APPENDIX A

ONONDAGA LAKE MONITORED NATURAL RECOVERY WORK PLAN

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AHA	activity hazard analyses
BSQV	Bioaccumulation-based sediment quality value
cm	centimeter
MNR	monitored natural recovery
NYSDEC	New York State Department of Environmental Conservation
PDI	pre-design investigation
PEC	Probably Effects Concentration
PRG	Preliminary Remedial Goal
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
ROD	Record of Decision
SMU	sediment management unit
SSP	subcontractor safety plans
SWAC	surface weighted average concentration
TLC	thin layer cap
TSS	total suspended solids
USEPA	United States Environmental Protection Agency

Note**:** One centimeter (cm) of length is approximately equivalent to 0.4 inch. One inch is approximately equivalent to 2.5 cm. 15 cm is approximately equivalent to 6 inches or 0.5 ft.

ONONDAGA LAKE POST MONITORED NATURAL RECOVERY WORK PLAN

This work plan describes the samples and data to be collected beginning in 2017 for the continued monitoring of natural recovery of sediments in Sediment Management Unit (SMU) 8 of Onondaga Lake. It also describes the compliance sampling that will be done to document achievement of the SMU 8 sediment remedial goals that are projected to be met via monitored natural recovery (MNR). In addition, this appendix describes the compliance program that will be implemented to document achievement of the mercury bioaccumulation-based sediment quality value (BSQV), which is applied on an area-wide basis and includes consideration of SMU 8 and littoral zone capped and uncapped areas. Descriptions of the field and analytical methods and quality assurance program supporting the field work is provided in the Quality Assurance Project Plan (QAPP), which is presented separate from this work plan (Parsons et al., 2017).

1.0 BACKGROUND AND OBJECTIVES

Sediment sampling in SMU 8 for mercury analysis is being conducted every three years to monitor ongoing natural recovery in accordance with the final design for the lake bottom remedy (Parsons and Anchor QEA, 2012). The primary objective of sediment sampling is to provide a basis for determining achievement of the Preliminary Remedial Goals (PRGs) described in the Record of Decision (ROD) (NYSDEC and EPA, 2005). This includes achieving a mercury Probable Effects Concentration (PEC) of 2.2 mg/kg or lower on a point-by-point basis in the profundal zone and the mercury BSQV of 0.8 mg/kg or lower on an area-wide basis within 10 years following remediation of upland sources, littoral sediments, and initial thin-layer capping in the profundal zone.

2.0 HEALTH AND SAFETY

The Honeywell Project Safety, Health, and Environmental Plan (Parsons, 2017) and subcontractor safety plans (SSPs) will be used for this investigation and will be strictly followed by all personnel. Safety plans will be updated annually. Job safety/activity hazard analyses (AHA) will be reviewed and made more specific for this work effort as appropriate before beginning field efforts. Any task outside of the previous field efforts will require a new AHA completed before the task begins.

3.0 SAMPLING SCOPE AND METHODS

Routine and compliance sampling design, rationale, and methods for SMU 8 sediment sampling, as well as for BSQV littoral zone sediment sampling, are provided below and summarized in Table 1. Surface sediment will be collected from SMU 8 and analyzed for mercury in two phases: routine monitoring (Section 3.1) and compliance verification monitoring Section 3.4). Routine monitoring will occur every three years. Once routine monitoring indicates that the PEC and BSQV are met, compliance verification sampling will be conducted at additional locations for two consecutive sampling events (Section 3.4). To supplement the MNR evaluations, the monitoring program also includes collection of cores within areas of previously placed microbeads (Section 3.2) and the deployment and retrieval of sediment traps to analyze settling sediment for total mercury and aid in the assessment of sediment deposition rates (Section 3.3).

3.1 Routine Monitoring of Mercury in SMU 8 Surface Sediment

Shallow sediment cores will be collected at the 20 locations most recently sampled in 2014 and two new locations in SMU 8 (Figures A-1A and A-1B). Samples will be collected using the gravity core methods successfully used since 2009. Sampling at these routine monitoring locations will occur every three years until results indicate that the mercury concentrations are in compliance with the mercury PEC and BSQV performance criteria in a given sub-area. Following achievement of performance criteria, future monitoring events will collect samples as part of compliance verification sampling as detailed in Section 3.4.

Sediment sampling will be conducted on a relatively calm weather day with little to no wind to allow sampling at each location without the need to anchor. The gravity corer used successfully since 2009 for SMU 8 sediment sampling will be used to collect sediment samples for this effort. Cores collected for analytical analysis will be segmented from depth intervals of 0 to 4 cm, and 4 to 10 cm. Should the compliance depth be revised in the future, refinements of the sediment sampling intervals may be needed. Samples will be submitted to a commercial laboratory for analysis of total mercury using a standard United States Environmental Protection Agency (USEPA) 7400 series method. Further details on sample collection, processing, and sample management can be found in the QAPP (Parsons et al., 2017).

3.2 Microbead Marker in SMU 8 Surface Sediment

A sediment core will be collected using gravity cores from two locations within each of the nine microbead plots for a total of 18 cores (Figure A-2). Core penetration at each sample location will be to a depth of at least nine inches. If sand microbead marker is not encountered, another core will be collected from another location within the same microbead plot until the sand microbead marker is observed. This monitoring will be carried out concurrent with routine surface sediment sampling detailed in Section 3.1.

