APPENDIX H

ONONDAGA LAKE PRE-DESIGN INVESTIGATION
PHASE IV DATA SUMMARY REPORT
ADDENDUM 1: HABITAT

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SECTION 1

INTRODUCTION

1.1 BACKGROUND

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 USEPA's 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 Pre-Design Investigation (PDI) was completed in 2005, the Phase II PDI was completed in 2006, and the Phase III PDI was completed in 2007 (in accordance with the procedures described in the Phase I-III PDI Work Plans, respectively (Parsons, 2005, 2006, and 2007). 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 United States Environmental Protection Agency (USEPA) on July 1, 2005 (NYSDEC and USEPA, 2005).

The Phase IV PDI was structured in a similar fashion as the Phase III effort to collect additional information for the Onondaga Lake design and to fulfill additional data gaps identified during design. Unless otherwise noted, the field activities identified in this addendum were conducted in accordance with the procedures outlined in the Phase I - IV PDI Work Plans and associated appendices (Parsons, 2005, 2006, and 2007; Parsons and QEA, 2008). This Data Summary Report describes the results of sample collection activities performed in 2008 required to fulfill several key data needs identified by the Habitat Technical Work Group (TWG). The details regarding the program objectives, methods of sample collection and analysis, and results are described in the sections below.

1.2 PROJECT OBJECTIVES

Before any of the remedial actions are implemented, additional information is required to complete the remedial design. Since many of the details around the design have not been finalized, this work plan is intended to address several remaining gaps within the existing data set that are needed to advance the conceptual design.

The specific objectives for the habitat PDI are as follows:

- Characterize centrarchid (bass and sunfish) nests to provide data for habitat layer substrate and thickness
- Characterize aquatic macrophytes to understand locations and water depths where macrophytes currently exist

- Evaluate the colonization rates of biota on different substrates to assess the suitability of potential habitat layer substrates

The first objective, characterize centrarchid (bass and sunfish) nests, addressed the data gap related to substrate thickness and protection of the cap. While several factors have been used to design the thickness and substrate characteristics of the habitat layer, there is limited information in the literature on the actual depth of centrarchid nest depression into the substrate. These data are expected to provide information, along with other sources of information (e.g., other fish species, as well as plants and invertebrates, reference sites, literature) to determine the appropriate thickness of the habitat layer.

The second objective, characterize aquatic macrophytes (plants) addressed the data gap related to macrophyte presence and the relationship with physical factors (e.g., substrate characteristics, energy regimes, and water depth). In addition, analysis of seasonal changes was completed to document habitat conditions during the various fish life cycles (reproductive cover, juvenile cover, adult cover) and potential limitations in habitat during any of these stages. These data are necessary during design to identify suitable or unsuitable habitat for macrophyte recolonization areas and facilitate the creation of diverse habitats (by understanding various plant species physical habitat characteristics) following remediation.

The third objective, evaluate the colonization rates of biota (including fish, macroinvertebrates, macrophytes) on different substrates, provided data for the type of substrate to use in areas where natural recolonization may be used for restoration (primarily coarse substrates and sand likely to be available in the quantities needed for the habitat layer). It is important to determine whether the selected substrates support the selected representative species early in the design to allow time for sourcing of the material.

The Phase IV habitat data has been combined with the existing information for the lake for use during remedial design and reviewed to determine whether there are remaining data gaps that need to be addressed during intermediate or final design.

SECTION 2

SAMPLE COLLECTION AND ANALYSIS

To address existing data gaps and further the design process, additional habitat related information was collected from the lake in 2008. Unless otherwise noted, samples collected as part of this program were in accordance with the Phase IV PDI Work Plan Addendum 1: Habitat (Parsons and QEA, 2008).

2.1 FISH NEST CHARACTERIZATION

Centrarchids (bass and sunfish) create nests in the littoral zone during spring each year. Nest characteristics, such as depth and substrate, have been used as one of several factors in designing the thickness and substrate characteristics of the habitat layer. The ROD-specified minimum thickness of the habitat layer is 1 ft., and data from this task has been incorporated into the determination of the appropriate thickness of the habitat layer. Nest characteristics of each species were measured, including the depth of the depression, height of the nest sides in relation to nest depression and surrounding substrate, and sediment composition of the nest.

