20169.

Remediation Area E (refer to Figure 5)

- SMU 5 sample locations were selected to further assess the north end of the proposed cap boundary.
- SMU 6 sample locations are near-shore points selected to assess dredge depth requirements north of Onondaga Creek.

Bulk Sediment

Bulk sediment will be collected for O'Brien & Gere for dewatering and analysis of water samples for molybdenum. Bulk sediment will be co-located with four proposed sediment, groundwater, or porewater sample locations within dredge areas for Remediation Areas A, B, C, and E. Because there are no sampling activities currently scheduled for Remediation Area D, two locations that have been sampled during previous PDIs (OL-STA-10115 and OL-STA-10117) have been selected for bulk sediment collection and are shown on Figure 6. All sediment will be collected to a depth of 6 ft. as indicated on Table 2 using vibracore equipment and placed in sealed 5-gallon buckets. Bulk samples will be provided to O'Brien & Gere for processing and molybdenum analysis. Table 2 also indicates the work plan figure illustrating the sediment, groundwater, or porewater locations where each bulk sample will be collected.

4.2 Sampling and Analysis

Sample processing and analysis will be conducted in accordance with the Phase I SAP and Quality Assurance Project Plan (QAPP) (Parsons, 2005a). Sediment vibracores analyses are listed on Table 1. Specific methods for sediment analysis are as follows:

- Mercury – SW846 7471A
- Volatile organic compounds (VOCs) chemical parameters of interest (CPOIs) – SW846 8260B
- Semivolatile organic compounds (SVOCs) CPOIs - SW846 8270C
- Polychlorinated biphenyls (PCBs) – SW846 8082
- pH – SW846 9054C
- Phenol – SW846 8270C
- TOC – Lloyd Kahn

Molybdenum analysis for sediment will be included for select sample locations within dredge areas as indicated on Table 2. Because sediment cores will not be collected from all remediation areas, some molybdenum samples will be collocated with a groundwater or porewater sample as indicated on Table 2. Analysis for molybdenum is being performed to facilitate assessment of Onondaga County Department of Water Environment Protection (OCDWEP) Metro Plant biosolids disposal options during lake dredging operations, since wastewater from the sediment consolidation area (SCA) water treatment plant will be discharged to the Metro plant. These data will be included with the submittal of PDI data as described in Section 7.

5.0 GROUNDWATER INVESTIGATION

5.1 Sediment Cores - Groundwater

Sediment cores will be advanced to a depth of 10 ft. in Remediation Areas A, C, and E as shown on Figures 7 through 9. The cores will be cut into 1-foot sections, capped, and brought to

shore for logging and processing. Duplicate cores will be collected from approximately 15 percent of the locations for reproducibility of groundwater upwelling velocity results. Specific objectives in Remediation Areas A, C, and E are given below:

Remediation Area A (refer to Figure 7)

- The near-shore sample locations were selected to evaluate whether this area could be capped rather than dredged to cleanup criteria.
- The SMU 5 sample location was selected to assess upwelling velocities within the western extent of the capping area.
- Remaining sample locations were selected to increase sample density in an area with slightly higher upwelling velocities. Note that no additional near-shore locations have been included since near-shore shallow and intermediate groundwater upwelling rates will be reduced by hydraulic controls associated with the Wastebeds 1-8 IRM. Additional information on this IRM and the magnitude of the anticipated reduction will be presented in the Caps and Dredge Intermediate Design.

Remediation Area C (refer to Figure 8)

- The near-shore sample locations were selected to assess upwelling rates around the Department of Transportation (DOT) turnaround area.
- The remaining locations were selected to revisit former Geoprobe locations with results that were in question due to uncertainty with the model fits as well as the presence of Solvay waste in the area. Note the presence of Solvay waste in these locations may result in the chloride profile results being biased high and may limit the usability of these data for estimating upwelling rates in this area.

Remediation Area E (refer to Figure 9)

- The near-shore sample locations were selected to evaluate whether this area could be capped rather than dredged to cleanup criteria.
- The remaining locations were selected as revisits for locations with higher than normal upwelling rate uncertainty based on historic data.

5.2 Sampling and Analysis

Sediment will be extruded vertically on-shore into the sample intervals described in Table 3. Due to limited sample volume with the fine intervals, major cations and anions will be analyzed only on the deeper samples to calculate the ion balance in these cores. The intervals specified on Table 3 were selected to focus data collection near the sediment-water interface, which is used to interpret the chloride profiles. Sample processing and analysis will be conducted in accordance with the Phase I QAPP (Parsons, 2005a). Samples will be analyzed for the following parameters:

- Specific Conductance (E120.1)
- Chloride (E300)
- pH (SW-846, 9040C)
- Cations/Anions (SW-6010B/E300)

6.0 POREWATER INVESTIGATION

6.1 Sediment Cores - Porewater

Fifty-six porewater cores will be advanced in Remediation Areas A through E using vibracore techniques in accordance with the procedures outlined in the Phase I PDI SAP (Parsons, 2005b). Following extraction, each core will be cut into 2-ft. intervals, capped, sealed, and shipped to the lab for processing. Samples will be collected to depths of between 10 and 12 ft. in Remediation Area A, 10 ft. in Remediation Areas B and C, 12 ft. in Remediation Area D, and 10 ft. in Remediation area E. The total sample depth in Remediation Area D (12 ft) is based on having at least two 2 ft. intervals below the anticipated dredge depths along the wall up to 2 meters or about 7 ft. Proposed sample depths are based on collection of at least two intervals below criteria exceedance depths from previous sample locations in the vicinity of the proposed locations. Specific objectives in Remediation Areas A, B, and C are given below:

Remediation Area A (refer to Figure 10):

- Near-shore sample locations were selected to evaluate whether this area could be capped rather than dredged to cleanup criteria.
- Remaining locations were selected to increase porewater density within cap areas and to evaluate VOC concentrations in the area.

Remediation Area B (refer to Figure 11):

- Sample locations were selected to increase porewater data density within the cap area.

Remediation Area C (refer to Figure 12):

- Sample locations were selected to increase porewater data density within the cap area.
- Sample locations near-shore to the DOT turnaround area were selected to assess extending the cap to shore.

Remediation Area D (refer to Figure 13):

- Sample locations were selected to facilitate cap design post barrier wall construction.

Remediation Area E (refer to Figure 14):

- Sample locations were selected to assess naphthalene concentrations.

6.2 Processing and Analysis

The collected cores will be processed and analyzed according to the Phase V PDI Work Plan and SOPs (Parsons, 2009):

- The cores will be maintained upright until the sections are measured, cut, capped, and labeled in the field before shipment to the lab. The cores will be cut, capped, and labeled on the sampling vessel.
- Lake water on top of the cores will be decanted before the core is capped. Any fluid that separates from the sediment within the core during sample shipment will be considered porewater and included in the analysis. Due to this modification, samples do not need to be kept vertical prior to processing.
- Centrifugation will be conducted in a refrigerated environment to minimize volatilization.
- The dissolved fraction of the porewater generated from these cores will be analyzed. For the dissolved porewater fraction, the non-volatile parameters (Hg, TOC, and pH) will be pressure filtered through 0.7 µm toxicity characteristic leaching procedure (TCLP) filtration paper. The volatiles will be centrifuged for 10 minutes and decanted into pre-preserved volatile organic analysis (VOA) vials.

7.0 DATA MANAGEMENT AND REPORTING

Field Database

An electronic database will be developed for the Phase VI PDI to ensure consistency in field sample ID assignment and compatibility with the Locus Focus data management system. The data collection program prepared for the Phase VI field program will be similar to the one used during previous phases of the PDI program. The database will be operated by trained Anchor/QEA or Parsons personnel.

Quality Assurance/Quality Control (QA/QC)

Field QA/QC will consist of the collection and analysis of field duplicates, and matrix spike/matrix spike duplicate samples in accordance with the Phase I PDI Work Plan (Parsons, 2005). All field QA/QC samples will be identified using standard sample identifiers and collected in accordance with the Phase I PDI Work Plan (Parsons, 2005).

Sample Holding, Collection, and Recordkeeping

Samples will be collected and handled according to the procedures outlined in the Phase I PDI Work Plan and associated appendices. Samples will be managed by the field database as described above. All sample recordkeeping and database entry (Locus Focus) will be conducted in accordance with the Phase I PDI Work Plan (Parsons, 2005).

Data Validation and Reporting

Analytical data generated during this investigation will be reviewed and validated in accordance with the Phase I PDI Work Plan (Parsons, 2005). The results will be incorporated into the LocusFocus database following validation.

Upon completion of the Phase VI PDI field activities and laboratory analyses, Parsons will submit unvalidated and validated data to NYSDEC in accordance with the Consent Decree for the lake. Once the Phase VI investigation and evaluation has been completed, a data summary report will be prepared and submitted to NYSDEC.

8.0 REFERENCES

NYSDEC and USEPA. 2005. *Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site Syracuse, New York Record of Decision*. Albany, New York.

Parsons. 2004. *Onondaga Lake Feasibility Study Report, Onondaga County, New York*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

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Parsons. 2007. *Onondaga Lake Pre-Design Investigation: Phase III Work Plan and Addenda*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

Parsons. 2008. *Onondaga Lake Pre-Design Investigation: Phase IV Work Plan and Addenda*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

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TABLES

Table 1
Vibracore Sediment Locations and Analyses

Description			Map Symbol	Number of Locations	Number of Intervals	Sampling Intervals (ft)	Location	Target Depth (ft)	Chemical Analysis: Mercury	VOCs (CPOIs) + Benzene & Toluene[1]	SVOCs (CPOIs)	Total PCBs	pH	TOC (Loyd Kahn)	Phenol	Lithology	Basis for Sample
									Number of Samples								
Remediation Area A	SMU 3	Vibracore		1	3	1-ft intervals from top of core	OL-VC-30173	3	3	3	3	3	3	3	3	1	Locations selected to confirm proposed cap boundary.
	SMU 4	Vibracore		1	3	1-ft intervals from top of core	OL-VC-40304	10	3	3	3	3	3	3	3	1	Locations selected to confirm proposed cap boundary.
		Near-shore[2] Vibracore		3	10	1-ft intervals from top of core	OL-VC-40269, 40270, 40271	10	30	30	30	30	30	30	30	3	Locations selected along shoreline extent of proposed dredge area to assess dredge depth requirements. Depth is based on criteria exceedance to 8 ft in this area.
	SMU 5	Vibracore		3	3	1-ft intervals from top of core	OL-VC-50080, 50081, 50082	3	9	9	9	9	9	9	9	3	Locations selected to confirm northern and eastern end of proposed cap boundary.
Remediation Area B	SMU 3	Vibracore		4	3	1-ft intervals from top of core	OL-VC-30157, 30158, 30174, 30175	3	12	12	12	12	12	12	12	4	30158 selected to assess SE extent of proposed cap area. 30157 selected to potentially refine south edge of proposed cap boundary.
Remediation Area C	SMU 2	Vibracore		4	10	1-ft intervals from top of core	OL-VC-20206, 20207, 20208, 20209	10	40	40	40	40	40	40		4	Locations selected to assess benzene at bottom (6 ft) of OL-VC-20169.
Remediation Area E	SMU 5	Vibracore		5	3	1-ft intervals from top of core	OL-VC-50083, 50084, 50085, 50086, 50091	3	15	15	15	15	15	15		5	Locations selected to confirm north end of proposed cap boundary.
	SMU 6	Near-shore[2] Vibracore		4	10	1-ft intervals from top of core	OL-VC-60264, 60265, 60266, 60271	10	40	40	40	40	40	40		4	Locations selected to assess nearshore dredge depth requirements. Depth is based on criteria exceedance at previous nearshore locations of 6.6 ft or less.
		Vibracore		2	12	1-ft intervals from top of core	OL-VC-60272, 60273	12	24	24	24	24	24	24		2	Locations selected to assess nearshore dredge depth requirements. Depth is based on criteria exceedance (individual PECs) at previous nearshore locations of 9.9 ft or less.
		Near-shore[2] Vibracore		4	12	1-ft intervals from top of core	OL-VC-60267, 60268, 60269, 60270	12	48	48	48	48	48	48		4	Locations selected to assess nearshore dredge depth requirements. Depth is based on criteria exceedance (individual PECs) at previous nearshore locations of 9.9 ft or less.

