APPENDIX E

ONONDAGA LAKE
HABITAT MONITORING WORK PLAN

Prepared For:

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OCTOBER 2017

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LIST OF ACRONYMS

AHA	Activity Hazard Analysis
GPS	Global Positioning System
NYSDEC	New York State Department of Environmental Conservation
QAPP	Quality Assurance Project Plan
ROD	Record of Decision
SSP	Subcontractor Safety Plan
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WBB/HB	Wastebed B/Harbor Brook Outboard Area
YOY	Young-of-the-year

ONONDAGA LAKE
HABITAT MONITORING WORK PLAN

1.0 INTRODUCTION

This work plan describes data to be collected beginning in 2017 related to habitat reestablishment and enhancement activities associated with remediated areas of Onondaga Lake, the Ninemile Creek spits and the Wastebed B/Harbor Brook Outboard Area[1]. Descriptions of the field and analytical methods, and Quality Assurance Program supporting the field work are described in the Quality Assurance Project Plan (QAPP) (Parsons et al., 2017 in preparation).

1.1 OBJECTIVES

The primary purpose of this monitoring program is to provide post-restoration data to assist in evaluating habitat restoration effectiveness. As described in Section 7 of this plan, the Record of Decision (ROD) (NYSDEC, 2005) specifies that, subsequent to dredging and capping, the littoral zone will be "restored to reestablish appropriate habitat and function following the removal of contaminated sediments." The goals, broadly defined, are to maintain or improve the:

- size, diversity and ecological function of wetlands;
- ecological function of the littoral zone;
- ecological function of the shoreline habitat;
- habitat conditions of 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 field personnel. Safety plans will be updated annually. Any task outside of the previous field efforts will have a new Activity Hazard Analysis (AHA) completed before the task begins.

1 The creation of the Wastebeds 1-8 Connected Wetlands (removals and capping) were included in the lake design. Details on the restoration (planting and structure) and Success Criteria of both the connected and perched (inland)wetlands are addressed in the *Integrated IRM, Mitigation Wetlands, and Remediation Area Hydraulic Control System 100 % Design Report Wastebeds 1-8*. (O'Brien and Gere Rev Ed. 2013).

3.0 SAMPLING SCOPE AND METHODS

3.1 VEGETATION

Wetland, Upland, and In-lake Planted Areas

The restored planted wetland vegetation and upland areas will be monitored annually for a minimum of five years to evaluate the success of the restoration, and verify that success criteria goals are met. The monitoring program will include both quantitative and qualitative evaluations, which will document parameters such as vegetative aerial percent cover, relative percent cover of each species, aerial percent cover of invasive species, cover type, counts of woody species, and wetland acreages. Trees installed as #20 or greater in size will also be monitored to document condition of each installed individual.

For the qualitative evaluation, a minimum of two comprehensive field reconnaissance efforts will be conducted annually in the planted areas at the mouth of Ninemile Creek (including the spits) and the Wastebed B/Harbor Brook (WBB/HB) Outboard area. During these efforts the overall condition and estimated cover of vegetation will be documented. All plant species encountered will be also be identified, and the locations of any invasive species will be recorded. These comprehensive reconnaissance efforts will be conducted during the early to mid-part of the growing season (i.e., June/July), and during the latter part of the growing season (i.e., August/September). Additional site visits will also occur periodically throughout the growing season at approximately bi-weekly intervals. During these regular reconnaissance site visits, similar information to the comprehensive monitoring efforts will be collected. In addition, representative photographs will be taken at predetermined locations of each site (Figures E-1 and E-2a and E-2b). These visits are intended to track the progress of vegetation and identify any potential issues before they become significant.

For quantitative evaluations, a minimum of two plot sampling locations per acre will be established within each habitat module in the planted areas at the mouth of Ninemile Creek (including the spits) and WBB/HB Outboard Area, and evaluated annually for five consecutive years. Sampling will occur each year during the mid-August to mid-September timeframe to target the approximate period of peak plant abundance. A total of 59 plots will be located in the planted areas at the mouth of Ninemile Creek (2.4 plots/acre), including the spits (7.8 plots/acre), and 64 plots will be distributed throughout the WBB/HB Outboard Area (3.8 plots/acre). Plot locations were chosen in a stratified random fashion to be reflective of individual module acreage and location of plantings (Figures E-1 and E-2). Each planted module contains a minimum of two plots per acre, and the density of sampling plots is higher in mitigation wetlands (spits at the mouth of Ninemile Creek and the WBB/HB Outboard area). Herbaceous vegetation will be evaluated within plots measuring approximately 50 square feet (8 ft. diameter circular plot) and woody vegetation will be evaluated within plots measuring approximately 200 square feet (16 ft. diameter circular plot). Vegetation in each plot will be evaluated for cover type, total percent aerial cover, and relative percent cover of each species. All large trees (#20 or larger) will be visually inspected, and their overall condition documented.

The overall habitat restoration goals for the site includes creation of a diverse native ecosystem with a significant wetland component. The data from the vegetation monitoring program will be used to assess if the restoration goals are being achieved. Annual estimates of wetland acre will be made based on vegetation cover types. In year three, a formal wetland survey will be performed by a certified wetland delineator based on vegetation and hydrology. Finally, a wetland delineation carried out per USACOE (USACOE, 2012) and NYSDEC (NYSDEC, 1995) methods will be completed in year five to quantify wetland mitigation acreage. Further details of monitoring and data documentation procedures are described in the QAPP.

Non-planted Shallow and Deep Littoral Zone

Aquatic macrophyte species composition and distribution will be characterized annually for the first five years. Sampling each year will occur in August at 218 locations distributed around the lake in both remediation and non-remediation areas (Figure E-3). Additionally, the 12 points sampled in the CSX area during the baseline habitat investigation in 2016, along with an additional six new locations, will be sampled. Points will be identified based on Global Positioning System (GPS) location. Sampling will be conducted at each point using methods described in Madsen (1999), consistent with the methods used during baseline monitoring. A sample rake will be tossed to the bottom one time per location and species presence or absence will be evaluated. In addition, water depth will be recorded at each point along the transect. Additionally, two qualitative boat surveys will be conducted from the shoreline to approximately 20 ft. of water to provide a broader perspective on vegetation distribution. One will be conducted in the spring and another in the same general time frame as the point sampling.