Each of the cores will be stored in a vertical position and frozen as quickly as possible using dry ice or equivalent. After each core is sufficiently frozen, the tubing and sediment making up the core will be sliced vertically to expose the core in cross section. Visual observations of the sand microbead marker (including the depth the microbead marker is encountered) and observations of sediment varves/layers will be recorded and documented with photos from each sliced core. A summary of prior observations related to varving in SMU 8 is provided in Attachment A. An estimate of the depth of mixing will also be made based on visual observations of these cores. The minimum mixing depth is reflected in the depth of the oxygenated zone, typically indicated by light brown sediment. Lack of a brown surface layer will indicate negligible bioturbation. Further details on sample collection, processing, and sample management can be found in the QAPP (Parsons et al., 2017).

3.3 Mercury in SMU 8 Settling Sediment

Sediment trap sampling will occur annually at South Deep (Figure A-1B) using the same sediment trap design and deployment protocols employed annually beginning in 2009. A set of three traps will be deployed weekly from mid-May through mid-November then collected a week later and replaced with a new set of traps. Total suspended solids (TSS) will be measured in the collected sediment trap weekly. Mercury analysis will be conducted on sediment trap samples collected every other week from mid-May through August, weekly during September until fall turnover (typically late October), and then every other week following fall turnover until mid-November. The need to continue to collect these data will be assessed annually and discussed with New York State Department of Environmental Conservation (NYSDEC).

Sediment traps will be deployed at the South Deep sampling location to a water depth below the thermocline (approximately 33 ft. or 10 meters). Sediment traps will generally be deployed for seven-day intervals. After retrieval, supernatant will be drained off via an opening located in the side of the traps well above the deposited sediments. The samples will then be homogenized, poured into bottles, and placed on ice.

Analyses of sediment trap slurry samples will include total mercury using a low-level USEPA Method 1631 and total, fixed, and volatile suspended solids using standard methods. Further details on sample collection, processing, and sample management can be found in the QAPP (Parsons et al., 2017).

3.4 Sampling for Compliance Verification

Sampling to confirm compliance with the mercury PEC and BSQV criteria will consist of two consecutive events. The first compliance sampling event will be subsequent to the event where routine monitoring, described in Section 3.1, indicates that performance criteria have been achieved. Compliance sampling may be completed for SMU 8 comprehensively or on an area-specific basis. Two comprehensive compliance sampling events will be completed within one to three years of one another (based on the results of the first event in consultation with NYSDEC), to confirm achievement of the mercury PEC performance criterion and BSQV criterion. BSQV evaluation methods and sample locations for final compliance verification will be consistent with those used in Appendix N of the Final Design Report (Parsons and Anchor QEA, 2012), with the following modifications:

- The BSQV evaluation in the Final Design included locations that received a thin layer cap (TLC) but the evaluation was based on predicted MNR results rather than incorporating the TLC. SMU 8 locations within areas that received a TLC will not be sampled as part of the MNR evaluation. Results from TLC sampling completed as part of the Long-Term Cap Monitoring Program will be used to determine the mercury concentrations in the TLC areas for calculating BSQV concentrations on an area-weighted average basis.
- The SMU 8 routine monitoring locations include several newer monitoring locations that were not part of the data set used for calculating the BSQV in the Final Design.

These locations will be included in the calculation of the BSQV for evaluating compliance.

- The Final Design used data that were collected as part of the Remedial Investigation (RI) and the Pre-Design Investigation (PDI) from littoral areas where a cap was not required. Compliance samples will be collected from a subset of the littoral zones sample locations used to calculate the BSQV in the Final Design to verify that conditions have not changed significantly. Following verification that results of this sampling confirm conditions have not changed significantly in the uncapped areas of the littoral zone, in consultation with NYSDEC, the new sample results and the prior results from the locations not resampled will be used for calculation of the BSQV. In the event that new sample results in uncapped areas are significantly higher than prior (RI/PDI) results, additional sampling in uncapped areas of the littoral zone will occur. The need for and scope of such sampling, and how the data are to be used, will be determined in consultation with NYSDEC.
- The Final Design assumed all capped areas of the lake had a mercury concentration of 0.1 mg/kg based on cap material mercury concentrations in fill materials placed to date at other Syracuse area remediation projects. Compliance sample results collected from the habitat layer as part of the Long-Term Cap Monitoring Program will be used in calculations of the BSQV for evaluating compliance as determined in consultation with, and approved by, NYSDEC. Sample depth intervals and appropriateness for evaluating compliance with the BSQV are discussed in Appendix D.
- Surface sediment data collected from the uncapped CSX Shoreline Area of RA-E as part of the Long-Term Cap Monitoring Program will be used in calculations of the BSQV for evaluating compliance.

The two compliance monitoring events will include 49 locations from SMU 8 and 14 locations of uncapped sediment in the littoral zone, as shown in Figures A-3A and A-3B. The scope for the second compliance monitoring event may be revised based on the results from the first compliance monitoring event and consideration of site-specific conditions. For example, littoral zone concentrations would not be expected to change significantly with time and therefore the littoral zone sampling program may be reduced or eliminated for the second compliance sampling event. Area-weighted surface sediment concentrations will be calculated for comparison to the BSQV for the five sub-areas of the lake established in the Final Design for evaluation of the BSQV (the North Basin, Ninemile Creek Outlet Area, Saddle, South Basin, and South Corner) based on Theissan polygons with border lines equidistant from the adjacent sample location. Compliance verification and termination of routine monitoring may occur independently for one or more of these subareas. Compliance for the mercury PEC on a point-by-point basis will also be based on all 49 SMU 8 locations.