Note:
Null fields indicate that parameter was not sampled for.
1. CPOI list for VOCs and SVOCs are the same compounds as the Phase I PDI (Parsons, 2005)

Table 2
Bulk Sediment and Molybdenum Locations

Description	Map Symbol	Number of Intervals	Sampling Intervals (ft)	Location	Associated Work Plan Figure	Target Depth (ft)	Bulk Sediment (5 gallons)	Molybdenum SW6010B
Remediation Area A (SMU 4)		1	Composite of 0-6 ft	OL-VC-40269	Figure 2	6		√
		1	Composite of 0-6 ft	OL-VC-40270	Figure 2	6	√	
		1	Composite of 0-6 ft	OL-VC-40271	Figure 2	6		√
		1	Composite of 0-6 ft	OL-VC-40277	Figure 10	6		√
Remediation Area B (SMU 3)		1	Composite of 0-6 ft	OL-VC-30159	Figure 11	6	√	
		1	Composite of 0-6 ft	OL-VC-30160	Figure 11	6		√
		1	Composite of 0-6 ft	OL-VC-30163	Figure 11	6		√
Remediation Area C (SMUs 2 & 3)		1	Composite of 0-6 ft	OL-VC-20198	Figure 8	6	√	
		1	Composite of 0-6 ft	OL-VC-20203	Figure 8	6		√
		1	Composite of 0-6 ft	OL-VC-30166	Figure 12	6		√
Remediation Area D (SMU 1)		1	Composite of 0-6 ft	OL-STA-10115	Figure 6	6	√	√
		1	Composite of 0-6 ft	OL-STA-10117	Figure 6	6	√	√
Remediation Area E (SMUs 6 & 7)		1	Composite of 0-6 ft	OL-VC-60266	Figure 5	6	√	
		1	Composite of 0-6 ft	OL-VC-60270	Figure 5	6		√
		1	Composite of 0-6 ft	OL-VC-60273	Figure 5	6		√
		1	Composite of 0-6 ft	OL-VC-60276	Figure 9	6		√
		1	Composite of 0-6 ft	OL-VC-60278	Figure 9	6		√
		1	Composite of 0-6 ft	OL-VC-70146	Figure 9	6		√

Note:
Null fields indicate that parameter was not sampled for.

Table 3
Groundwater Vibracore Sample Locations and Analyses

Description			Map Symbol	Number of Locations	Number of Intervals	Sampling Intervals (ft)	Location [1]	Target Depth (ft)	Groundwater Analyses: Specific Conductance (Salinity Calculated)	Groundwater Analyses: pH	Groundwater Analyses: Chloride	Groundwater Analyses: Cations/Anions	Lithology	Basis for Sample
									Number of Samples					
Remediation Area A	SMU 4	Near-shore[2] Vibracore		8	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-40287, 40288, 40289, 40289A, 40290, 40291, 40292, 40293	10	56	56	56		8	Locations selected to evaluate whether this area can be capped rather than dredged to cleanup critiera.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			56	56		56		
		Vibracore		11	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-40294, 40294A, 40295, 40296, 40297, 40297A, 40298, 40299, 40305, 40306, 40307	10	77	77	77		11	Locations selected to increase sample density in an area with slightly higher upwelling velocities.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			77	77		77		
	SMU 5	Vibracore		1	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-50087	10	7	7	7		1	Locations selected to assess upwelling rate in northern wing of remediation cap area.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			7	7		7		
Remediation Area C	SMU 2	Near-shore[2] Vibracore		6	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-20198, 20199, 20200, 20201, 20202, 20203	10	42	42	42		6	Locations around "DOT Turnaround" selected to assess nearshore upwelling rates.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			42	42		42		
		Vibracore		3	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-20204, 20204A, 20205	10	21	21	21		3	Locations selected to re-sample locations with higher than normal estimated upwelling uncertainty.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			21	21		21		
	SMU 3	Vibracore		5	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-30176, 30177, 30178, 30179, 30180	10	35	35	35		5	Locations selected to re-sample locations with higher than normal estimated upwelling uncertainty.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			35	35		35		
Remediation Area E	SMU 5	Vibracore		3	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-50088, 50088A, 50089	10	21	21	21		3	Locations selected to address a general lack of upwelling data for this recently expanded cap area.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			21	21		21		
	SMU 6	Near-shore[2] Vibracore		15	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-60274, 60275, 60276, 60277, 60278, 60278A, 60279, 60280, 60281, 60282, 60283, 60284, 60285, 60286, 60287	10	105	105	105		15	Locations selected to evaluate whether this area can be capped rather than dredged to cleanup critiera.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			105	105		105		
		Vibracore		12	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-60288, 60289, 60290, 60290A, 60291, 60292, 60293, 60294, 60294A, 60295, 60296, 60297	10	84	84	84		12	Locations selected to re-sample locations with higher than normal estimated upwelling uncertainty.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			84	84		84		
	SMU 7	Vibracore		12	7	0-0.25, 0.25-0.5, 0.5-0.75, 0.75-1.0, 1.0-1.25, 1.25-1.5, 1.5-1.75	OL-VC-70144, 70145, 70146, 70147, 70147A, 70148, 70149, 70150, 70151, 70152, 70153, 70154	10	84	84	84		12	OL-VC-70144, 70145, 70146, 70147, 70147A, 70148, 70149, 70150 - Locations selected to re-sample locations with higher than normal estimated upwelling uncertainty. OL-VC-70151, 70152, 70153, 70154 - Locations selected to evaluate whether this area can be capped rather than dredged to cleanup critiera.
					7	2.0-2.5, 3.0-3.5, 4.0-4.5, 5.0-5.5, 6.0-6.5, 7.5-8.0, 9.0-9.5			84	84		84		

Note:
Null fields indicate that parameter was not sampled for.
1. Co-located vibracores for field duplicate indicated with an "A".
2. Near-shore samples are defined as within 10 ft. of the shoreline

Table 4
Porewater Locations and Analyses

Description			Map Symbol	Number of Locations	Number of Intervals	Sampling Intervals (ft)	Location	Target Depth (ft)	Water Chemical Analyses				Raw Sediment Chemical Analyses						Basis for Sample
									Mercury	VOCs (CPOIs)[1]	pH	DOC	Mercury	VOCs (CPOIs)[1]	pH	TOC	Percent Moisture	Specific Gravity	
									Number of Samples										
Remediation Area A	SMU 4	Vibracore	▲	12	5	2 ft intervals from top of core	OL-VC-40272, 40273, 40274, 40725, 40276, 40277, 40278, 40308, 40309, 40310, 40311, 40312	10	60	60	60	60	60	60	60	60	60	60	Sample locations selected to evaluate VOC concentrations in the area.
			▲	8	6	2 ft intervals from top of core	OL-VC-40279, 40280, 40281, 40282, 40283, 40284, 40285, 40286	12	48	48	48	48	48	48	48	48	48	48	Sample locations selected to address nearshore data gaps west of NMC.
Remediation Area B	SMU 3	Vibracore	▲	3	5	2 ft intervals from top of core	OL-VC-30159, 30162, 30164	10	15	15	15	15	15	15	15	15	15	15	Sample locations selected to increase sample density.
		Near-shore[2] Vibracore	▲	3	5	2 ft intervals from top of core	OL-VC-30160, 30161, 30163	10	15	15	15	15	15	15	15	15	15	15	
Remediation Area C	SMU 2	Near-shore[2] Vibracore	▲	4	5	2 ft intervals from top of core	OL-VC-20212, 20213, 20214, 20215	10	20	20	20	20	20	20	20	20	20	20	Locations nearshore off DOT turnaround to assess extending cap to shore.
	SMU 3	Vibracore	▲	5	5	2 ft intervals from top of core	OL-VC-30165, 30166, 30167, 30168, 30169	10	25	25	25	25	25	25	25	25	25	25	Sample locations selected to increase sample density.
Remediation Area D	SMU 1	Vibracore	▲	2	6	2 ft intervals from top of core	OL-VC-10192, 10193	12	12	12	12	12	12	12	12	12	12	12	Sample locations selected to facilitate cap design post barrier wall construction.
	SMU 2		▲	2	6	2 ft intervals from top of core	OL-VC-20216, 20217	12	12	12	12	12	12	12	12	12	12	12	
Remediation Area E	SMU 6	Vibracore	▲	14	5	2 ft intervals from top of core	OL-VC-60314, 60315, 60316, 60317, 60318, 60319, 60320, 60321, 60322, 60323, 60324, 60325, 60326, 60327	10	70	70	70	70	70	70	70	70	70	70	Sample locations selected to assess napthalene concentrations.
		Near-shore[2] Vibracore	▲	2	5	2 ft intervals from top of core	OL-VC-60312, 60313	10	10	10	10	10	10	10	10	10	10	10	sample locations selected to assess napthalene concentrations associated with historical locations 60269 and 60270.

Note:

1. CPOI list for VOCs are the same compounds as the Phase I PDI (Parsons, 2005)

FIGURES

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FIGURE 1

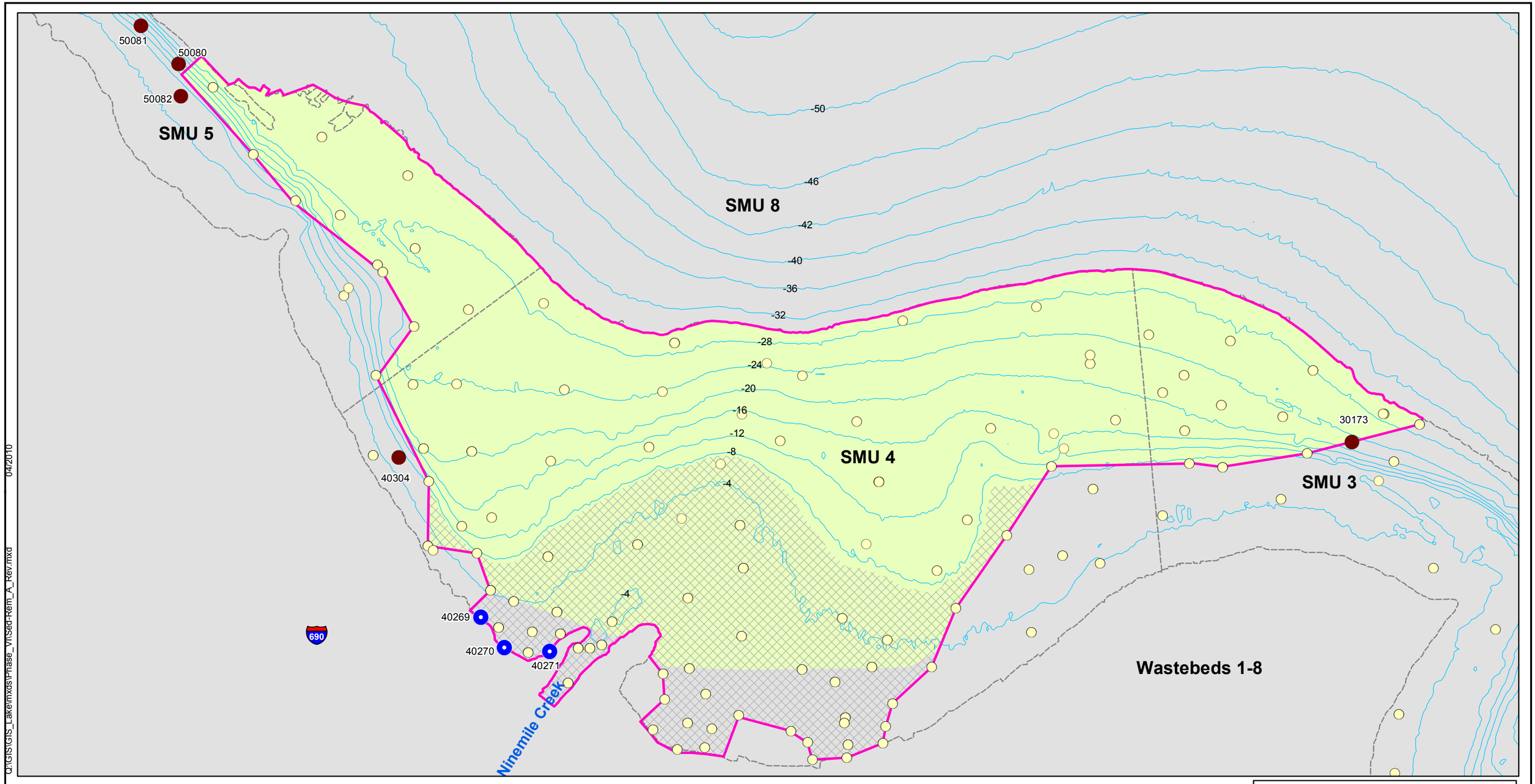
Honeywell

Onondaga Lake
Syracuse, New York

SMU Boundaries and Remediation Areas

PARSONS

301 PLAINFIELD RD, SUITE 350, SYRACUSE, NY 13212



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Proposed Phase VI PDI Sample Locations

- 3 ft. Vibracore
- 10 Ft. Nearshore Vibracore

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

0 100 200 400 600 800 1,000
Feet

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.