Qualitative Baseline Shoreline Survey

A qualitative baseline shoreline survey will be conducted by boat in 2018 to document the vegetative community types present around the margins of the lake. The survey will include the documentation of dominant cover types along the shoreline, dominant species, and areas that contain a significant invasive species population.

3.2 FISH AND WILDLIFE COMMUNITY MONITORING

3.2.1 Fish Community Composition and Population Assessment

Fish community information will be collected annually to provide data that will help facilitate an understanding of fish community response to habitat re-establishment. Assessments of fish community composition as well as population will aid in this understanding. Adult and juvenile fish will be collected using the same methods that have been utilized since 2008, to the extent practical. Some locations being sampled for post remedy monitoring have been sampled since 2008, while other locations have been adjusted, at the request of NYSDEC, to focus on remediation areas (Figure E-4). Sampling locations are representative of fish use in and adjacent to each remediation area. Due to the extremely shallow water within the CSX area (as shown on Figure E-4) and immediately offshore, fish monitoring stations are not included within the CSX area. However, standard observations to identify fish visible within the CSX area will be conducted

during other monitoring activities within the CSX area (i.e., benthic community sampling, aquatic vegetation surveys, sediment sampling). Fish community assessments will be conducted monthly from June through October to account for seasonal fish movement. Sampling methods will include seining, gill netting, and trap netting. Approximately three to five days will be allocated to trap and gill nets each month. Sampling with seines to target juvenile fishes will occur once annually, usually in early to mid-August to allow time for young-of-the-year hatched in spring to grow to catchable size. Fish will be identified in the field to the lowest taxonomic level possible, and the abundance recorded along with life history stage, as practical. The first thirty individuals of each species will be measured for total length in millimeter. Further details of sampling and processing procedures are described in the QAPP.

Northern Pike (*Esox lucius*) and other wetland spawning species are expected to utilize the WBB/HB Outboard Area. Monitoring in this area, expected to begin in 2018, will be focused on documenting evidence of spawning by these species. Sampling will focus on the early spring period when water temperatures are between 41°F and 55°F, when spawning by Northern Pike typically occurs. Sampling will consist of a combination of visual site walks along the shoreline and a minimum of two trap nets set each week (Figure E-5). Net locations may be periodically moved between the three locations shown on Figure E-5 or to other locations within the WBB/HB Outboard Area to optimize catch efficiency, as site conditions allow (Figure E-5). Any Pike captured during this sampling will measured for total length (mm) and immediately released at their point of capture.

An additional sampling effort will occur in the summer months to capture young-of-the-year (YOY) Northern Pike and/or other wetland spawning species that may be present in the WBB/HB Outboard Area. To account for the diversity of water depths and vegetation, a variety of locations and sampling techniques may be utilized, including but not limited to visual surveys, boat electrofishing, backpack electrofishing, trap/fyke nets, and minnow traps. Sampling will be limited to catch and release to minimize impacts on Northern Pike re-establishment. Additionally, sampling techniques must be protective of newly installed vegetation critical to promote spawning of wetland species; therefore, large bag seines or other techniques that could damage plants will likely not be used in this monitoring effort.

3.2.2 Wildlife

The restored wetland areas will be the focus of wildlife monitoring efforts because they provide the greatest diversity of habitat and are therefore expected to attract the greatest diversity of wildlife. Other remediated areas are mostly open water and the taxa using these areas will be mostly fish and benthic invertebrates that are addressed in Sections 3.2.1 and 3.3. Wildlife observations will still be made in these areas however, so that transient waterfowl and other piscivorous birds such as Osprey and Bald Eagle that utilize the area are documented.

Wildlife usage will be documented during all reconnaissance site visits (at least bi-weekly during the growing season), in addition to vegetation monitoring events, using the same techniques that have been utilized successfully at the Geddes Brook and Ninemile Creek sites since 2013

(Parsons, 2016). Wildlife usage will be assessed by recording evidence of reptiles, amphibians, birds, and mammals obtained using standard observation methods (e.g., direct visual observation, tracks, scat, trail cameras, etc.). Site-specific observations will be completed during favorable conditions (e.g., wet conditions for amphibians, or at dawn and dusk for birds) to the extent practicable. Specialized site visits will be conducted during important seasonal wildlife activity peaks, such as during the spring mating season for amphibians and/or during the fall for migratory birds. Amphibian call surveys will be conducted based upon USGS protocols (https://www.pwrc.usgs.gov/naamp/naamp_protocol.pdf) and typical hiding locations used by amphibians, such as beneath woody debris, large rocks, etc., will be periodically checked during site visits. Further details of monitoring and data documentation procedures are described in the QAPP.

3.3 MACROINVERTEBRATE COMMUNITY MONITORING

Community composition of benthic macroinvertebrates will be monitored to document the recolonization of the remediated area as well as changes to the community composition of invertebrates following the completion of capping. Sampling will occur twice within the first five years following completion of capping, with the first event scheduled to occur in 2018, with the second event in either 2019 or 2020. The need for subsequent sampling will be determined following the second sampling event in consultation with NYSDEC. Sampling will be conducted at 54 locations around the lake using two different methods (petite ponar and multiplates) (Figures E-6A through E-6C). Most sample locations (42) are within remediation areas and nine are located outside of remediation areas and are consistent with shallow water locations sampled during baseline monitoring (Parsons et al., 2010). Sampling locations within remediation areas encompass all remediation cap types (topsoil, sand, gravel, coarse gravel, modified protective cap [MPC]) and include deeper sections of the littoral zone (modules 1 and/or 2). Additionally, three locations are located in the CSX Shoreline area. Due to constraints in the types of substrates that are efficiently sampled using a petite ponar (i.e., fine sediment only/soft sediments), these locations are in either sand or topsoil areas. Sampling in areas of gravel and coarse gravel is to be conducted using multiplates. A sample from each location will be collected and sent to a professional laboratory to taxonomic identification to the lowest taxonomic resolution practical. Additional details on sample collection, processing, and management can be found in the QAPP.