SMU 8 sampling methods for final compliance verification will be consistent with those specified in Section 3.1 for routine monitoring. Samples in the profundal zone (SMU 8) in both unremediated and remediated areas will be from 0 to 4 and 4 to 10 cm. Samples in unremediated portions of the littoral zone will be from the 0 to 6 inches interval. Samples in the remediated portions of the littoral zone to be used for BSQV compliance will be from the upper habitat layer compliance sample (typically approximately 6 inches below the cap/water interface where sand cap material can be collected). Results from the cap monitoring program will be used for this analysis. If there are large portions of capped areas in a given BSQV zone where only porewater sampling in the habitat layer is possible due to the presence of gravel/cobble, porewater concentrations will be converted to solid phase concentrations consistent with the methods specified in the Cap Monitoring Work Plan (Appendix D of the OLMMP) for incorporation into the surface weighted average concentration (SWAC) estimates for BSQV compliance. If detections in porewater in the habitat layer (cap compliance sample) result in estimated solid-phase concentrations greater than the BSQV, consideration will be given to collecting and analyzing a solid-phase sample if sufficient sediments have filled the voids in the gravel/cobble layer and/or accumulated above the gravel/cobble layer.

4.0 QUALITY ASSURANCE AND DATA MANAGEMENT

Sample names, quality assurance/quality control (QA/QC) samples, procedures, sample collection, data entry, and data validation for this portion of the work will be conducted in accordance with procedures summarized in the QAPP (Parsons et al., 2017). Analytical results from laboratory determinations of mercury and solids content will be incorporated into the Honeywell's data management system and provided to NYSDEC in the preferred electronic data deliverable format following validation.

5.0 REFERENCES

NYSDEC and USEPA Region 2. 2005. *Record of Decision. Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site*. July 2005.

Parsons, 2017. *2017 Honeywell – Syracuse Operation, Maintenance, and Monitoring Project Safety, Health, and Environmental Plan*. Prepared for Honeywell. Onondaga County, Syracuse, NY.

Parsons, Anchor QEA, and Upstate Freshwater Institute, 2017. *Quality Assurance Project Plan for Onondaga Lake Construction and Post-Construction Media Monitoring.* Prepared for Honeywell. Syracuse, NY.

Parsons and Anchor QEA, 2012. *Onondaga Lake Capping, Dredging, Habitat and Profundal Zone (Sediment Management Unit 8) Final Design*. Prepared for Honeywell. March 2012.