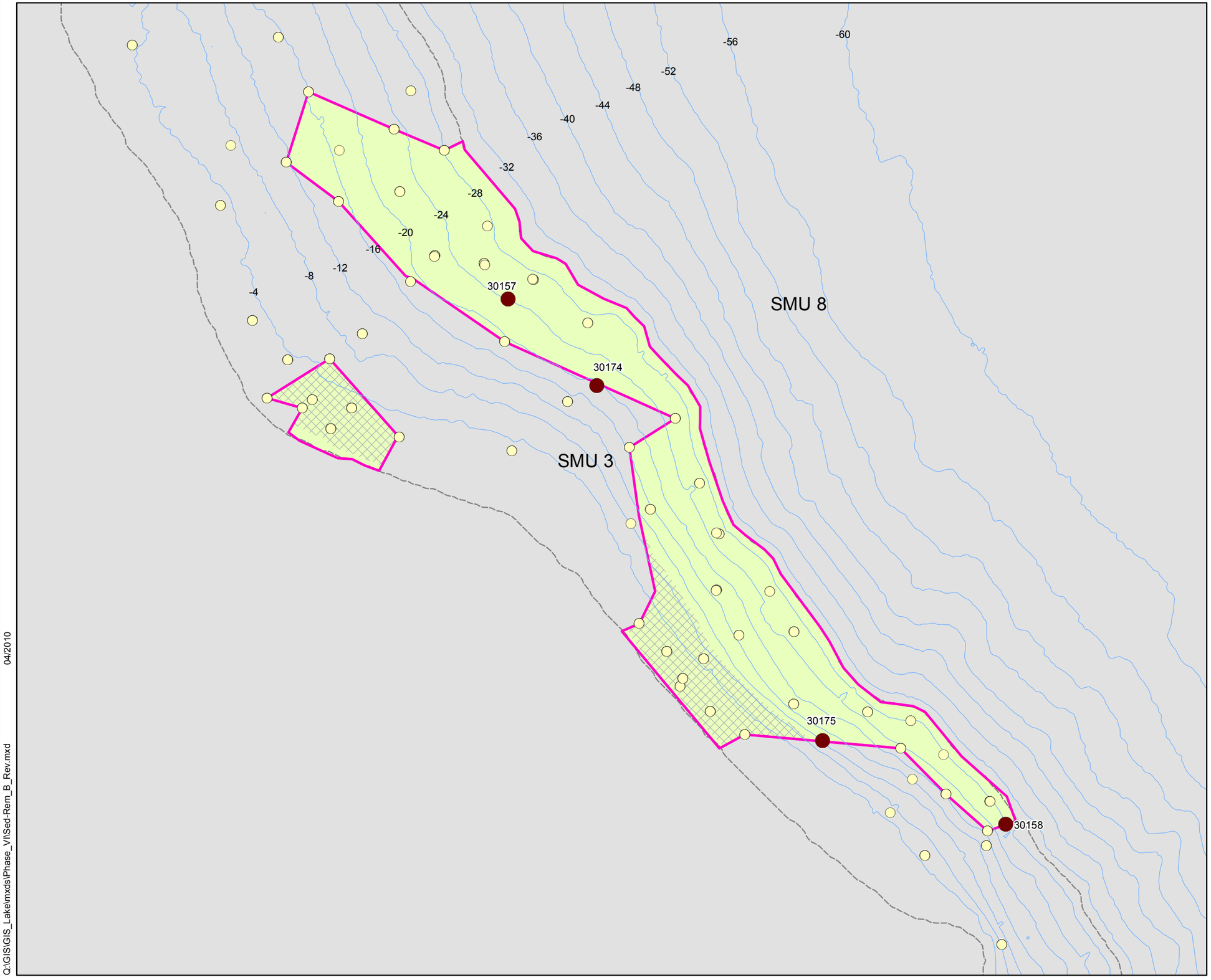
FIGURE 2

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area A
Proposed Phase VI PDI
Sediment Sample Locations

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



Proposed Phase VI PDI Sample Locations

- 3 ft. Vibracore

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 85 170 340 510 680
Feet

FIGURE 3

Honeywell
Onondaga Lake
Syracuse, New York

Remediation Area B
Proposed Phase VI PDI
Sediment Sample Locations

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

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SMU 3

SMU 2

SMU 8

20206

20207

20208

20209

-56
-52
-48
-44
-40
-36
-32
-28
-24
-20
-16
-12
-8
-4

Proposed Phase VI PDI Sample Locations

10 ft. Nearshore Vibracore

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

Area with Wooden Pilings

ILWD Boundary

Willis/Semet IRM Barrier Wall

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 85 170 340 510 680

Feet

FIGURE 4

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area C
Proposed Phase VI PDI
Sediment Sample Locations

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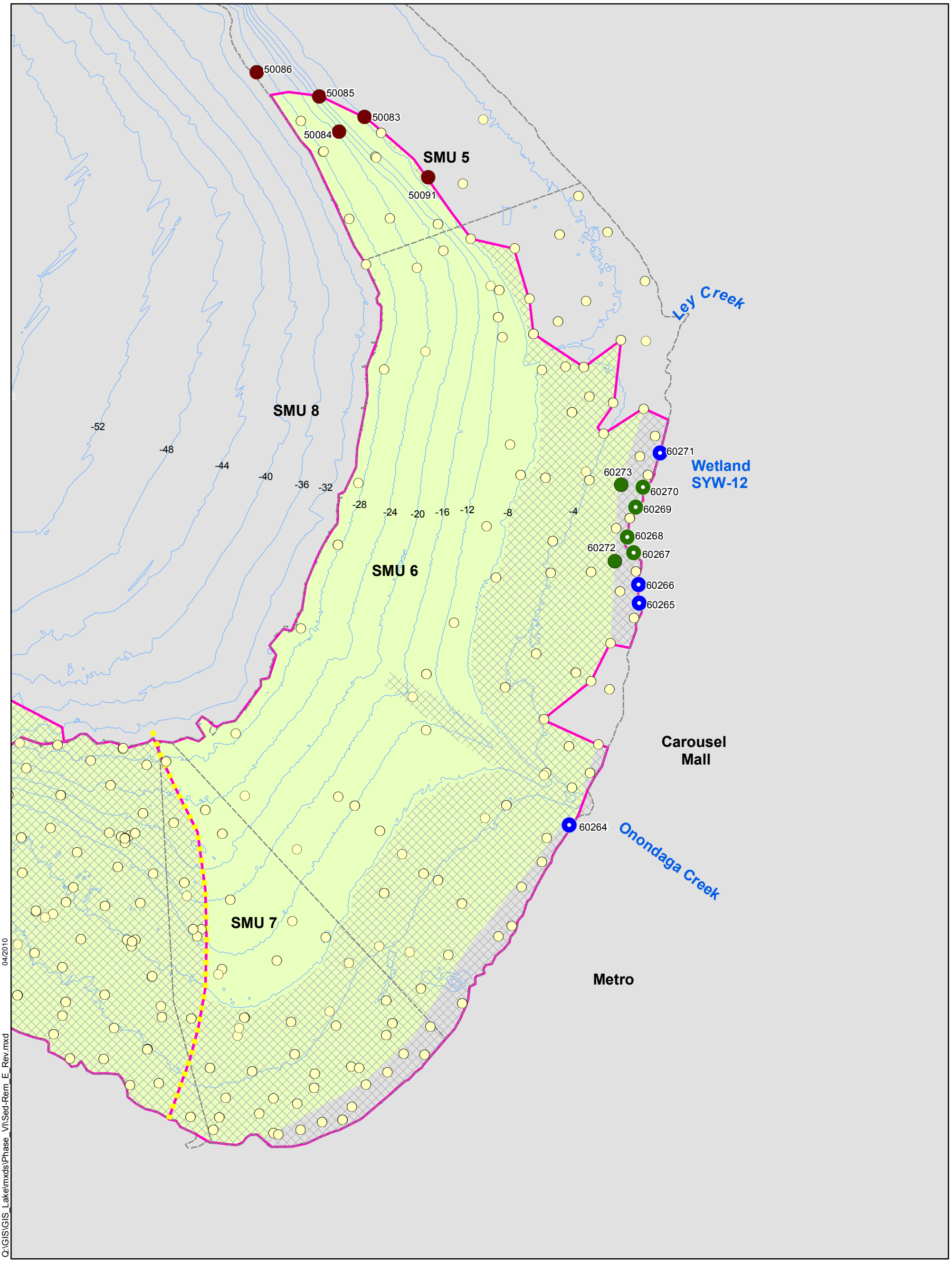


Proposed Phase VI PDI Sample Locations

- 3 ft. Vibracore
- 10 ft. Nearshore Vibracore
- 12 ft. Vibracore
- 12 ft. Nearshore Vibracore

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
- 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

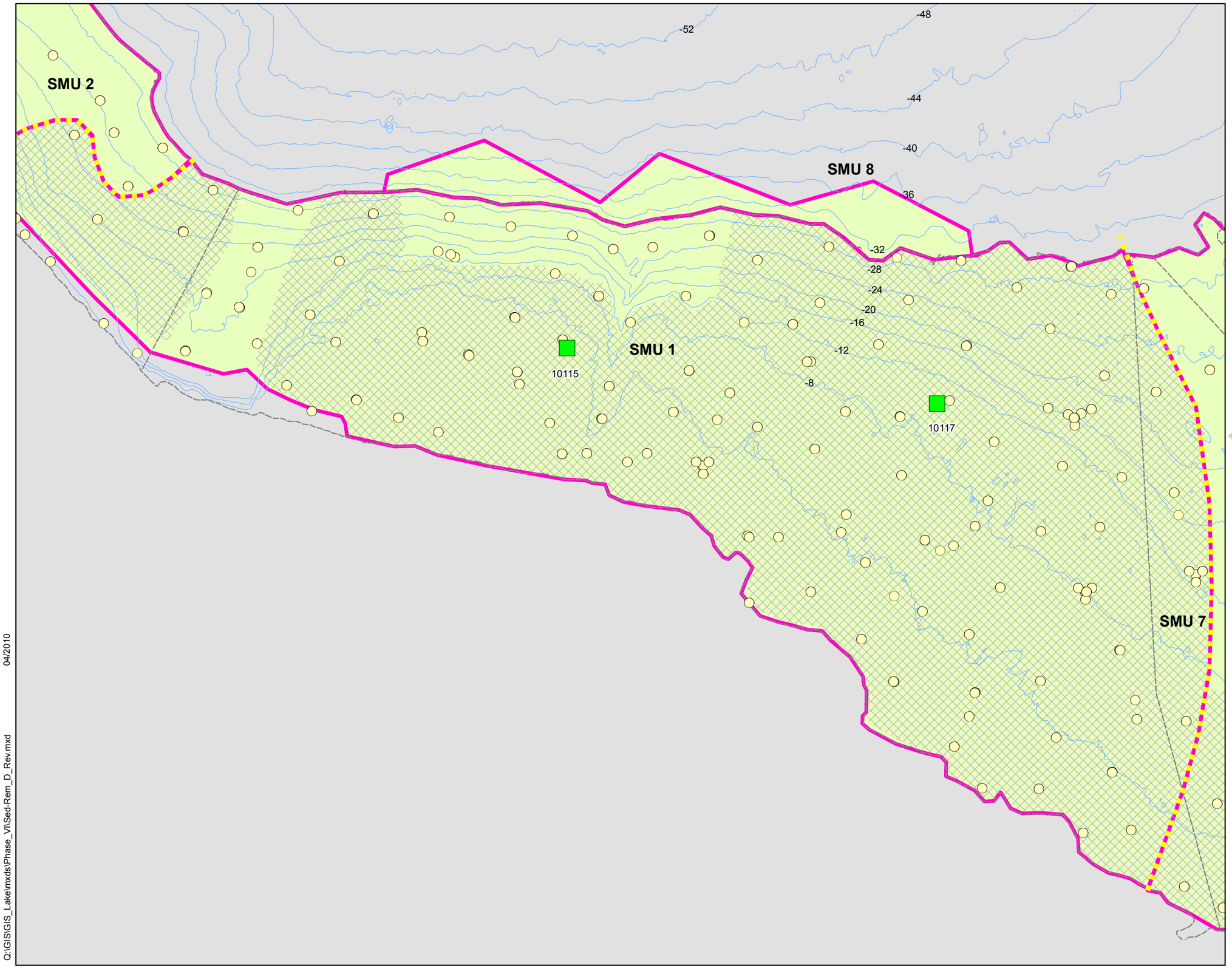
FIGURE 5

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area E
Proposed Phase VI PDI
Sediment Sample Locations

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



Proposed Phase VI PDI Sample Locations

- Bulk Sediment

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
- 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 70 140 280 420 560
Feet