4.0 DATA COMPLILATION/ MANAGEMENT

Laboratory and field generated data will be compiled in electronic file format. Pertinent field data will be entered into electronic format during collection. The QAPP specifies minimum requirements for sample information that will be entered into the database.

5.0 REFERENCES

Madsen, J., 1999. Point Intercept and Line Intercept Methods for Aquatic Plant Management. US Army Engineer Waterways Experiment Station Aquatic Plant Control Technical Note MI-02. Vicksburg, MS.

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US Army Corps of Engineers, 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region.* Prepared for USACOE. Washington, DC.

FIGURES

MODULE 2A

MODULE 2A

MODULE 3A

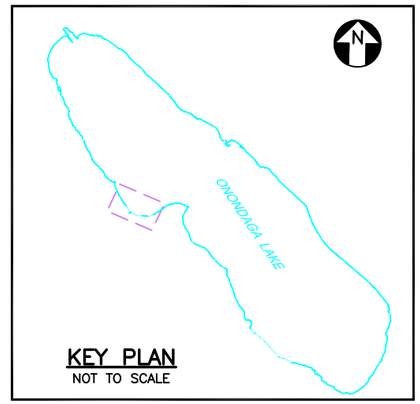
MODULE 3B

NINEMILE CREEK

LEGEND:

- 4A1 — DEEP FLOATING AQUATIC WETLAND (ZONE 4A1)
- 4A2 — SHALLOW FLOATING AQUATIC WETLAND (ZONE 4A2)
- 5A3 — NON-PERSISTENT EMERGENT WETLAND TRANSITION (ZONE 5A3)
- 6A1 — PERSISTENT EMERGENT WETLAND WATER FRINGE (ZONE 6A1)
- 6A2 — PERSISTENT EMERGENT WETLAND INTERIOR (ZONE 6A2)
- 6A3 — PERSISTENT EMERGENT WETLAND TRANSITION (ZONE 6A3)
- SHORELINE STABILIZATION AND ENHANCEMENT AREA
- VEGETATION PLOTS[1]
- MODULE BOUNDARY
- REMEDIATION AREA CAP BOUNDARY
- SHORELINE (FOR PLANTING PURPOSES – 362.8')
- PHOTO LOCATIONS AND DIRECTION

1. ALL PLOTS IN MODULES 4, 5, AND 6A1 ARE HERBACEOUS. PLOTS LOCATED IN 6A2 AND 6A3 WILL BE MONITORED FOR HERBACEOUS AND WOODY COMPONENTS.



KEY PLAN
NOT TO SCALE

150 0 150 300

SCALE: 1"=150'

FIGURE E-1

Honeywell

MOUTH OF NINEMILE CREEK PLANTED AREA VEGETATION MONITORING PLOTS AND PHOTOGRAPH LOCATIONS

PARSONS
301 PLAINFIELD ROAD • SUITE 350 • SYRACUSE, NY 13212 • 315/451-9560
OFFICES IN PRINCIPAL CITIES

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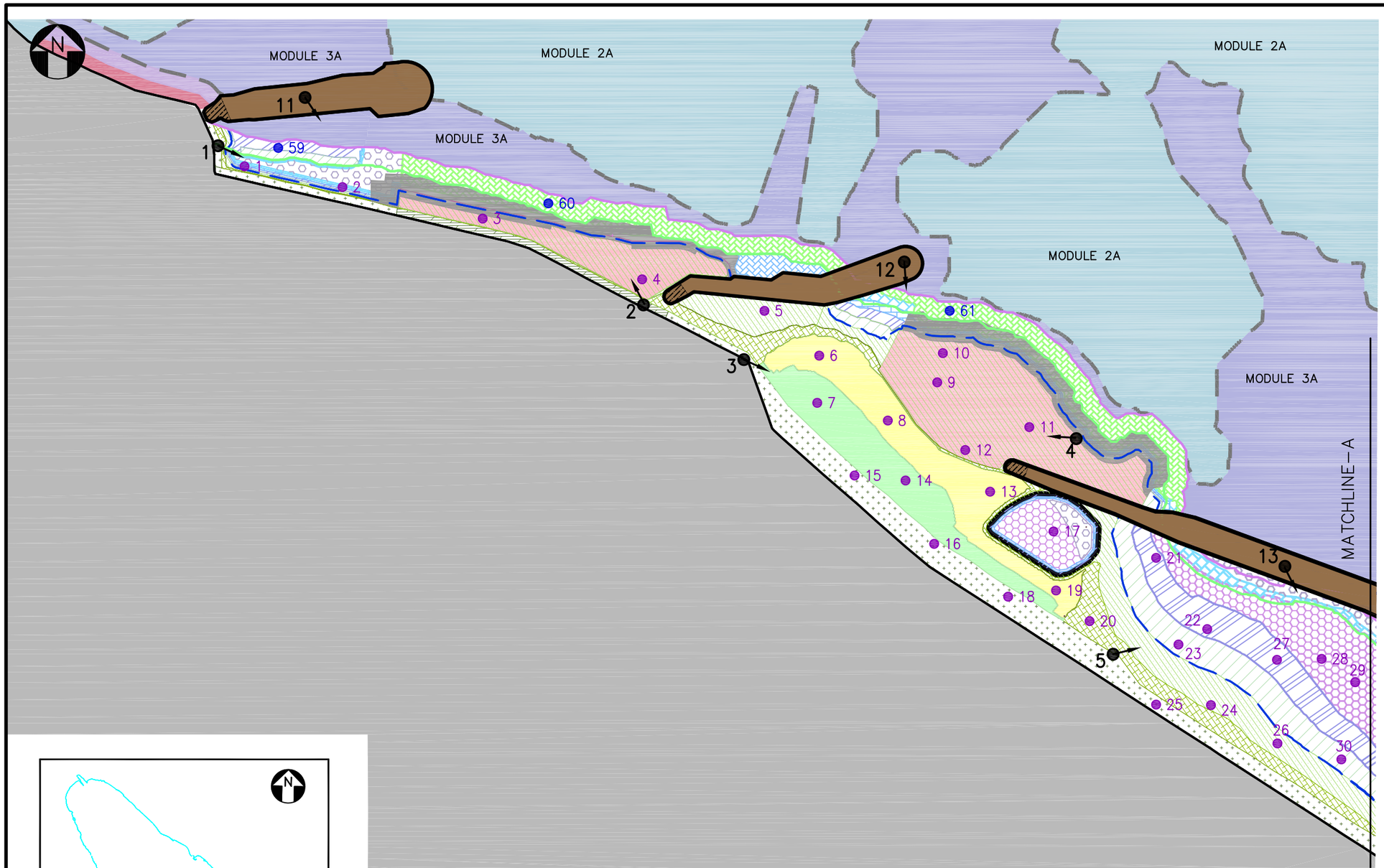