TABLES

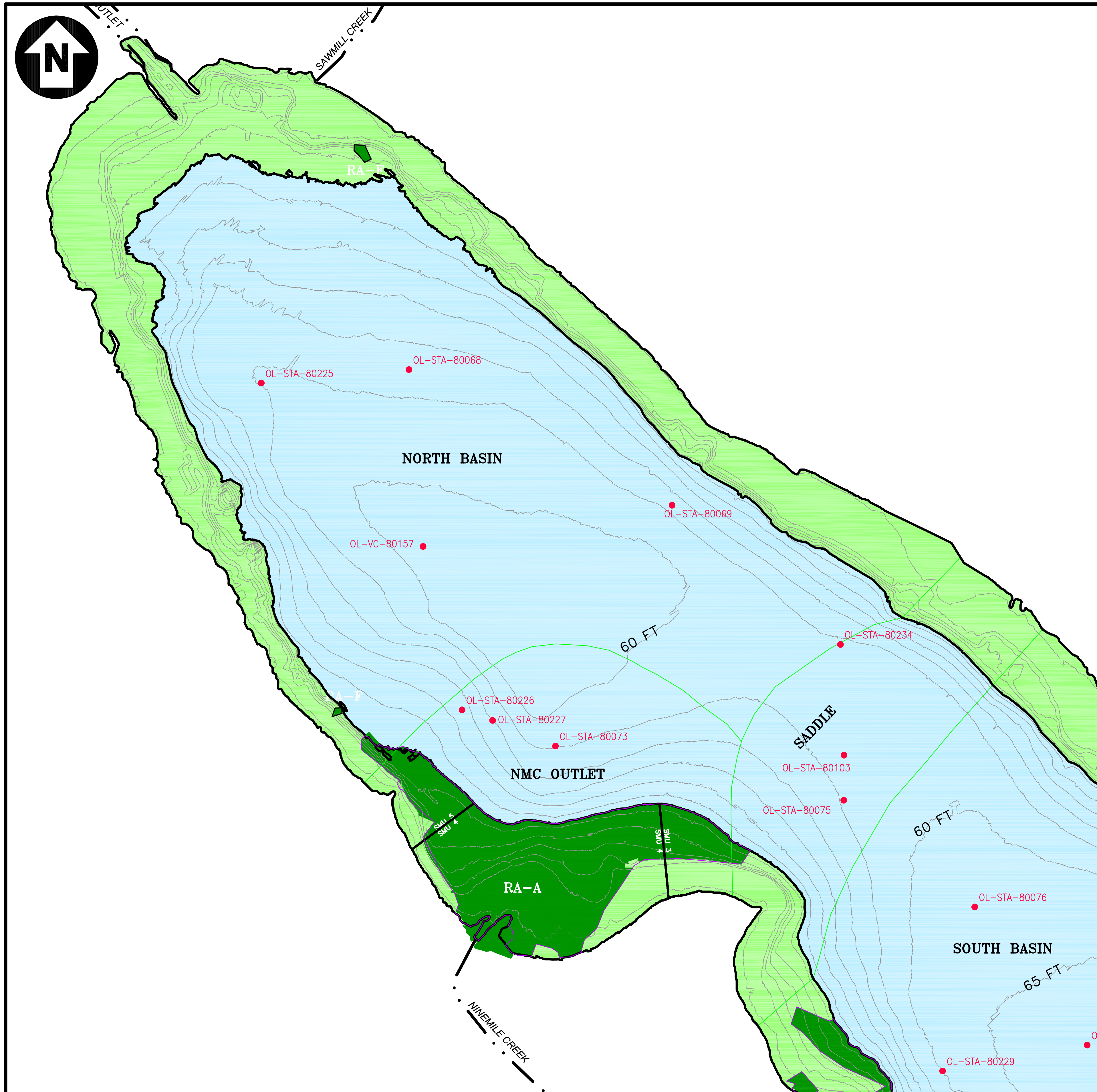
TABLE A-1
ONONDAGA LAKE MNR MONITORING SUMMARY

	Sub-area	Number of MNR Sampling Locations			
		SMU 8 Analytical	Littoral zone analytical[2]	SMU 8 Microbead	South Deep Sediment traps[1]
Routine Monitoring Locations	North Basin	4	-	10	-
	Ninemile Creek Outlet	3	-	-	-
	Saddle	3	-	-	-
	South Basin	6	-	4	-
	South Corner	6	-	4	1
	Total	**22**	**-**	**18**	**1**
Compliance Monitoring Locations	North Basin	9	5	-	-
	Ninemile Creek Outlet	8	1	-	-
	Saddle	3	2	-	-
	South Basin	14	4	-	-
	South Corner	15	2	-	-
	Total	**49**	**14**	**-**	**-**

[1] Sediment traps deployed at one station weekly for TSS measurements; mercury analysis is conducted every two weeks from mid-May through August, weekly from September until fall turnover, then every two weeks until mid-November, for a total of approximately 18 sediment trap sampling events (dependent upon fall turnover).

[2] Littoral zone samples are being collected for evaluation of compliance with the BSQV.

FIGURES



LEGEND:

REMEDIATION AREA BOUNDARY

SMU BOUNDARY

CAPPED AREAS (INCLUDES ALL ISOLATION, THIN LAYER, AND MODIFIED PROTECTIVE CAPS)

SMU 8

LITTORAL ZONE

SEDIMENT SAMPLE LOCATIONS

DEMARCATION FOR BSQV SUBAREAS (DELINEATION IS APPROXIMATE AND MAY BE MODIFIED BASED ON DEVELOPMENT OF FINAL THIESSEN POLYGONS FOR BSQV EVALUATION)

NOTES:

1. WATER DEPTH CONTOUR INTERVAL IS 5 FT.
2. THE 30' WATER DEPTH CONTOUR IS THE BOUNDARY BETWEEN THE LITTORAL ZONE (SMUs 1–7) AND SMU 8.

1200 600 0 1200 2400

SCALE: 1"=1200'

FIGURE A–1A

Honeywell ONONDAGA LAKE SYRACUSE, NEW YORK

SMU 8 ROUTINE SEDIMENT SAMPLE LOCATIONS IN NORTH HALF OF ONONDAGA LAKE

PARSONS
301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315–451–9560

FILE NAME: P:\HONEYWELL -SYR\450102 - 2016 OL REMEDIAL GOAL MONITORING\10 TECHNICAL CATEGORIES\CAD\2016\450102-MNR-002.DWG
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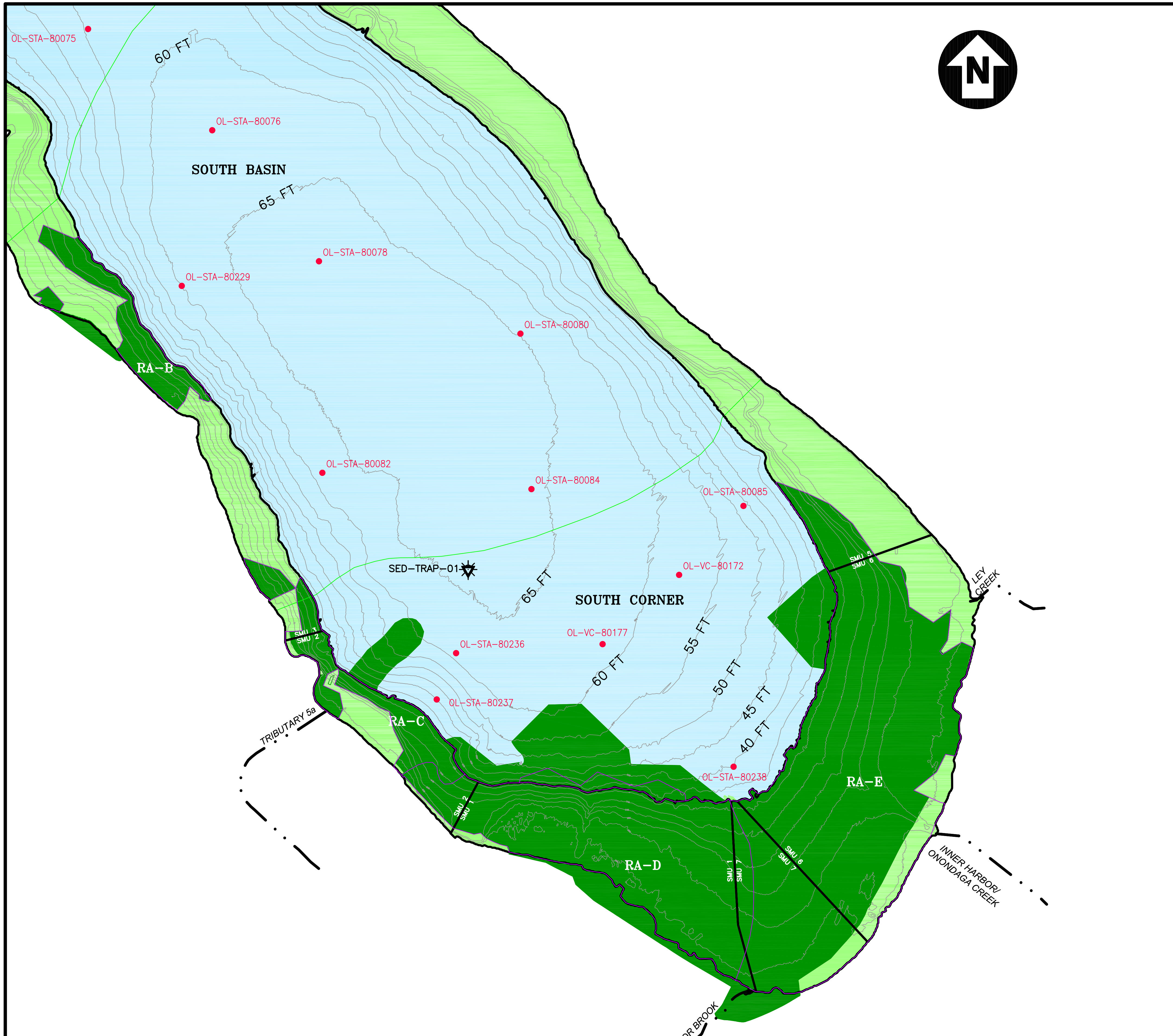