FIGURE 6

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area D
Proposed Phase VI PDI
Sediment Sample Locations

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

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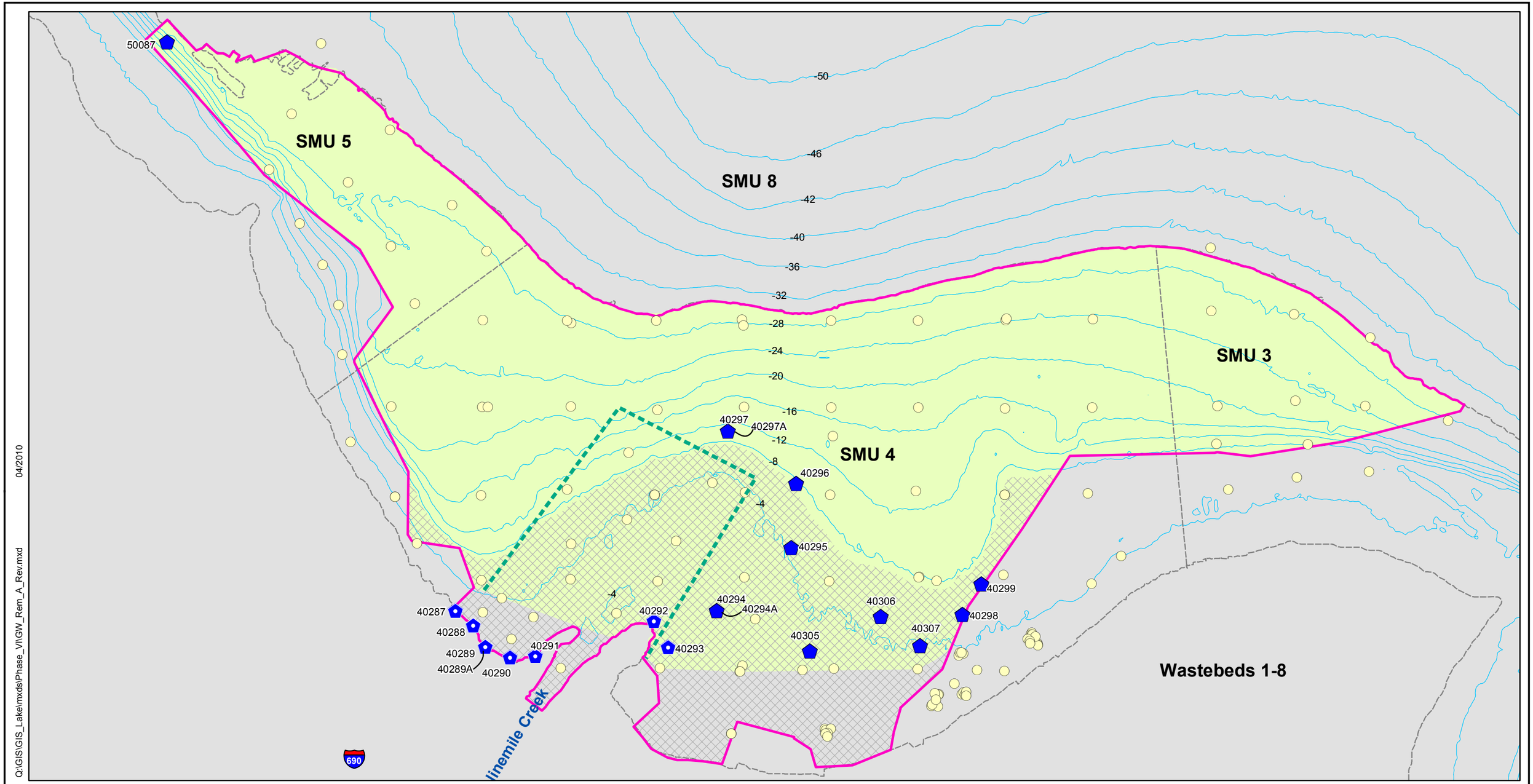


Proposed Phase VI PDI Sample Locations

- 10 ft. Vibracore
- 10 Ft. Nearshore Vibracore

Historical Sample Locations (RI to Phase V PDI)

- Historical Groundwater Location

- Preliminary Potential Remediation Area- Final Delineation to be Determined
- Preliminary Dredge Area
- Preliminary Cap Area
- Cap Model Area - Cap area within boundaries is Cap Model Area A-2; cap area outside of boundaries is Cap Model Area A-1.
- SMU Boundary

0 100 200 400 600 800 1,000
Feet

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.

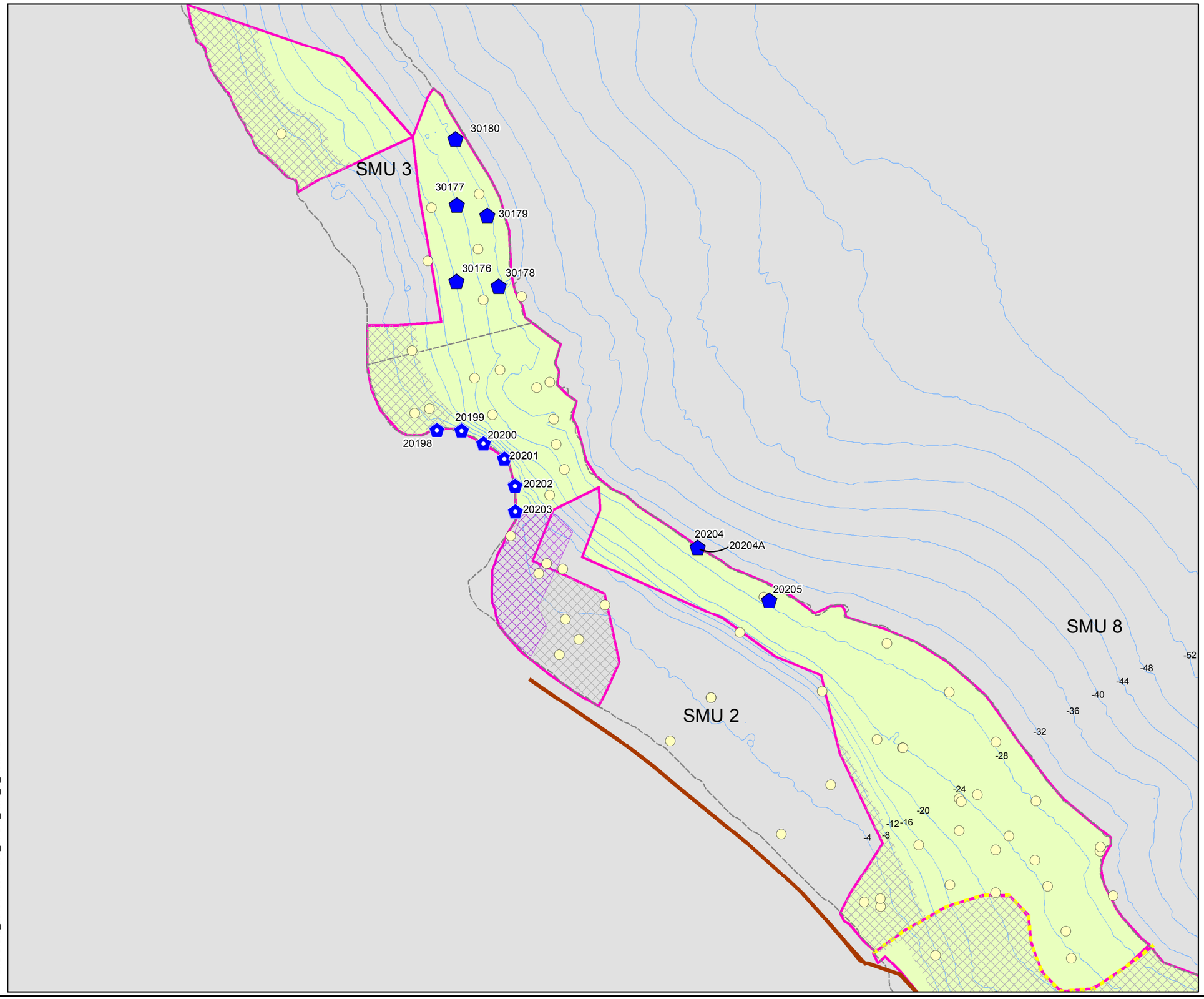
FIGURE 7

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area A
Proposed Phase VI PDI
Groundwater Sample Locations

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



Proposed Phase VI PDI Sample Locations

- 10 Ft. Vibracore
- 10 Ft. Nearshore Vibracore

Historical Sample Locations (RI to Phase V PDI)

- Historical Groundwater Location

- Preliminary Potential Remediation Area- Final Delineation to be Determined
- Preliminary Dredge Area
- Preliminary Cap Area
- Area with Wooden Pilings
- ILWD Boundary
- Willis/Semet IRM Barrier Wall
- 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 85 170 340 510 680
Feet

FIGURE 8

Honeywell
Onondaga Lake
Syracuse, New York

Remediation Area C
Proposed Phase VI PDI
Groundwater Sample Locations

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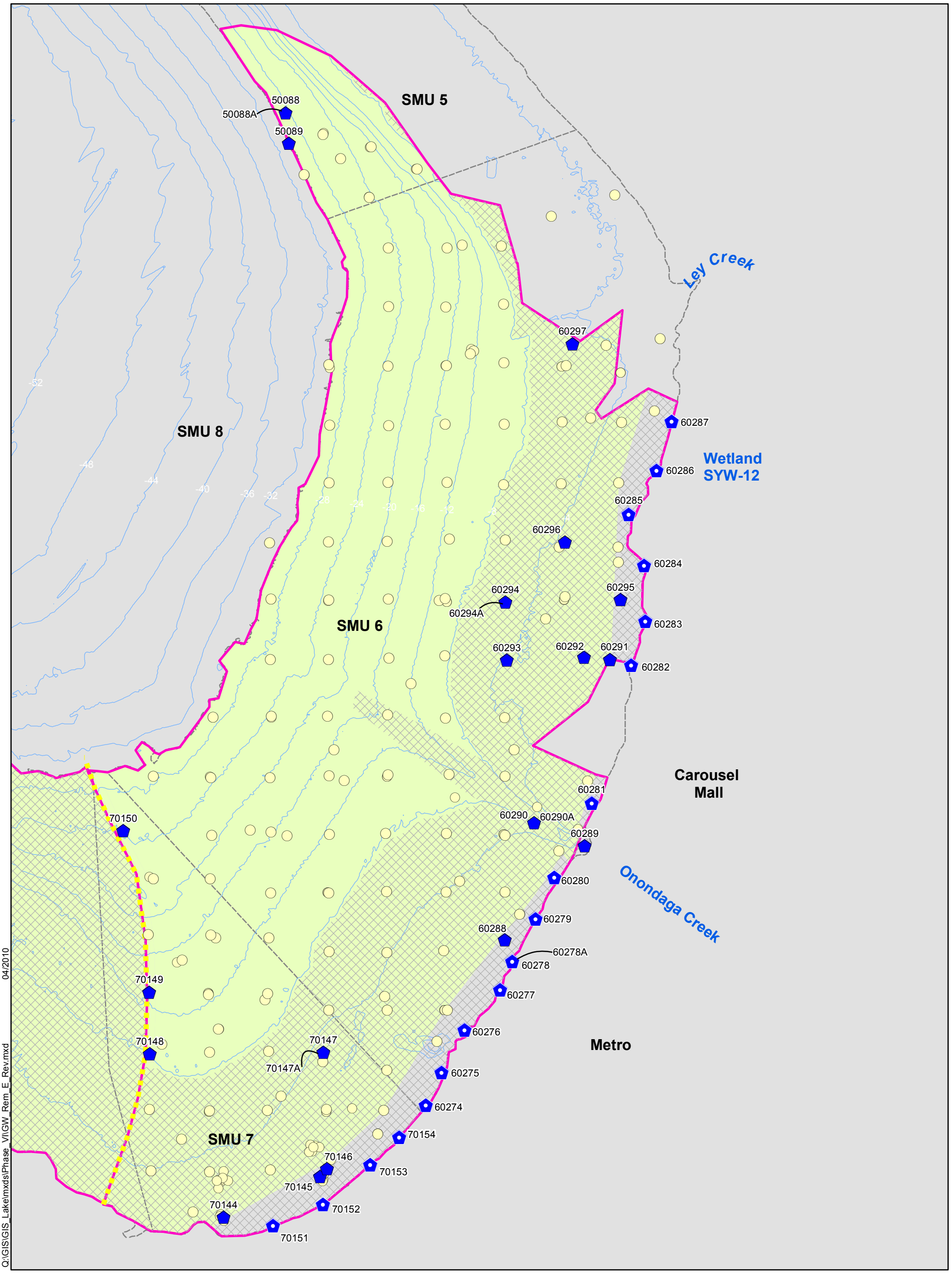

Proposed Phase VI PDI Sample Locations

- 10 Ft. Vibracore
- 10 Ft. Nearshore Vibracore

Historical Sample Locations (RI to Phase V PDI)

- Historical Groundwater Location

- Preliminary Potential Remedial Area- Final Delineation to be Determined
- Preliminary Dredge Area
- Preliminary Cap Area
- SMU Boundary
- Extent of ILWD

0 262.5 525 1,050 Feet

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 the figure.