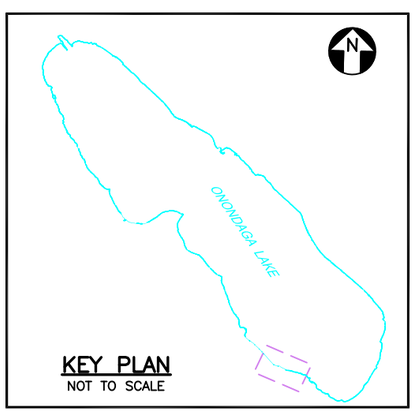

3A SHALLOW WATER (ZONE 3A)

4A1 DEEP FLOATING AQUATIC (ZONE 4A1)

4A2 SHALLOW FLOATING AQUATIC (ZONE 4A2)

5A1 NON–PERSISTENT EMERGENT WETLAND FRINGE (ZONE 5A1)

5A2 NON–PERSISTENT EMERGENT WETLAND INTERIOR (ZONE 5A2)

5A3 PERSISTENT/NON–PERSISTENT EMERGENT TRANSITION (ZONE 5A3)

6A1 PERSISTENT EMERGENT WETLAND FRINGE (ZONE 6A1)

6A2 PERSISTENT EMERGENT WETLAND INTERIOR (ZONE 6A2)

6A2 PERSISTENT EMERGENT PLATEAU 363.3' (ZONE 6A2)

6A3 PERSISTENT EMERGENT WETLAND TRANSITION (ZONE 6A3)

8A SHORELINE BANK SCRUB–SHRUB/ FORESTED (ZONE 8A)

8B SHORELINE BANK PROTECTIVE EDGE (ZONE 8B)

9B1 FORESTED WETLAND (ZONE 9B1)

9B2 FORESTED WETLAND INTERIOR (ZONE 9B2)

SPECIAL TRANSITION AREA

PROTECTIVE EDGE

PROTECTIVE BERMS

30' PLANTING ZONE ON BERMS ONLY

VEGETATION PLOT[1]

VEGETATION PLOT[2]

MODULE BOUNDARY

REMEDIATION AREA CAP BOUNDARY

OUTBOARD BOUNDARY

25' PLANTED BUFFER LIMIT

SHORELINE (FOR PLANTING PURPOSES – 362.8')

PHOTO LOCATIONS AND DIRECTION

1. PLOTS IN MODULES 8 AND 9 WILL BE MONITORED FOR HERBACEOUS AND WOODY COMPONENTS. ALL OTHER PLOTS ARE HERBACEOUS ONLY.

2. VEGETATION PLOTS WILL BE CONDUCTED WITH A THROW RAKE DUE TO WATER DEPTH.

150 0 150 300

SCALE: 1"=150'

FIGURE E–2a

Honeywell

WESTERN WASTEBED B/HARBOR BROOK OUTBOARD AREA VEGETATION MONITORING PLOTS AND PHOTOGRAPH LOCATIONS

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OFFICES IN PRINCIPAL CITIES

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MODULE 2A

MODULE 2B

MODULE 3A

MODULE 3B

MODULE 5B

MODULE 6B

MATCHLINE–A

HARBOR BROOK

29 31 62 6 32 33 34 63 35 36 38 37 39 14 40 41 42 43 44 45 8 46 47 64 15 57 58 55 56 54 51 52 53 50 48 49 9 10

1. PLOTS IN MODULES 8 AND 9 WILL BE MONITORED FOR HERBACEOUS AND WOODY COMPONENTS. ALL OTHER PLOTS ARE HERBACEOUS ONLY.

2. VEGETATION PLOTS WILL BE CONDUCTED WITH A THROW RAKE DUE TO WATER DEPTH.

KEY PLAN
NOT TO SCALE

ONONDAGA LAKE

150 0 150 300

SCALE: 1"=150'

- 3A SHALLOW WATER (ZONE 3A)
- 4A1 DEEP FLOATING AQUATIC (ZONE 4A1)
- 4A2 SHALLOW FLOATING AQUATIC (ZONE 4A2)
- 5A1 NON–PERSISTENT EMERGENT WETLAND FRINGE (ZONE 5A1)
- 5A2 NON–PERSISTENT EMERGENT WETLAND INTERIOR (ZONE 5A2)
- 5A3 PERSISTENT/NON–PERSISTENT EMERGENT TRANSITION (ZONE 5A3)
- 6A1 PERSISTENT EMERGENT WETLAND FRINGE (ZONE 6A1)
- 6A2 PERSISTENT EMERGENT WETLAND INTERIOR (ZONE 6A2)
- 6A2 PERSISTENT EMERGENT PLATEAU 363.3' (ZONE 6A2)
- 6A3 PERSISTENT EMERGENT WETLAND TRANSITION (ZONE 6A3)
- 8A SHORELINE BANK SCRUB–SHRUB/ FORESTED (ZONE 8A)
- 8B SHORELINE BANK PROTECTIVE EDGE (ZONE 8B)
- 9B1 FORESTED WETLAND (ZONE 9B1)
- 9B2 FORESTED WETLAND INTERIOR (ZONE 9B2)
- SPECIAL TRANSITION AREA
- PROTECTIVE EDGE
- PROTECTIVE BERMS
- 30' PLANTING ZONE ON BERMS ONLY
- VEGETATION PLOT[1]
- VEGETATION PLOT[2]
- MODULE BOUNDARY
- REMEDIATION AREA CAP BOUNDARY
- OUTBOARD BOUNDARY
- 25' PLANTED BUFFER LIMIT
- SHORELINE (FOR PLANTING PURPOSES – 362.8')
- PHOTO LOCATIONS AND DIRECTIONS