LEGEND:

- REMEDIATION AREA BOUNDARY
- SMU BOUNDARY
- CAPPED AREAS (INCLUDES ALL ISOLATION, THIN LAYER, AND MODIFIED PROTECTIVE CAPS)
- SMU 8
- LITTORAL ZONE
- SEDIMENT SAMPLE LOCATIONS
- SEDIMENT TRAP SAMPLE LOCATION
- DEMARCATION FOR BSQV SUBAREAS (DELINEATION IS APPROXIMATE AND MAY BE MODIFIED BASED ON DEVELOPMENT OF FINAL THIESSEN POLYGONS FOR BSQV EVALUATION)

NOTES:

1. WATER DEPTH CONTOUR INTERVAL IS 5 FT.
2. THE 30' WATER DEPTH CONTOUR IS THE BOUNDARY BETWEEN THE LITTORAL ZONE (SMUs 1–7) AND SMU 8.
3. SAMPLE LOCATIONS USED IN THE FINAL DESIGN REPORT (PARSONS AND ANCHOR QEA, 2012) THAT ARE NOW WITHIN CAPPED AREAS WILL BE SAMPLED UNDER THE CAP MONITORING PROGRAM. SEE SECTION 6 OF THE OLMMP FOR FURTHER DETAILS.

1200 600 0 1200 2400

SCALE: 1"=1200'

FIGURE A–1B

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ONONDAGA LAKE
SYRACUSE, NEW YORK

SMU 8 ROUTINE SEDIMENT SAMPLE LOCATIONS IN SOUTH HALF OF ONONDAGA LAKE

PARSONS

301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\450102 - 2016 OL REMEDIAL GOAL MONITORING\10 TECHNICAL CATEGORIES\CAD\2016\450102-MNR-002.DWG
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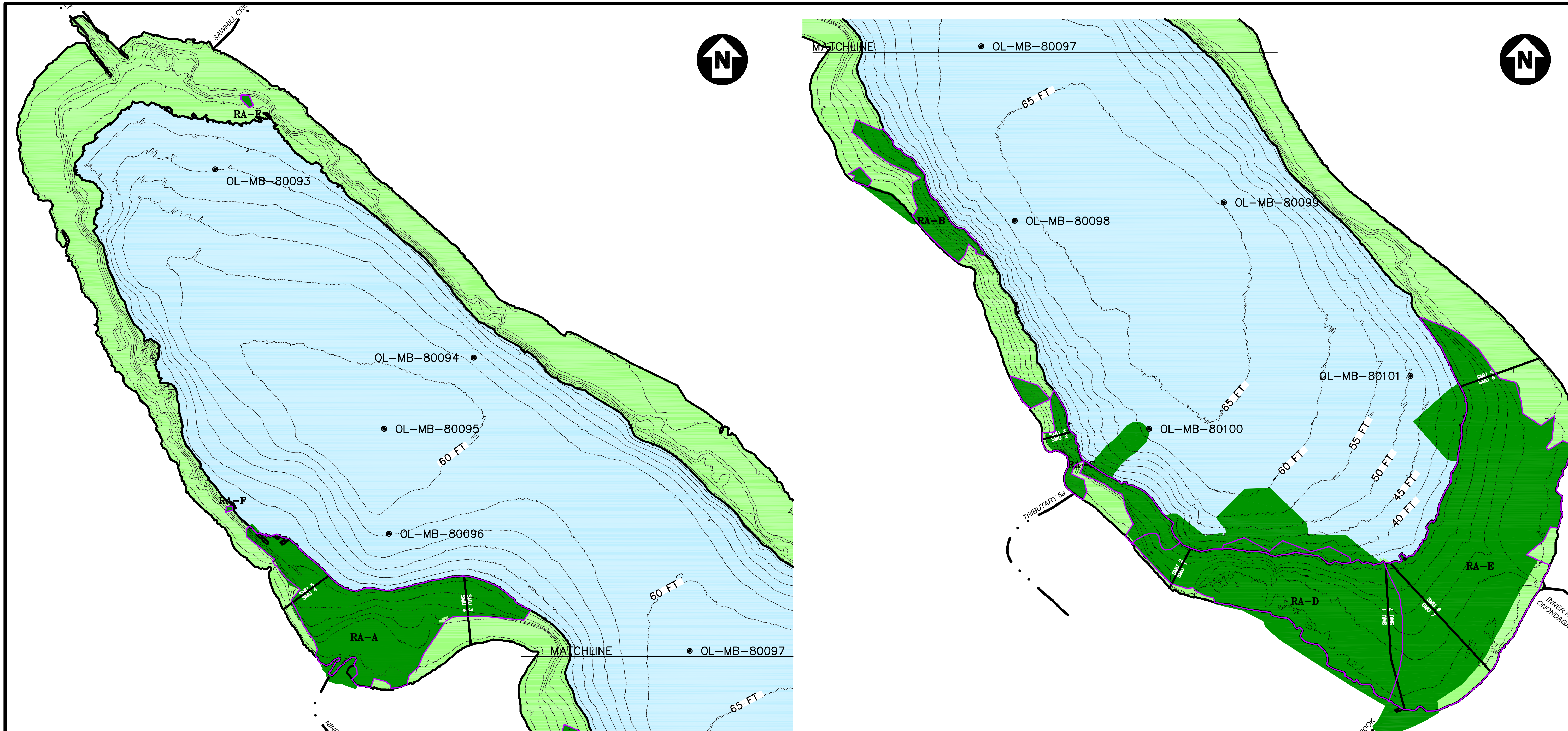