FIGURE 9

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area E
Proposed Phase VI PDI
Groundwater Sample Locations

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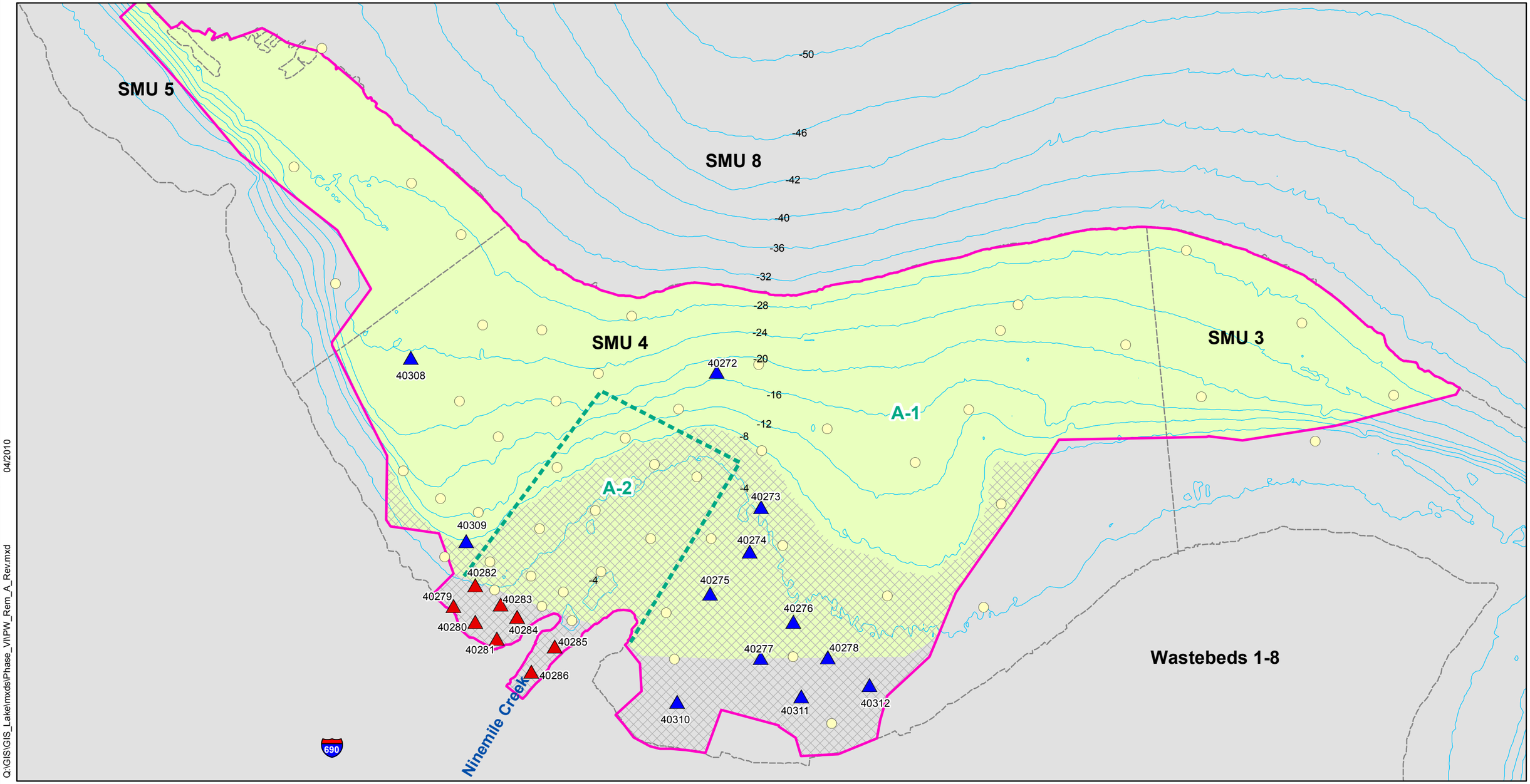

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Proposed Phase VI PDI Sample Locations

- 10 ft. Vibracore
- 12 ft. Vibracore

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.

Historical Sample Locations (RI to Phase V PDI)

- Historical Porewater Location

0 100 200 400 600 800 1,000
Feet

- Preliminary Potential Remediation Area-Final Delineation to be Determined
- Preliminary Dredge Area
- Preliminary Cap Area
- Cap Model Area - Cap area within boundaries is Cap Model Area A-2; cap area outside of boundaries is Cap Model Area A-1.
- SMU Boundary

FIGURE 10

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area A
Proposed Phase VI PDI
Porewater Sample Locations

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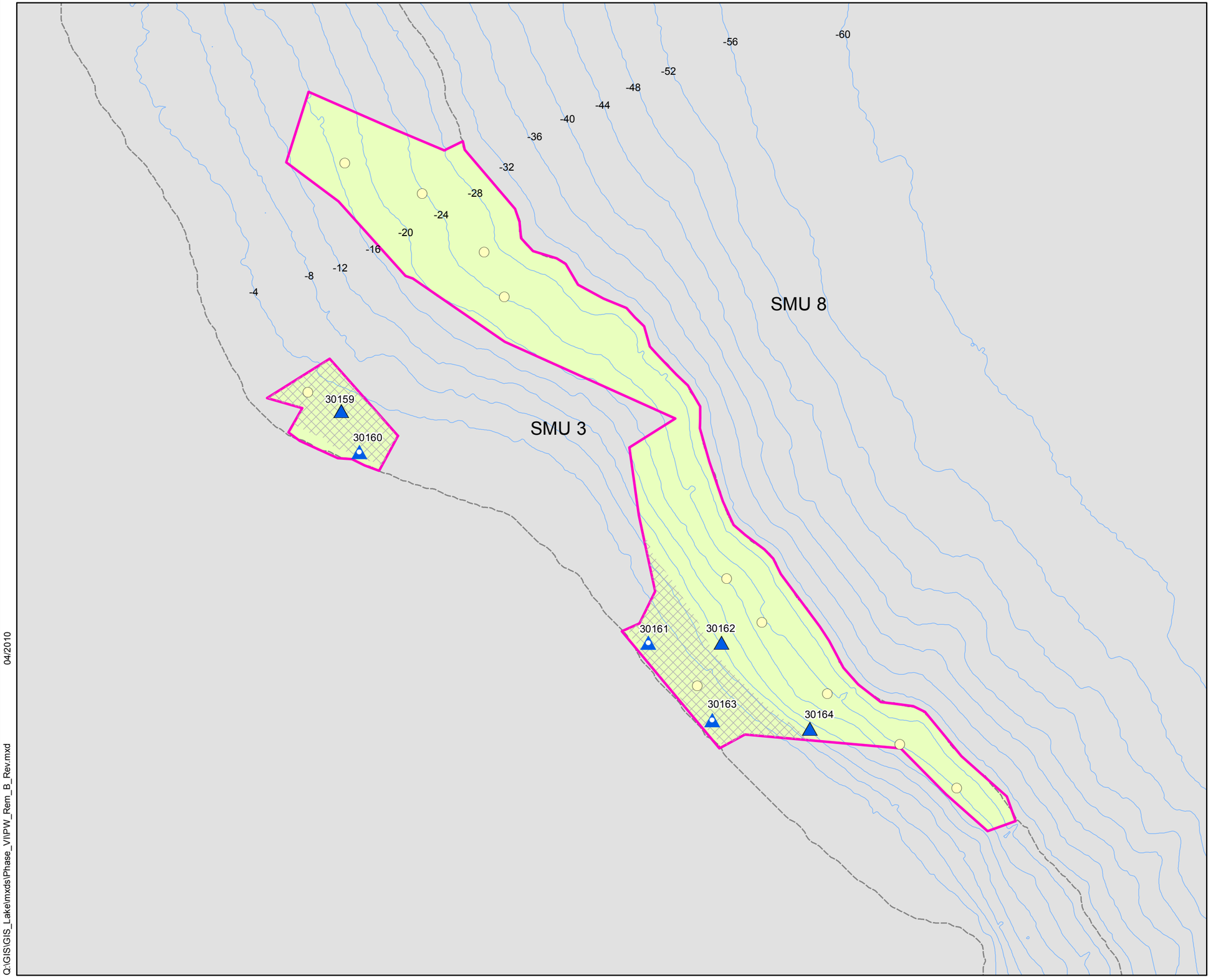

Proposed Phase VI PDI Sample Locations

- 10 ft. Vibracore
- 10 ft. Nearshore Vibracore

Historical Sample Locations (RI to Phase V PDI)

- Historical Porewater 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 85 170 340 510 680

Feet

FIGURE 11

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area B
Proposed Phase VI PDI
Porewater Sample Locations

PARSONS

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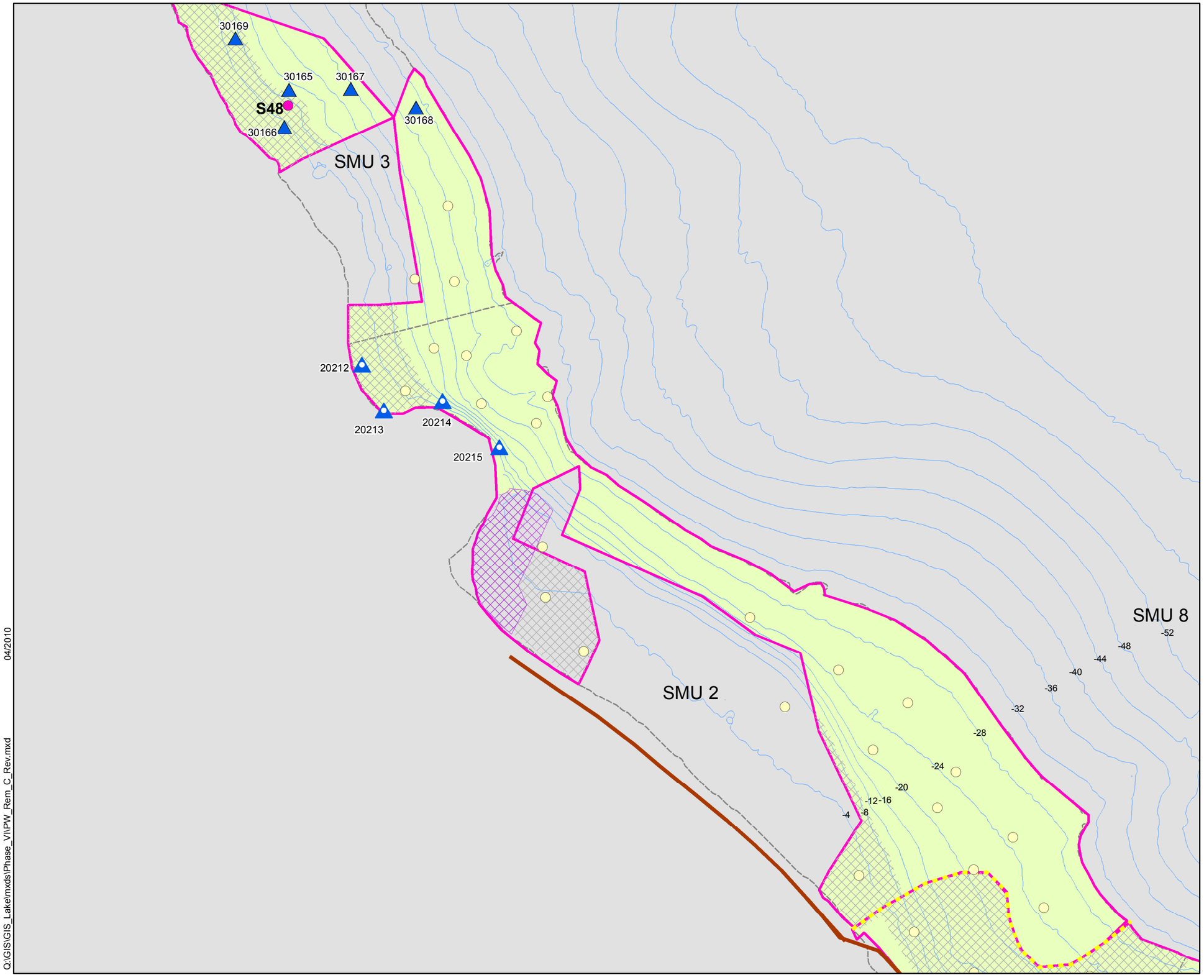