FIGURE E–2b

Honeywell

EASTERN WASTEBED B/HARBOR BROOK OUTBOARD AREA VEGETATION MONITORING PLOTS AND PHOTOGRAPH LOCATIONS

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OFFICES IN PRINCIPAL CITIES

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X MACROPHYTE SAMPLING LOCATIONS

REMEDIATION AREA BOUNDARY

SMU BOUNDARY

SMU 8

LITTORAL ZONE

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

CSX SHORELINE

NOTES:

1. WATER DEPTH CONTOUR INTERVAL IS 5 FT. (PRE-REMEDY CONTOURS SHOWN)

2000 1000 0 2000 4000

SCALE: 1"=2000'

FIGURE E-3

Honeywell

ONONDAGA LAKE
SYRACUSE, NEW YORK

MACROPHYTE SAMPLING 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-MACROPHYTE-ESF.DWG
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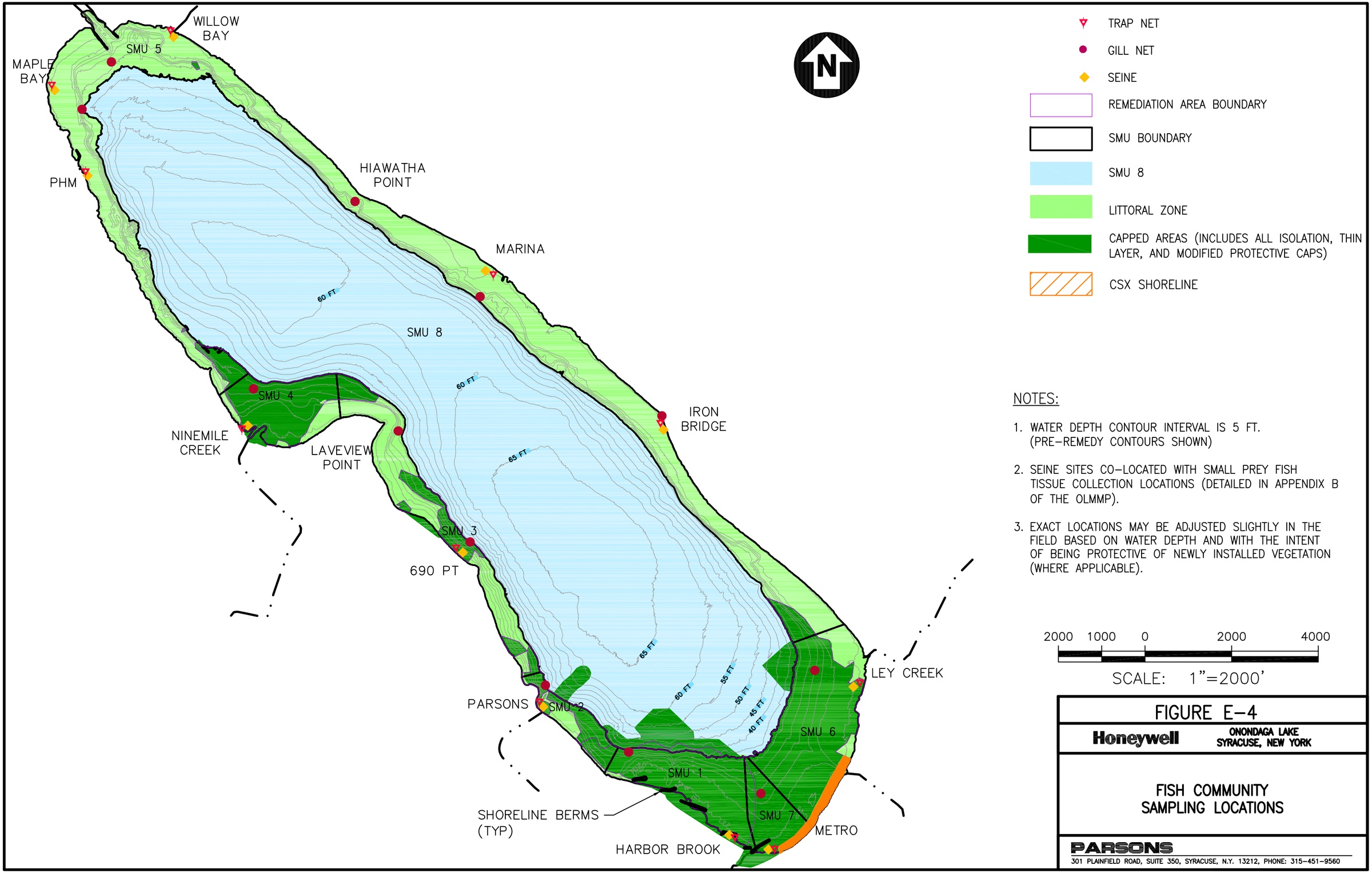

NOTES:

1. WATER DEPTH CONTOUR INTERVAL IS 5 FT. (PRE-REMEDY CONTOURS SHOWN)
2. SEINE SITES CO-LOCATED WITH SMALL PREY FISH TISSUE COLLECTION LOCATIONS (DETAILED IN APPENDIX B OF THE OLMMP).
3. EXACT LOCATIONS MAY BE ADJUSTED SLIGHTLY IN THE FIELD BASED ON WATER DEPTH AND WITH THE INTENT OF BEING PROTECTIVE OF NEWLY INSTALLED VEGETATION (WHERE APPLICABLE).