The characteristics of up to 30 nests per species (largemouth bass [*Micropterus salmoides*], smallmouth bass (*Micropterus dolomieu*), bluegill sunfish (*Lepomis macrochirus*), and pumpkinseed sunfish (*Lepomis gibbosus*) were evaluated from June 9 through June 13, 2008 from locations around the lake (primarily in SMU 5). Thirty bluegill, 30 pumpkinseed, 14 smallmouth bass, and 27 largemouth bass nests were evaluated (nests were only selected for evaluation if the nest was active with the fish species identified upon approach). The nest characteristics were measured based on the methods detailed in the Standard Operating Procedures (SOP) (Parsons and QEA, 2008).

2.2 AQUATIC MACROPHYTE SURVEY

Aquatic macrophytes within the littoral zone of Onondaga Lake were characterized to understand the relationship between physical factors (e.g., substrate, energy, water depth) and the presence of aquatic macrophytes, including the two threatened and endangered species currently known to exist in the lake. In addition, analysis of seasonal changes was completed to document habitat conditions during the various fish life cycle stages (reproductive, juvenile, adult) and potential limitations in habitat during any of these stages. The survey methods followed the detailed methodology provided in the Work Plan (Parsons and QEA, 2008).

One hundred twenty (120) sites were originally randomly selected for biomass sampling based on location within remedial area: 40 points within the dredge and cap areas, 40 points in the cap only areas, and 40 points in the unremediated areas (Figures 1 through 11). However, 38 sites were too deep (>9.8 ft. [3.0 m]) to sample due to limitations of the sampling device. The following number of locations were sampled for biomass within each SMU:

- SMU 1 - 15 points
- SMU 2 - 2 points
- SMU 3 - 5 points
- SMU 4 - 9 points
- SMU 5 – 26 points
- SMU 6 - 19 points
- SMU 7 - 6 points

Species distribution was mapped for July through October based on presence or absence at each point location. In addition, total acreage of all macrophytes was calculated using the 2008 macrophyte sampling data. The nearshore area of the lake, in SMUs 1-7, was divided by a 2-acre area grid and macrophytes were sampled at the center of these grid cells as described in the Work Plan (Parsons and QEA, 2008). Since macrophytes historically have not been identified deeper than 23 ft. (7 m), the grid was clipped by the shoreline and the 23 ft. (7 m) depth contour. Total macrophyte acreage was calculated as the sum of all clipped grid cells that contained any submerged aquatic vegetation (SAV) at the center sampling point. In addition, the macrophyte acreage was calculated between the 2 and 7 ft. (0.6 and 2.1 m) depth contours in SMU 5 using the same procedure. The cover values calculated using this method are likely overestimates, as the proportion of each grid cell covered by macrophytes was not verified by the field sampling crew. However, the macrophyte acreages calculated using this method are consistent with those reported in the Onondaga County Department of Water Environment Protection Ambient Monitoring Program.

2.3 SUBSTRATE SUITABILITY STUDY

This task was designed to evaluate the natural recolonization of different substrate types (primarily coarse substrates and sand, likely to be the size of material with sufficient erosion resistance and available in the quantities needed for the habitat layer) by macrophytes, macroinvertebrates, and fish. Recolonization was evaluated for three substrate types (sand, sand/gravel mix, gravel/cobble mix) and three energy regimes. Energy regimes were based on the general categories currently used by the Onondaga County Department of Water Environment Protection (OCDWEP) (OCDWEP, 2007). Sampling methods followed those described in the Work Plan (Parsons and QEA, 2008).