Proposed Phase VI PDI Sample Locations

- 10 ft. Vibracore
- 10 ft. Nearshore Vibracore

Historical Sample Locations (RI to Phase V PDI)

- Historical Porewater Location
- S48
- Preliminary Potential Remediation Area-Final Delineation to be Determined
- Preliminary Dredge Area
- Preliminary Cap Area
- Area with Wooden Pilings
- ILWD Boundary
- Willis/Semet IRM Barrier Wall
- 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 85 170 340 510 680
Feet

FIGURE 12

Honeywell
Onondaga Lake
Syracuse, New York

Remediation Area C
Proposed Phase VI PDI
Porewater Sample Locations

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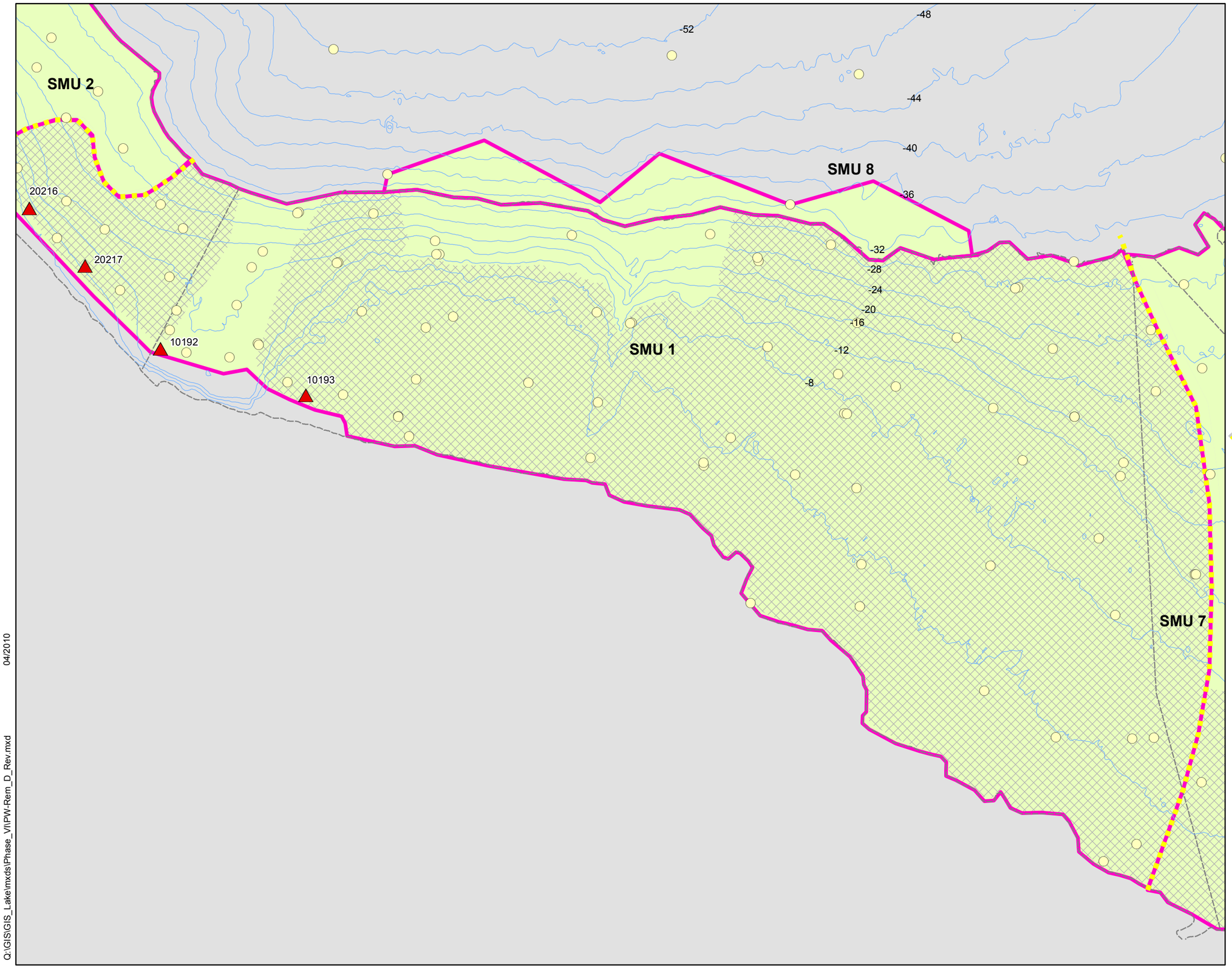

Proposed Phase VI PDI Sample Locations

- 12 ft. Vibracore

Historical Sample Locations (RI to Phase V PDI)

- Historical Porewater 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 70 140 280 420 560
Feet

FIGURE 13

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area D
Proposed Phase VI PDI
Porewater Sample Locations

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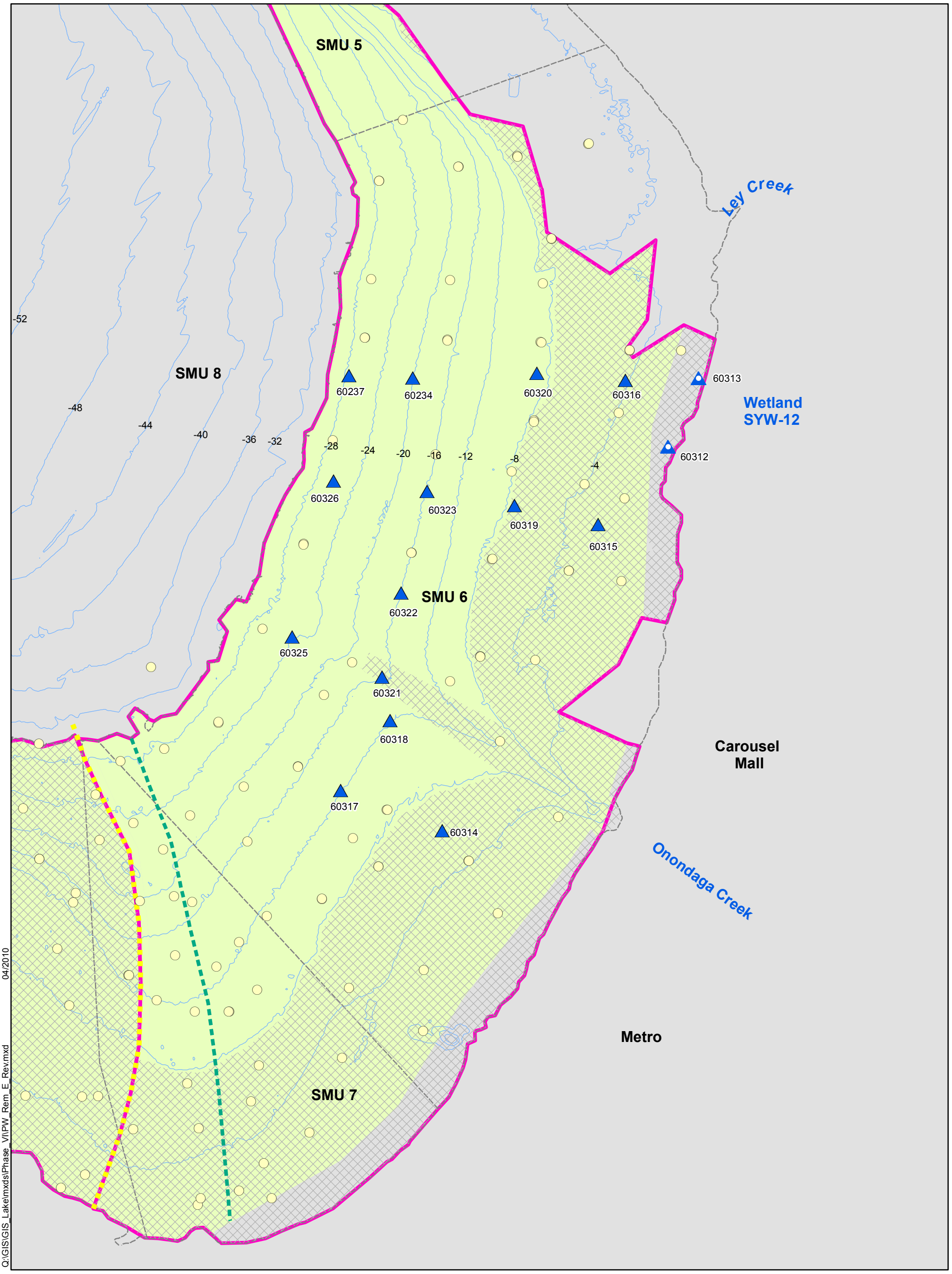

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Phase VI PDI Proposed Sample Locations

- 10 ft. Vibracore
- 10 ft. Nearshore Vibracore

Historical Sample Locations (RI to Phase V PDI)

- Historical Porewater Location

- Preliminary Potential Remediation Area-Final Delineation to be Determined
- Preliminary Dredge Area
- Preliminary Cap Area
- Cap Model 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.

0 130 260 520 780 1,040 Feet

FIGURE 14

Honeywell

Onondaga Lake
Syracuse, New York

Remediation Area E
Proposed Phase VI PDI
Porewater Sampling Locations

PARSONS
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APPENDIX A

QUALITY ASSURANCE PROJECT PLAN MODIFICATION

M E M O R A N D U M

May 12, 2010

To: Tom Abrams

From: Maryanne Kosciewicz

Subject: Updates/Modifications to the Onondaga Lake Quality Assurance Project Plan for the upcoming 2010 field work.

Modifications to the Parsons Appendix B Onondaga Lake Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP), September 2005 have been made to reflect current PDI activities at the Onondaga Lake Site. The following modifications are presented:

Subsection B2.1.3: Parsons

Parsons is providing the management, technical staff, and subcontractor support to execute this project. Mr. Edward Glaza, PE, is the technical manager for this project. Mr. Glaza is responsible for technical review, identifying design data needs and technical management of specialty subcontractors conducting studies and design subcontractors.

Mr. Tom Abrams is the project manager and assists Mr. Glaza. He is responsible to Honeywell and Parsons' management to see that the project objectives are met. He will maintain the project schedule, keep the project within budget, and monitor the technical adequacy of the work performed. He will also be the primary point of contact for Honeywell on technical, schedule, and contractual issues.

Ms. Maryanne Kosciewicz is the quality assurance officer (QAO) and will review data quality objectives, set assessment criteria, and conduct audits to evaluate compliance. She is responsible to see that data comply with this QAPP and to oversee data verification and validation. She will routinely monitor the laboratory's progress and maintain the QAPP.

Ms. Lorraine Weber is the database manager (DBM) and will be the point of contact for laboratory and project personnel with regard to database issues and data outputs. She will be responsible for establishing and maintaining the project database, as well as for performing quality assurance/quality control (QA/QC) procedures and ensuring the integrity of the project database.

Ms. Laura Drachenberg is the technical specialist and is responsible for establishing and maintaining the project database as well as ensuring the integrity of the project database.

Subsection B2.1.4 Analytical Services

Honeywell-approved analytical laboratory (or laboratories) will analyze environmental samples collected at the Onondaga Lake Site. Laboratory operations will be conducted under the supervision of a general manager or laboratory director and a quality assurance manager (QAM). A project manager and alternate will be assigned to each project. The project manager will be the primary point of contact and will be responsible for coordination and quality of all laboratory activities associated with the project. The laboratory's project manager will manage project sample receipt, analysis scheduling, and data reporting. In case of temporary absence, the direct supervisor will assume the responsibilities of the absent employee or delegate the responsibility to qualified personnel. Sample management staff is responsible for receiving, logging, and maintaining internal custody of samples during the sample's residence in the laboratory. In addition, the laboratory will ensure that project analytical requirements are met; monitor project analytical compliance and notify Parsons immediately if conflict or discrepancies arise; initiate and implement appropriate corrective actions; ensure adequate quality review of deliverables prior to release; and participate in weekly coordination meetings with Parsons.

FIGURE A1 – PROJECT ORGANIZATION

Figure A1 Project Organization (attached) supersedes Figure B2.1.

FIGURE A2 – LABORATORY ORGANIZATION

Figure A2 Laboratory Organization (attached) supersedes Figure B2.2.

KEY PROJECT CONTACTS

Key Project Contacts presented below supersedes Tables B2.1 and B2.2.