2000 1000 0 2000 4000

SCALE: 1"=2000'

FIGURE E-4

Honeywell — ONONDAGA LAKE SYRACUSE, NEW YORK

FISH COMMUNITY SAMPLING LOCATIONS

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

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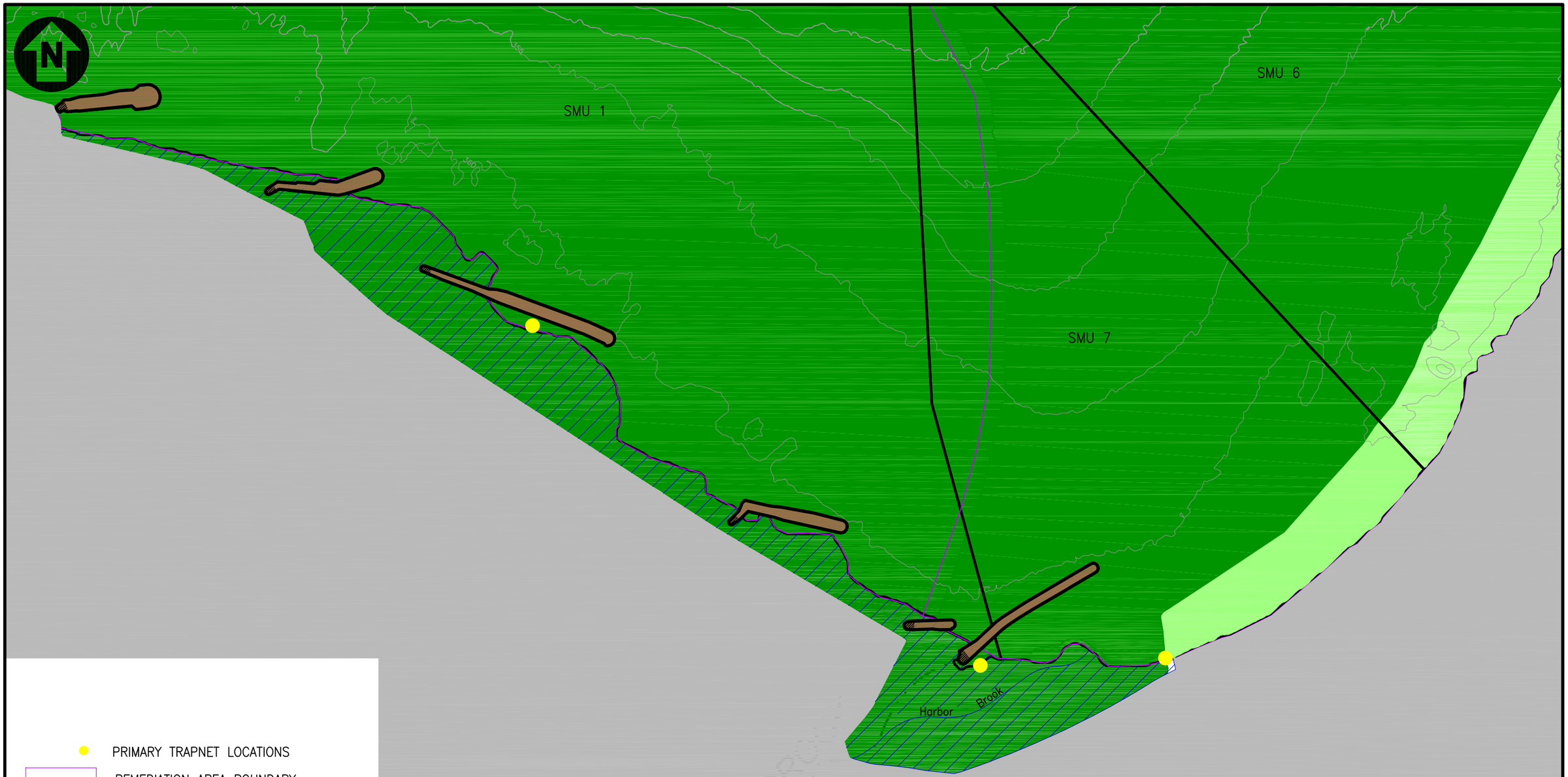

NOTES:

1. WATER DEPTH CONTOUR INTERVAL IS 5 FT. (PRE-REMEDY CONTOURS SHOWN)

300 150 0 300 600

SCALE: 1"=300'