MICROBEAD PLOT LOCATIONS (TWO CORES PER LOCATION)

REMEDIATION AREA BOUNDARY

SMU BOUNDARY

SMU 8

LITTORAL ZONE

CAPPED AREAS (INCLUDES ALL ISOLATION, THIN LAYER, AND MODIFIED PROTECTIVE CAPS)

NOTES:

1. WATER DEPTH CONTOUR INTERVAL IS 5 FT.
2. THE 30' WATER DEPTH CONTOUR IS THE BOUNDARY BETWEEN THE LITTORAL ZONE (SMUs 1-7) AND SMU 8.

1500 0 1500 3000

SCALE: 1"=1500'

FIGURE A-2

Honeywell

ONONDAGA LAKE
SYRACUSE, NEW YORK

SMU 8 MICROBEAD PLOT CORING LOCATIONS

PARSONS
301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\450102 - 2016 OL REMEDIAL GOAL MONITORING\10 TECHNICAL CATEGORIES\CAD\2016\450102-MNR-003.DWG
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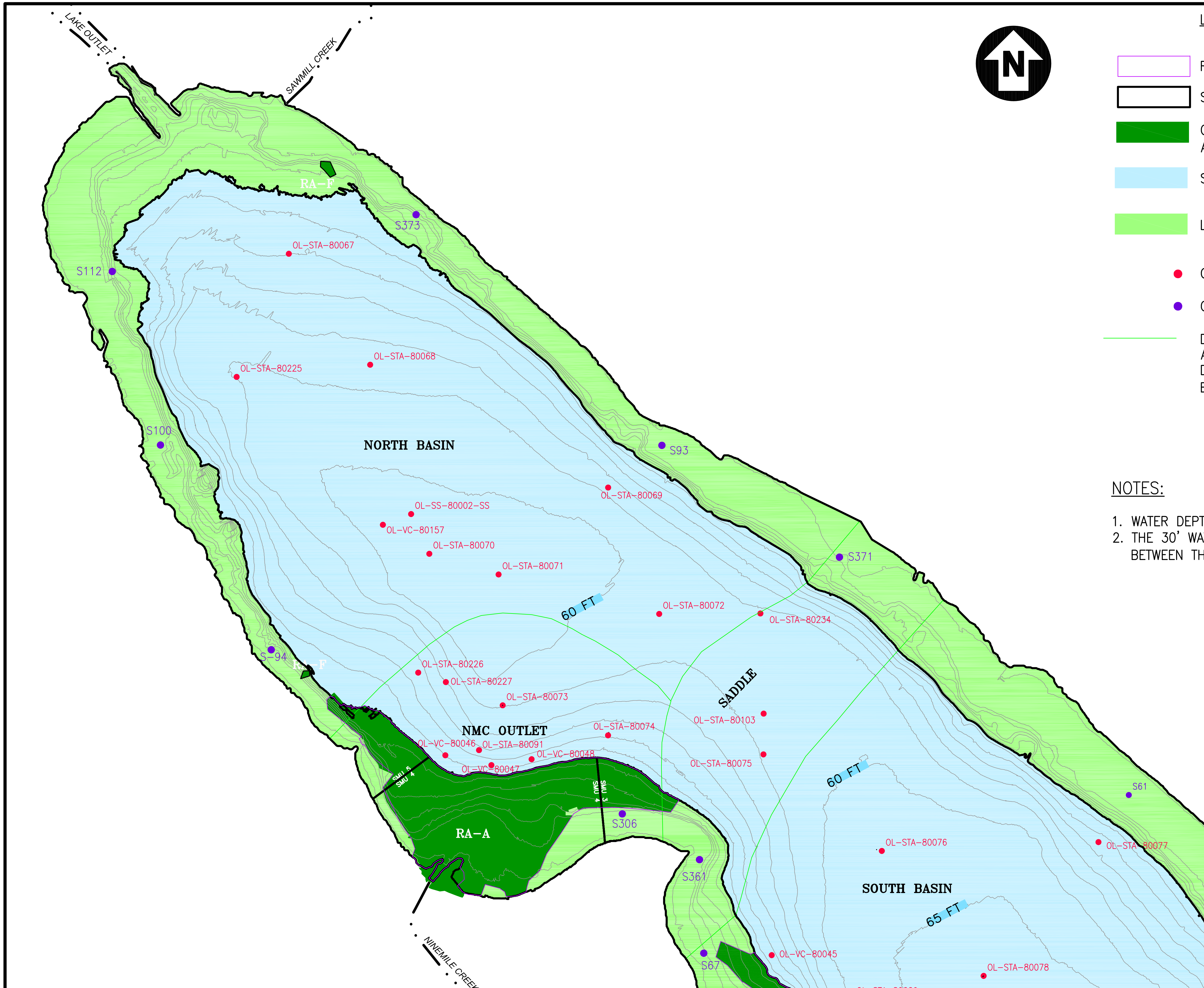