KEY PROJECT CONTACTS

Name	Project Role	Affiliation	Telephone Number	Fax Number	E-mail Address
Ed Glaza	Technical Manager	Parsons	(315) 451-9560	(315) 451-9570	Edward.Glaza@parsons.com
Tom Abrams	Project Manager	Parsons	(315) 451-9560	(315) 451-9570	Tom.Abrams@parsons.com
Maryanne Kosciewicz	Quality Assurance Officer	Parsons	(315) 451-9560	(315) 451-9570	Maryanne.Kosciewicz@parsons.com
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TABLE A1

- Table A1 'Summary of DQOs for Analytical and Testing Parameters for Sediment, Porewater, Groundwater and Other Water Samples" supersedes Table B3.1

TABLES A2A, A2B, A2C, and A2D

- Table A2A Quality Control Criteria and Reporting Limits for Sediment Samples
- Table A2B Quality Control Criteria and Reporting Limits for Porewater Samples
- Table A2C Quality Control Criteria and Reporting Limits for Groundwater Samples
- Table A2D Quality Control Criteria and Reporting Limits for Other Water Samples

supersede Tables B3.2, B3.3A, B3.3B, B7.1A, B7.4, and B7.5

TABLES A3A and A3B

- Table A3A Containerization, Preservation, and Holding Times for Sediment samples
- Table A3B Containerization, Preservation, and Holding Times for Water samples

supersede Table B4.1

TABLES

TABLE A1

SUMMARY OF DQOs FOR ANALYTICAL AND TESTING PARAMETERS FOR SEDIMENT, POREWATER, GROUNDWATER, AND OTHER WATER SAMPLES

PARAMETER	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Total Mercury				X
CPOI VOCs				X
Benzene				
Toluene				
Chlorobenzene				
Ethylbenzene				
m,p-xylene				
o-xylene				
Total Xylenes				
1,2-Dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
1,2,3-Trichlorobenzene				
1,2,4-Trichlorobenzene				
1,3,5-Trichlorobenzene				
Naphthalene				
CPOI SVOCs (Phenol + PAHs)				X
Phenol				
Acenaphthene				
Acenaphthylene				
Anthracene				
Benzo(a)anthracene				
Benzo(a)pyrene				
Benzo(b)fluoranthene				
Benzo(g,h,i)perylene				
Benzo(k)fluoranthene				
Chrysene				
Dibenz(a,h)anthracene				
Fluoranthene				
Fluorene				
Indeno(1,2,3-cd)pyrene				
Phenanthrene				
Pyrene				
PCBs				X
Aroclor-1016				
Aroclor-1221				
Aroclor-1232				
Aroclor-1242				
Aroclor-1248				
Aroclor-1254				
Aroclor-1260				
Aroclor-1268				
Total PCBs				

TABLE A1

SUMMARY OF DQOs FOR ANALYTICAL AND TESTING PARAMETERS FOR SEDIMENT, POREWATER, GROUNDWATER, AND OTHER WATER SAMPLES

PARAMETER	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
Total Organic Carbon (TOC)				X
Dissolved Organic Carbon (DOC)				X
pH			X	
Molybdenum				X
Cations Calcium Iron Magnesium Manganese Potassium Sodium				X
Anions Chloride Nitrate o-Phosphate Sulfate				X
Specific Conductance			X	
Salinity		X		
Ammonia Nitrogen				X
Alkalinity				X
Sulfide				X
Fluoride				X
Nitrite				X
Nitrate-Nitrite				X
Hardness				X
Chemical Oxygen Demand (COD)				X
Biochemical Oxygen Demand (BOD_5)				X
Total Suspended Solids (TSS)			X	
Total Dissolved Solids (TDS)			X	
Grain Size			X	
Atterberg Limits			X	
Specific Gravity			X	
Moisture Content				X
Carbonate Content			X	
Bulk Density			X	
UU Triaxial Strength			X	
CU Triaxial Strength			X	
Consolidation			X	

NOTE: Suite of analytical parameters will vary by sample type and sample location.

TABLE A2A

QUALITY CONTROL CRITERIA AND REPORTING LIMITS FOR SEDIMENT SAMPLES

ANALYTICAL METHOD	PARAMETER	PRECISION (RPD)	LCS ACCURACY (%R)	MS/MSD ACCURACY (%R)	RL	UNITS	MDL
SW-846 7471A	**Total Mercury**	20	80-120	75-125	0.033	mg/kg	0.012
SW-846 8260B	**CPOI VOCs**						
	Benzene	24	78-120	41-136	1	µg/kg	0.34
	Toluene	26	79-122	32-145	1	µg/kg	0.29
	Chlorobenzene	26	80-117	33-140	5	µg/kg	0.34
	Ethylbenzene	27	81-121	28-147	1	µg/kg	0.37
	m,p-xylene	29	79-121	22-150	2	µg/kg	0.47
	o-xylene	27	79-122	26-151	1	µg/kg	0.47
	Total Xylenes	28	80-121	24-150	2	µg/kg	0.47
	1,2-Dichlorobenzene	29	77-117	20-146	5	µg/kg	0.27
	1,3-Dichlorobenzene	30	77-116	19-147	5	µg/kg	0.28
	1,4-Dichlorobenzene	30	76-113	19-143	5	µg/kg	0.34
	1,2,3-Trichlorobenzene	35	54-133	9-150	5	µg/kg	1.6
	1,2,4-Trichlorobenzene	34	67-127	10-155	5	µg/kg	0.35
	1,3,5-Trichlorobenzene	30	70-130	60-140	5	µg/kg	N/A
	Naphthalene	36	59-131	10-157	5	µg/kg	0.74
SW-846 8270C or 8270C SIM	**CPOI SVOCs (Phenol + PAHs)**						
	Phenol	24	27-107	27-107	33	µg/kg	3.4
	Acenaphthene	28	43-109	39-116	3.3	µg/kg	0.45
	Acenaphthylene	28	36-102	9-134	3.3	µg/kg	0.97
	Anthracene	24	38-120	36-122	3.3	µg/kg	0.34
	Benzo(a)anthracene	34	29-125	30-133	3.3	µg/kg	0.44
	Benzo(a)pyrene	31	32-120	33-116	3.3	µg/kg	0.5
	Benzo(b)fluoranthene	32	31-138	17-153	3.3	µg/kg	1.6
	Benzo(g,h,i)perylene	36	32-115	33-125	3.3	µg/kg	1.3
	Benzo(k)fluoranthene	34	38-132	37-120	3.3	µg/kg	0.8
	Chrysene	25	50-112	32-128	3.3	µg/kg	0.45
	Dibenz(a,h)anthracene	36	38-119	34-131	3.3	µg/kg	0.96
	Fluoranthene	27	45-105	32-122	3.3	µg/kg	0.33
	Fluorene	26	45-104	28-124	3.3	µg/kg	0.41
	Indeno(1,2,3-cd)pyrene	36	37-116	29-132	3.3	µg/kg	1.3
	Phenanthrene	30	37-113	21-142	3.3	µg/kg	0.52
	Pyrene	27	42-114	28-134	3.3	µg/kg	0.38

TABLE A2A

QUALITY CONTROL CRITERIA AND REPORTING LIMITS FOR SEDIMENT SAMPLES

ANALYTICAL METHOD	PARAMETER	PRECISION (RPD)	LCS ACCURACY (%R)	MS/MSD ACCURACY (%R)	RL	UNITS	MDL
SW-846 8082	**PCBs**						
	Aroclor-1016	42	80-158	43-173	34	µg/kg	12
	Aroclor-1221	30	70-130	70-130	34	µg/kg	22
	Aroclor-1232	30	70-130	70-130	34	µg/kg	11
	Aroclor-1242	30	70-130	70-130	34	µg/kg	12
	Aroclor-1248	30	70-130	70-130	34	µg/kg	6.6
	Aroclor-1254	24	70-130	70-130	34	µg/kg	8.4
	Aroclor-1260	41	70-145	34-164	34	µg/kg	13
	Aroclor-1268	30	70-130	70-130	34	µg/kg	7.6
	Total PCBs	N/A	N/A	N/A	34	µg/kg	N/A
EPA Approved Lloyd Kahn	**Total Organic Carbon (TOC)**	32	80-120	51-132	500	mg/kg	363
SW-846 9045C	**pH**	10	N/A	N/A	N/A	units	N/A
SW-846 6010B	**Molybdenum**	20	80-120	75-125	2	mg/kg	0.24
ASTM 1429	**Specific Gravity**	11	N/A	N/A	N/A	N/A	N/A
SM 2540G	**Moisture Content as % Solids**	N/A	N/A	N/A	N/A	%	N/A

NOTES: RPD - Relative Percent Difference.
%R - Percent Recovery.
RL - Reporting Limit. RLs are less than applicable PECs and are wet weight basis.
Individual sample RLs will be adjusted accordingly based on moisture and aliquots used for analysis.
MDL - Method Detection Limit. The laboratory will report nondetects at the MDLs for metals (mercury and molybdenum).
MS/MSD - Matrix Spike/Matrix Spike Duplicate.
LCS - Laboratory Control Sample.
N/A - Not Applicable.

TABLE A2B

QUALITY CONTROL CRITERIA AND REPORTING LIMITS FOR POREWATER SAMPLES

ANALYTICAL METHOD	PARAMETER	PRECISION (RPD)	LCS ACCURACY (%R)	MS/MSD ACCURACY (%R)	RL	UNITS	MDL
SW-846 7470A	**Total Mercury**	20	80-120	75-125	0.2	µg/L	0.082
SW-846 8260B	**CPOI VOCs**						
	Benzene	13	75-122	38-139	1	µg/L	0.23
	Toluene	14	76-126	44-141	1	µg/L	0.3
	Chlorobenzene	12	76-124	65-128	1	µg/L	0.39
	Ethylbenzene	13	77-124	37-143	1	µg/L	0.27
	m,p-xylene	13	77-125	32-146	1	µg/L	0.25
	o-xylene	12	76-126	46-141	1	µg/L	0.25
	Total Xylenes	13	77-125	36-144	1	µg/L	0.25
	1,2-Dichlorobenzene	23	74-125	65-128	1	µg/L	0.26
	1,3-Dichlorobenzene	13	73-124	63-128	1	µg/L	0.25
	1,4-Dichlorobenzene	13	71-123	63-126	1	µg/L	0.28
	1,2,3-Trichlorobenzene	14	62-132	54-137	5	µg/L	0.47
	1,2,4-Trichlorobenzene	13	67-132	59-135	5	µg/L	0.56
	1,3,5-Trichlorobenzene	30	70-130	60-140	5	µg/L	N/A
	Naphthalene	15	37-146	34-156	5	µg/L	0.97
SM 5310B	**Dissolved Organic Carbon (DOC)**	31	90-110	78-120	1	mg/L	0.47
SM20 4500H B	**pH**	5	N/A	N/A	N/A	units	N/A

NOTES: RPD - Relative Percent Difference.
%R - Percent Recovery.
RL - Reporting Limit.
MDL - Method Detection Limit. The laboratory will report nondetects at the MDLs for metals (mercury).
MS/MSD - Matrix Spike/Matrix Spike Duplicate.
LCS - Laboratory Control Sample.
N/A - Not Applicable.

TABLE A2C

QUALITY CONTROL CRITERIA AND REPORTING LIMITS FOR GROUNDWATER SAMPLES

ANALYTICAL METHOD	PARAMETER	PRECISION (RPD)	ACCURACY (%R)	RL	UNITS	MDL
SW-846 6010B	**Cations**					
	Calcium	20	80-120 (LCS), 75-125 (MS, MSD)	5	mg/L	0.0436
	Iron	20	80-120 (LCS), 75-125 (MS, MSD)	0.1	mg/L	0.0176
	Magnesium	20	80-120 (LCS), 75-125 (MS, MSD)	5	mg/L	0.0147
	Manganese	20	80-120 (LCS), 75-125 (MS, MSD)	0.015	mg/L	0.00046
	Potassium	20	80-120 (LCS), 75-125 (MS, MSD)	10	mg/L	0.0747
	Sodium	20	80-120 (LCS), 75-125 (MS, MSD)	10	mg/L	0.0137
	Anions					
EPA 300.0	Chloride	20	90-110 (LCS), 80-120 (MS)	2	mg/L	0.0087
EPA353.2/SM4500NO2B	Nitrate only by calculation	N/A	N/A	0.11	mg/L	0.009
EPA 353.2	Nitrate + Nitrite	19	90-110 (LCS), 58-134 (MS)	0.1	mg/L	0.008
SM19 4500NO2B	Nitrite	25	90-110 (LCS), 60-120 (MS)	0.01	mg/L	0.001
SM 4500 PE	o-Phosphate	21	80-120 (LCS), 71-120 (MS)	0.5	mg/L	0.005
EPA 300.0	Sulfate	20	90-110 (LCS), 80-120 (MS)	10	mg/L	0.449
SM 2510B	**Specific Conductance**	N/A	N/A	0.5	µmhos/cm	N/A
SM 2520B	**Salinity**	N/A	N/A	0.1	psu	N/A

NOTES: RPD - Relative Percent Difference.
%R - Percent Recovery.
RL - Reporting Limit.
MDL - Method Detection Limit. The laboratory will report nondetects at the MDLs for metals (cations).
MS/MSD - Matrix Spike/Matrix Spike Duplicate.
LCS - Laboratory Control Sample.
N/A - Not Applicable.