FIGURE E-5

Honeywell

ONONDAGA LAKE
SYRACUSE, NEW YORK

WB-B/HB OUTBOARD AREA NORTHERN PIKE SAMPLING LOCATIONS

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

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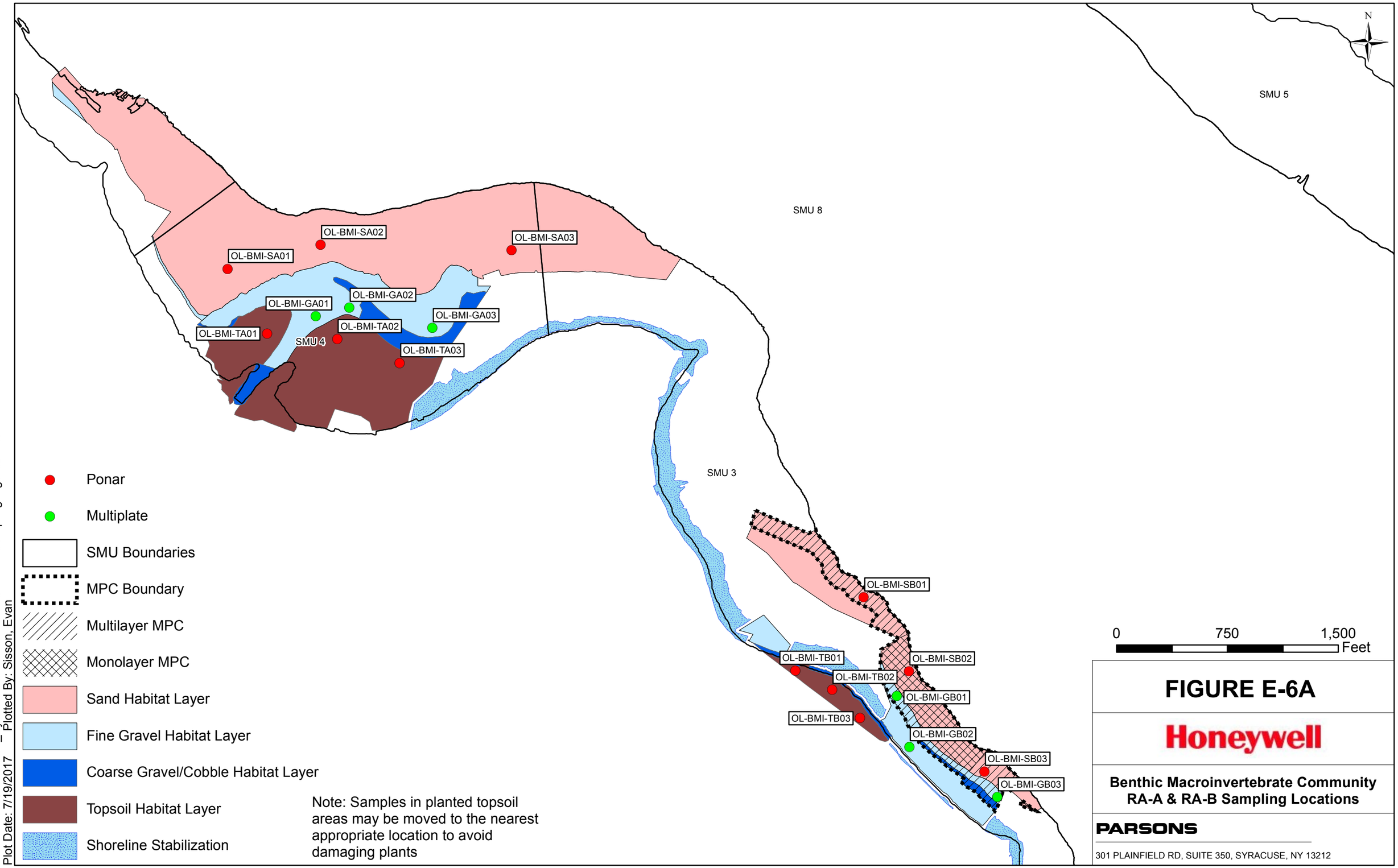
N
SMU 5
SMU 8
SMU 4
SMU 3
OL-BMI-SA01
OL-BMI-SA02
OL-BMI-SA03
OL-BMI-GA01
OL-BMI-GA02
OL-BMI-GA03
OL-BMI-TA01
OL-BMI-TA02
OL-BMI-TA03
OL-BMI-SB01
OL-BMI-SB02
OL-BMI-SB03
OL-BMI-TB01
OL-BMI-TB02
OL-BMI-TB03
OL-BMI-GB01
OL-BMI-GB02
OL-BMI-GB03
Ponar
Multiplate
SMU Boundaries
MPC Boundary
Multilayer MPC
Monolayer MPC
Sand Habitat Layer
Fine Gravel Habitat Layer
Coarse Gravel/Cobble Habitat Layer
Topsoil Habitat Layer
Shoreline Stabilization
Note: Samples in planted topsoil areas may be moved to the nearest appropriate location to avoid damaging plants
0
750
1,500
Feet
FIGURE E-6A
Honeywell
Benthic Macroinvertebrate Community
RA-A & RA-B Sampling Locations
PARSONS
301 PLAINFIELD RD, SUITE 350, SYRACUSE, NY 13212
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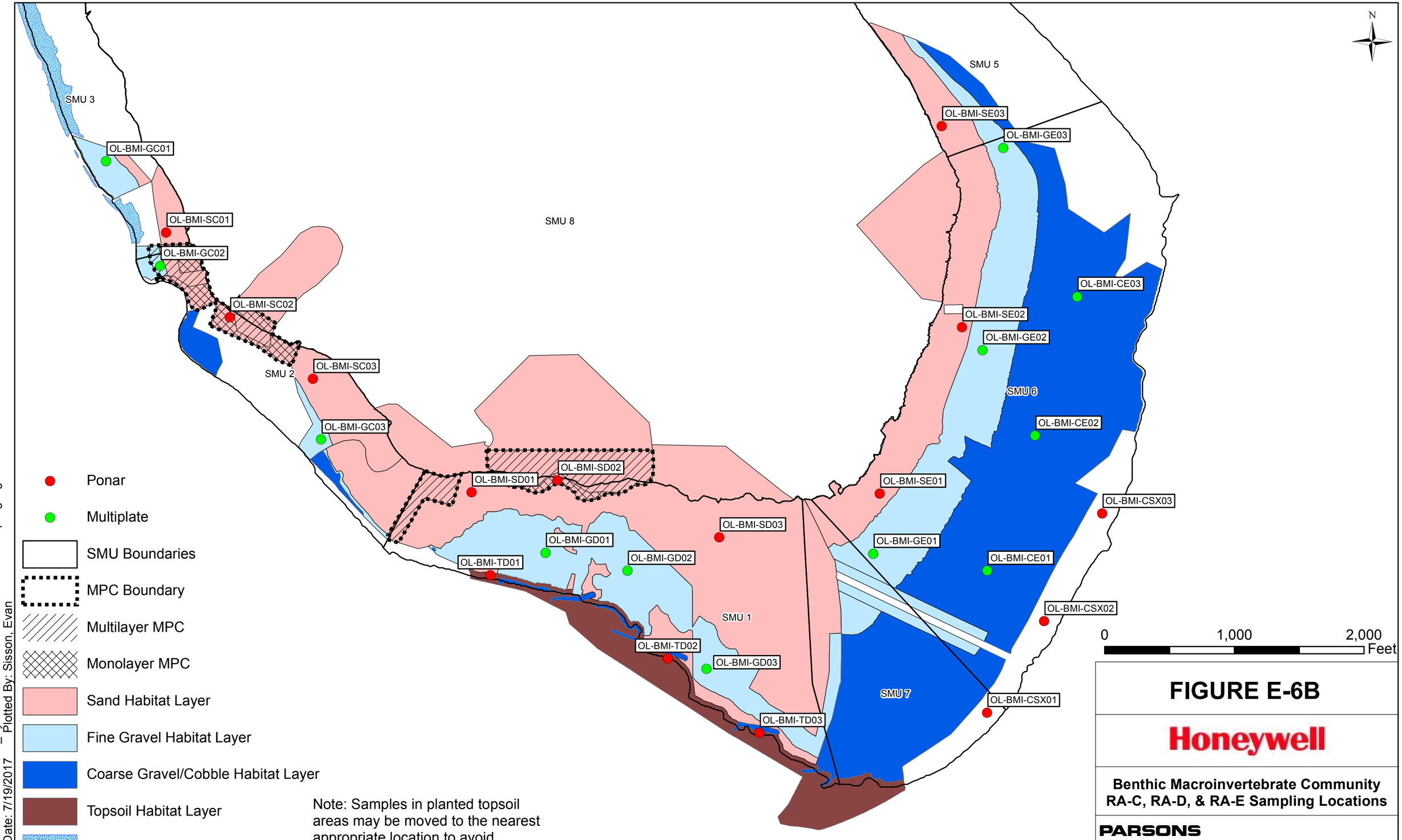