LEGEND:

- REMEDIATION AREA BOUNDARY
- SMU BOUNDARIES
- CAPPED AREAS (INCLUDES ALL ISOLATION, THIN LAYER, AND MODIFIED PROTECTIVE CAPS)
- SMU 8
- LITTORAL ZONE
- COMPLIANCE VERIFICATION SAMPLE LOCATIONS (SMU 8)
- COMPLAINCE VERIFICATION SAMPLE LOCATIONS (LITTORAL)
- DEMARCATION FOR BSQV SUBAREAS (DELINEATION IS APPROXIMATE AND MAY BE MODIFIED BASED ON DEVELOPMENT OF FINAL THIESSEN POLYGONS FOR BSQV EVALUATION)

NOTES:

1. WATER DEPTH CONTOUR INTERVAL IS 5 FT.
2. THE 30' WATER DEPTH CONTOUR IS THE BOUNDARY BETWEEN THE LITTORAL ZONE (SMUs 1-7) AND SMU 8.

1200 600 0 1200 2400

SCALE: 1"=1200'

FIGURE A-3A

Honeywell

ONONDAGA LAKE
SYRACUSE, NEW YORK

COMPLIANCE VERIFICATION SEDIMENT SAMPLE LOCATIONS IN NORTH HALF OF ONONDAGA LAKE

PARSONS
301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\450102 - 2016 OL REMEDIAL GOAL MONITORING\10 TECHNICAL CATEGORIES\CAD\2016\450102-MNR-004.DWG
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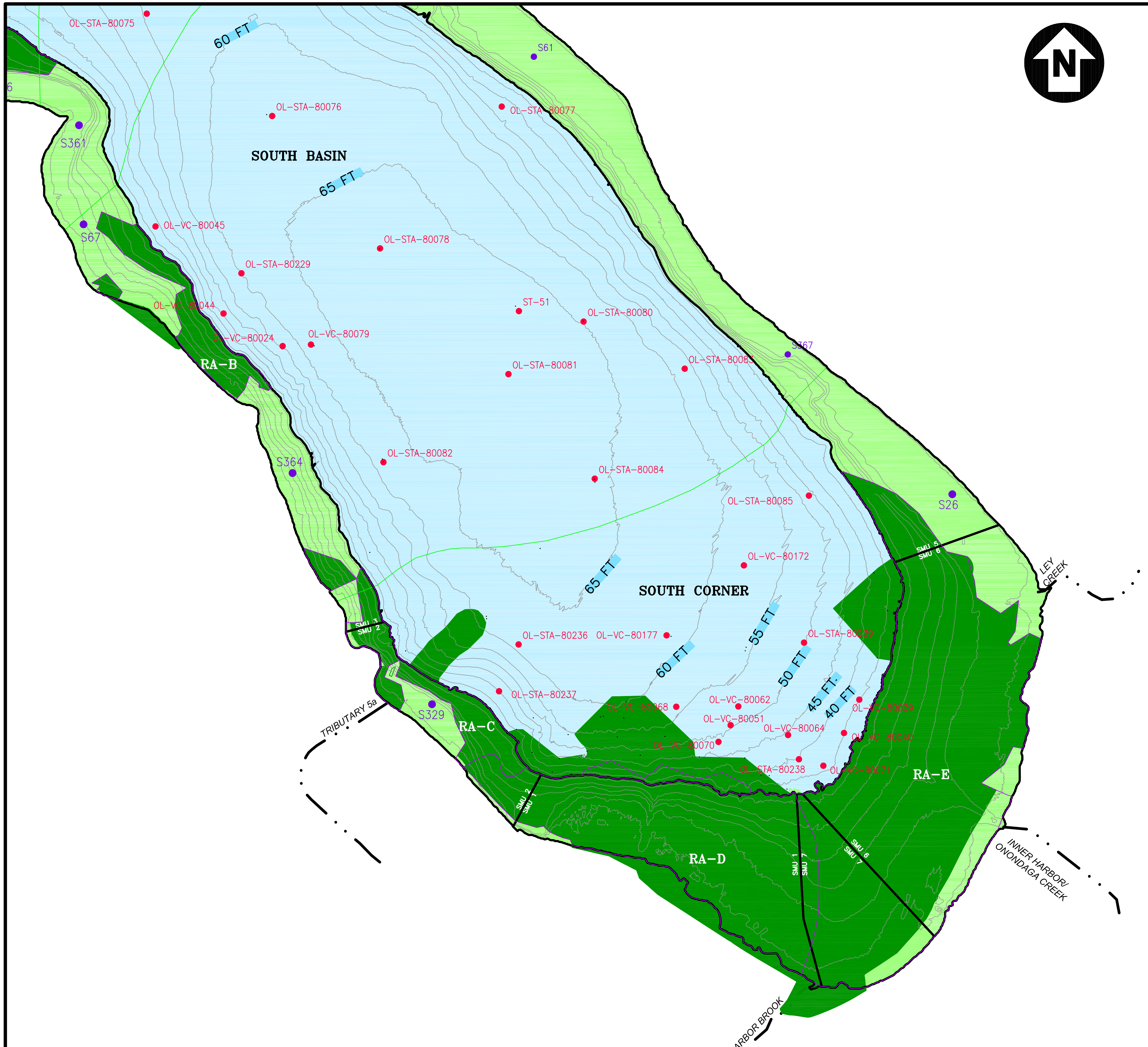