TABLE A2D

QUALITY CONTROL CRITERIA AND REPORTING LIMITS FOR OTHER WATER SAMPLES

ANALYTICAL METHOD	PARAMETER	PRECISION (RPD)	ACCURACY (%R)	RL	UNITS	MDL
EPA 1631E	**Mercury**	24	71-125 (MS/MSD); 75-125 (LCS)	0.5	ng/L	0.2
SM20 5310B, 9060 M	**Total Organic Carbon (TOC)**	32	90-110 (LCS), 77-133 (MS)	1	mg/L	0.47
SM20 4500NH3G,LACHAT	**Ammonia Nitrogen**	27	80-120 (LCS), 44-153 (MS)	0.2	mg/L	0.169
SM 2320B	**Alkalinity**	10	80-120 (LCS), 75-125 (MS)	5	mg/L	0.7
SM20 4500S2 F	**Sulfide**	16	80-120 (LCS), 55-131 (MS)	2	mg/L	0.314
EPA 300.0	**Fluoride**	20	90-110 (LCS), 80-120 (MS)	0.2	mg/L	0.0022
SM19 4500NO2B	**Nitrite**	25	90-110 (LCS), 60-120 (MS)	0.01	mg/L	0.001
EPA 353.2	**Nitrate + Nitrite**	19	90-110 (LCS), 58-134 (MS)	0.1	mg/L	0.008
SM19 2340C	**Hardness**	10	80-120 (LCS), 80-122 (MS)	4	mg/L	3.2
SM20 5220C,HACH 8000	**Chemical Oxygen Demand (COD)**	38	90-110 (LCS), 57-134 (MS)	20	mg/L	7.4
SM20 5210B	**Biochemical Oxygen Demand (BOD_5)**	43	85-115 (LCS)	2	mg/L	0.4
SM20 2540D	**Total Suspended Solids (TSS)**	10	N/A	4	mg/L	1.7
SM20 2540C	**Total Dissolved Solids (TDS)**	12	N/A	10	mg/L	1.6

NOTES: RPD - Relative Percent Difference.
%R - Percent Recovery.
RL - Reporting Limit.
MDL - Method Detection Limit. The laboratory will report nondetects at the MDLs for metals (mercury).
TBD - To Be Determined. MDLs and QC accuracy limits will be determined by the Honeywell approved laboratory.
MS/MSD - Matrix Spike/Matrix Spike Duplicate.
LCS - Laboratory Control Sample.
N/A - Not Applicable.

TABLE A3A

CONTAINERIZATION, PRESERVATION, AND HOLDING TIMES FOR SEDIMENT SAMPLES

ANALYTICAL METHOD	PARAMETER	CONTAINER[1]	PRESERVATION[2]	HOLDING TIME[3]
SW-846 7471A	**Total Mercury**	4 oz. jar		28 days
SW-846 8260B	**CPOI VOCs**	2-4 oz. jars		14 days
	Benzene			
	Toluene			
	Chlorobenzene			
	Ethylbenzene			
	m,p-xylene			
	o-xylene			
	Total Xylenes			
	1,2-Dichlorobenzene			
	1,3-Dichlorobenzene			
	1,4-Dichlorobenzene			
	1,2,3-Trichlorobenzene			
	1,2,4-Trichlorobenzene			
	1,3,5-Trichlorobenzene			
	Naphthalene			
SW-846 8270C or 8270C SIM	**CPOI SVOCs (Phenol + PAHs)**	8 oz. jar		14 days to extract;
	Phenol			40 days to analyze
	Acenaphthene			
	Acenaphthylene			
	Anthracene			
	Benzo(a)anthracene			
	Benzo(a)pyrene			
	Benzo(b)fluoranthene			
	Benzo(g,h,i)perylene			
	Benzo(k)fluoranthene			
	Chrysene			
	Dibenz(a,h)anthracene			
	Fluoranthene			
	Fluorene			
	Indeno(1,2,3-cd)pyrene			
	Phenanthrene			
	Pyrene			
SW-846 8082	**PCBs**	8 oz. jar		14 days to extract;
	Aroclor-1016			40 days to analyze
	Aroclor-1221			
	Aroclor-1232			
	Aroclor-1242			
	Aroclor-1248			
	Aroclor-1254			
	Aroclor-1260			
	Aroclor-1268			
	Total PCBs			
EPA Approved Lloyd Kahn	**Total Organic Carbon (TOC)**	8 oz. jar		14 days
SW-846 9045C	**pH**	4 oz. jar		immediately
SW-846 6010B	**Molybdenum**	8 oz. jar		6 months
ASTM D854	**Specific Gravity**	8 oz. jar		N/A
SM 2540G	**Moisture Content as % Solids**	4 oz. jar		N/A

NOTES: 1 - Sample volumes may vary per laboratory requirements.

2 - All samples will be iced, preserved at 4°C, and shipped to Accutest Laboratories laboratory within 24-48 hours from sample collection.

3 - Holding time is calculated from the day of sample collection or from the day the vibracore sample is processed.

TABLE A3B

CONTAINERIZATION, PRESERVATION, AND HOLDING TIMES FOR WATER SAMPLES

ANALYTICAL METHOD	PARAMETER	CONTAINER[1]	PRESERVATION[2]	HOLDING TIME[3]
SW-846 7470A	**Total Mercury**	500 mL P, G	HNO_3 to pH<2	28 days
SW-846 8260B	**CPOI VOCs**	3-40 mL G, PTFE lined septa	HCl to pH<2	14 days
	Benzene			(7 days unpreserved)
	Toluene			
	Chlorobenzene			
	Ethylbenzene			
	m,p-xylene			
	o-xylene			
	Total Xylenes			
	1,2-Dichlorobenzene			
	1,3-Dichlorobenzene			
	1,4-Dichlorobenzene			
	1,2,3-Trichlorobenzene			
	1,2,4-Trichlorobenzene			
	1,3,5-Trichlorobenzene			
	Naphthalene			
SM 5310B	**Dissolved Organic Carbon (DOC)**	2-40 mL P, G	HCl to pH<2	28 days
SM20 4500H B	**pH**	100 mL P, G		immediately
SW-846 6010B	**Cations**	500 mL P, G	HNO_3 to pH<2	6 months
	Calcium			
	Iron			
	Magnesium			
	Manganese			
	Potassium			
	Sodium			
	Anions	500 mL P, G		
EPA 300.0	Chloride			28 days
EPA 353.2	Nitrate			48 hours
SM 4500 PE	o-Phosphate			48 hours
EPA 300.0	Sulfate			28 days
SM 2510B	**Specific Conductance**	100 mL P, G		28 days
SM 2520B	**Salinity**	100 mL P, G		28 days
EPA 1631E	**Mercury**	500 mL PTFE	HNO3 to pH<2	28 days
SM 5310C	**Total Organic Carbon (TOC)**	2-40 mL P, G	HCL to pH<2	28 days
EPA 350.1	**Ammonia Nitrogen**	500 mL P, G	H_2SO_4 to pH<2	28 days
SM 2320B	**Alkalinity**	100 mL P, G		14 days
SM 4500	**Sulfide**	500 mL P, G	NaOH to pH>9, Zinc Acetate	7 days
EPA 300.0	**Fluoride**	500 mL P		28 days
SM 4500	**Nitrite**	100 mL P, G		48 hours
SM 4500	**Nitrate-Nitrite**	200 mL P, G	H_2SO_4 to pH<2	28 days
SM 2340B	**Hardness**	100 mL P, G	HNO_3 to pH<2	6 months
SM 5220C	**Chemical Oxygen Demand (COD)**	100 mL P, G	H_2SO_4 to pH<2	28 days
SM 5210B	**Biochemical Oxygen Demand (BOD)**	1 L P, G		48 hours
SM 2540D	**Total Suspended Solids (TSS)**	500 mL P, G		7 days
SM 2540C	**Total Dissolved Solids (TDS)**	100 mL P, G		7 days

NOTES: 1 - Polyethylene (P); Glass (G); Fluoropolymer/Teflon® (PTFE); Sample volumes may vary per laboratory requirements.

2 - All samples will be iced, preserved at 4°C, and shipped to Accutest Laboratories within 24-48 hours from sample collection. Porewater samples are generated by the laboratory.

3 - Holding time is calculated from the day of sample collection or from the day the vibracore sample is processed.

FIGURES

FIGURE A1

Project Organization

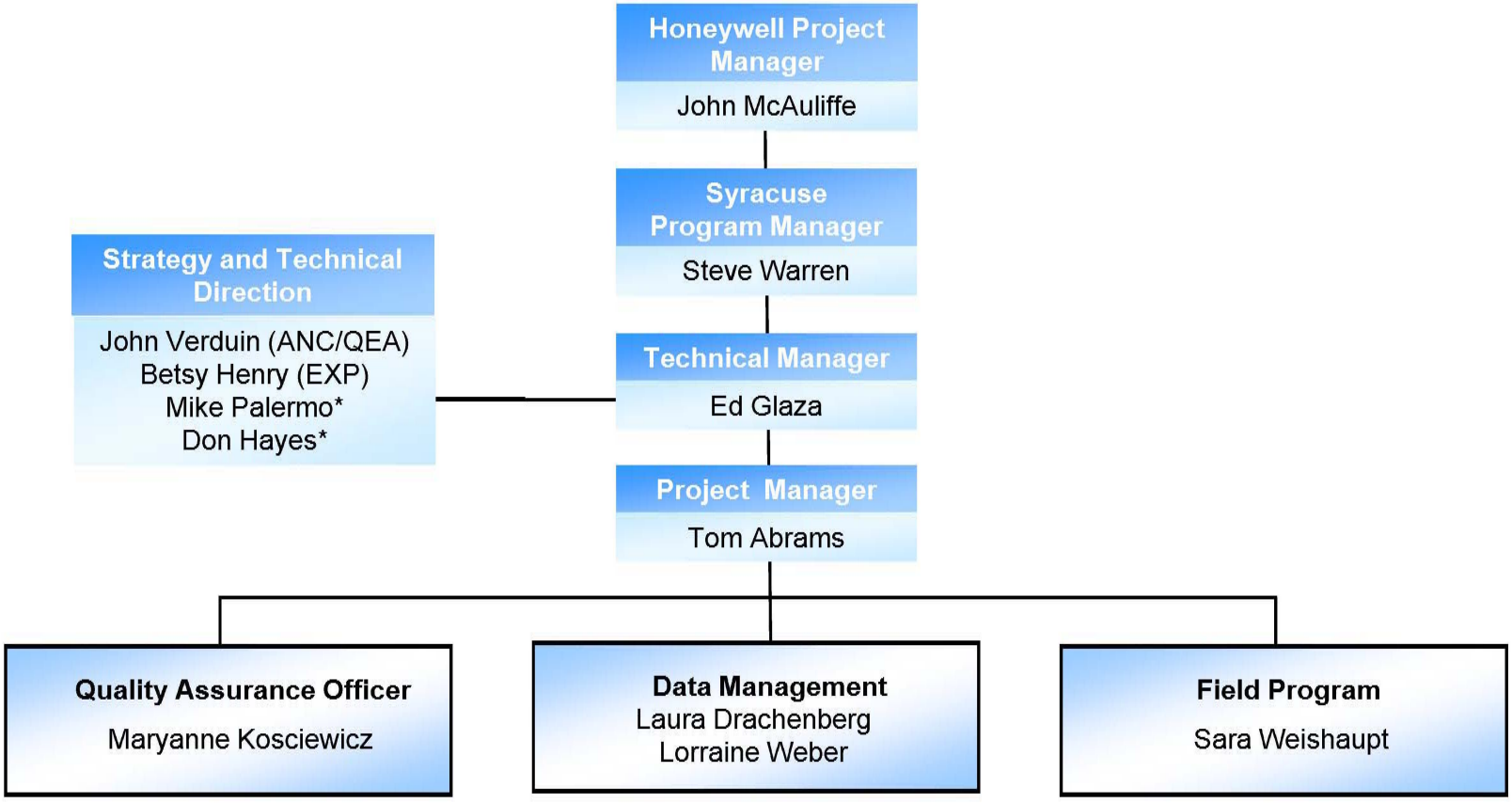

Figure A2
Accutest Laboratories Organization Chart