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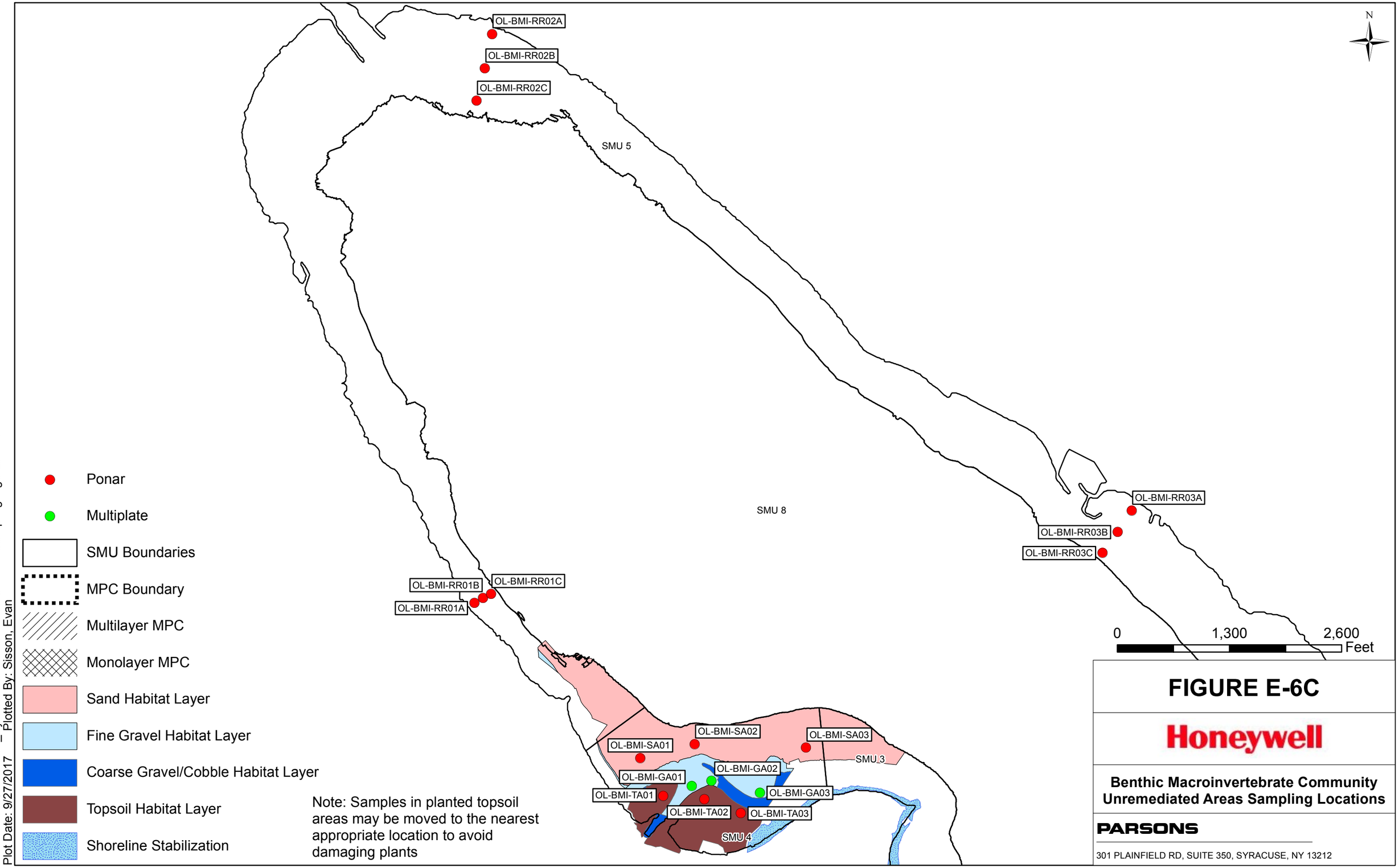
Plot Date: 7/19/2017 Plotted By: Sisson, Evan

FIGURE E-6B

Honeywell

Benthic Macroinvertebrate Community RA-C, RA-D, & RA-E Sampling Locations

PARSONS
301 PLAINFIELD RD, SUITE 350, SYRACUSE, NY 13212



File Name: Q:\GIS\Hon_Syracuse\OLMMS\MXDs\OLMMP Sampling Figures.mxd
Plot Date: 9/27/2017 Plotted By: Sisson, Evan

FIGURE E-6C

Honeywell

Benthic Macroinvertebrate Community Unremediated Areas Sampling Locations

PARSONS
301 PLAINFIELD RD, SUITE 350, SYRACUSE, NY 13212