LEGEND:

- REMEDIATION AREA BOUNDARY
- SMU BOUNDARIES
- CAPPED AREAS (INCLUDES ALL ISOLATION, THIN LAYER, AND MODIFIED PROTECTIVE CAPS)
- SMU 8
- LITTORAL ZONE
- COMPLIANCE VERIFICATION SAMPLE LOCATIONS (SMU 8)
- COMPLAINCE VERIFICATION SAMPLE LOCATIONS (LITTORAL)
- DEMARCATION FOR BSQV SUBAREAS (DELINEATION IS APPROXIMATE AND MAY BE MODIFIED BASED ON DEVELOPMENT OF FINAL THIESSEN POLYGONS FOR BSQV EVALUATION)

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3. SAMPLE LOCATIONS USED IN THE FINAL DESIGN REPORT (PARSONS AND ANCHOR QEA, 2012) THAT ARE NOW WITHIN CAPPED AREAS WILL BE SAMPLED UNDER THE CAP MONITORING PROGRAM. SEE SECTION 6 OF THE OLMMP FOR FURTHER DETAILS.

1200 600 0 1200 2400

SCALE: 1"=1200'

FIGURE A–3B

Honeywell ONONDAGA LAKE SYRACUSE, NEW YORK

COMPLIANCE VERIFICATION SEDIMENT SAMPLE LOCATIONS IN SOUTH HALF OF ONONDAGA LAKE

PARSONS
301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\450102 - 2016 OL REMEDIAL GOAL MONITORING\10 TECHNICAL CATEGORIES\CAD\2016\450102-MNR-004.DWG
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ATTACHMENT A

SMU 8 MONITORED NATURAL RECOVERY VARVE SUMMARY

SMU 8 MONITORED NATURAL RECOVERY VARVE SUMMARY

The rate and depth of mixing of relatively clean settling sediments from the water column with the underlying sediments is one of the key processes involved in predicting natural recovery in SMU 8. Mixing of sediments can result from physical processes such as currents driven by wind, and from movement of benthic organisms in the sediment, known as bioturbation. Presence of laminations (also called layering or varves) in sediments is a good indication that vertical mixing is limited and that natural recovery is an applicable alternative. Laminations in SMU 8 sediments on a millimeter scale up to the sediment-water interface were initially documented during the 1990s (Rowell, 1992 and Effler et al., 1996) and again during the 2010 Pre-Design Investigation (PDI) (Appendix M of the Final Design Report [Parsons and Anchor QEA, 2012c]). The presence of these laminations near the sediment surface is indicative that no significant vertical mixing was occurring in SMU 8 sediments. This lack of mixing is a consequence of both an absence of significant benthic macroinvertebrate populations in the sediment due to hypolimnetic anoxia during the summer stratification period and the depth of overlying water that limits resuspension by water currents. More recent cores (e.g., 2011, 2012, 2014, 2015) show a mixing layer (i.e., no varves) of several centimeters in depth. Although laminations have not been observed up to the sediment/water interface in recent years, laminations have been observed within the first four centimeters (i.e., the SMU 8 compliance depth) in 22 out of 26 cores collected since 2011. Of the four cores where consistent laminations were noted to begin deeper than 4 centimeters (cm), two showed a surface sediment lamination of brown sediment less than 4 cm thick. Laminations have been observed within the first 4 cm (i.e., the SMU 8 compliance depth) in all eleven cores collected during the most recent coring event in 2015, as detailed below:

- 2011- five cores (from 35+ feet of water)
  - All five cores showed laminations in the top 2-3 cm
- 2012- six cores from three locations (from 38+ feet of water)
  - Three cores showed laminations beginning within the top 2.5 cm
  - One core showed laminations beginning at a depth of 6 cm
  - Two cores showed consistent laminations beginning at depths of 6 cm, 7 cm, and 13 cm, respectively (each showed a thin layer [0.1 to 1 cm] of brown sediment at the top followed by a thicker layer of mottled sediment)
- 2014- four microbead cores from three locations (from approximately 50+ feet of water)
  - Three cores, two from the south basin and one from the north basin showed laminations starting between 0.5 and 1.75 cm below the core surface
  - One core from the north basin had laminations beginning at 7 cm
- 2015 – 11 cores (31.4+ feet of water)
  - All 11 cores showed laminations beginning between 1.5 and 4 cm below the core surface

Profundal zone benthic macroinvertebrate sampling was conducted in 1992, 2008, 2012, and 2015. Benthic macroinvertebrates in the profundal zone were virtually non-existent in samples collected in 1992. Samples collected during 2012 and 2015 contained an increased number of benthic macroinvertebrates. This increase in the profundal benthic population likely explains the mixing depths, of essentially no mixing in the 1990s (laminations on a millimeter scale up to the sediment-water interface), to limited mixing (several centimeters in depth) in more recent cores.