Wading pools (approximately 36 inch diameter, 8 inches deep) were filled to the top with the substrates and placed on the sediment surface in the littoral zone at each location between July 21 and July 25, 2008. Additional substrate was placed around the pools to create a slope from the sediment surface to the top of the wading pool. Bi-weekly monitoring (i.e., every two weeks) was conducted from August through October at each location to assess macrophyte presence and fish use of these locations. Invertebrate composition was assessed on October 22, 2008. Pools were left in place over the winter and a subset (9 pools per location) were sampled once in June 2009 for invertebrates, macrophyte composition, grain size, and total organic carbon (results reported in the Phase V PDI Addendum 1 – Habitat Data Summary Report).

SECTION 3

RESULTS

3.1 FISH NEST CHARACTERIZATION

3.1.1 Physical Attributes

The physical attributes, including nest depth and nest site slope are summarized in Table 1. Nest depth was measured by subtracting the depth of the depression from the depth of substrate outside the nest. The top of the rim was not used because it is generally more built up than the outside area. Average nest depths ranged from 1.65 inches (4.2 cm) for pumpkinseed to 2.8 inches (7.2 cm) for smallmouth bass with the maximum depth of 6.3 inches (16 cm) recorded for smallmouth bass (Table 1).

Most nests were circular in form and generally occurred in areas where the nest site slope was fairly low, with a drop of 0.39 inches (1 cm) depth per 3.28 ft (1 m) of transect distance (Table 1). Bluegill had the smallest and roundest nests, while the largest and most oblong nests were built by smallmouth bass (Table 1).

3.1.2 Nest Composition

During the act of nest building, the centrarchid removes smaller sediment particles from the nest area and leaves larger particles such as gravel and pebble. There were many nests in which a hard calcium carbonate layer below the sand and gravel became exposed. While this layer may have limited the depth of the nest, there also were shallow nests observed in areas with and without the calcium carbonate layer and some of the deepest nests contained little calcium carbonate. Visual estimates were made of the sediment directly adjacent to the nests based on the modified Wentworth scale and embeddedness was assessed to estimate the degree to which larger particles were covered with finer particles. Bluegill nests tended to be built in areas with the highest percentage of sand (92.5 percent), followed by pumpkinseed (83.5 percent), largemouth bass (78.9 percent), and smallmouth bass (72.1 percent). Mixtures of gravel and pebbles made up the rest of the sediment adjacent to the nests (Table 2).

Gravel was the most prevalent particle size inside of the centrarchid nests (Table 2). Bluegill and largemouth bass nests contained the largest amount of sand (36.9 percent and 37.3 percent, respectively), while smallmouth bass had the lowest amount of sand in their nests (23.9 percent). A hard calcium carbonate bottom was visible in many of the nests sampled, and it was a major component of a few nests (Table 2).

3.1.3 Summary

The objectives of the centrarchid nest characterization were met and provide the necessary data to understand potential impacts of nesting on the habitat and cap layers. The habitat layer, as currently proposed, should be thick enough to support nest building by these four species within the habitat layer (since the deepest nest was observed at 6.30 inches into the substrate). In addition, the most common substrates identified from each nest (gravel and sand), have been identified for several of the Habitat Modules that include centrarchids as representative species (i.e., Modules 1 through 5B).

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3.2 AQUATIC MACROPHYTE SURVEY

3.2.1 Composition

During the 2008 monthly macrophyte community sampling (May-October), 14 species of aquatic macrophytes were identified (Table 3). One of the unidentified species is an emergent macrophyte (some type of sedge) that was observed in SMU 3 and SMU 6; the other unidentified species is a broad leaf pondweed (species unknown since flower parts not observed) that was observed at the mouth of Ley Creek in SMU 6. Both unidentified plants were sent to John Madsen (Mississippi State) for identification; however, definitive identification was not possible due to the lack of flowers and/or seeds. The two threatened and endangered species (*Najas guadalupensis* and *Potamogeton strictifolius*) were not found during the surveys in 2008.

Based on relative abundance, six species were characterized as "abundant" (including two invasive species – Eurasian watermilfoil and curly-leaf pondweed) because they were identified at more than 20 percent of the sample points for at least one month during the sampling season (Table 3). Three species were characterized as "common" because they were observed during most months, but in less than 20 percent of the sample points in any given month. Five species were characterized as uncommon because they were observed sporadically in the macrophyte community. In addition, six species were noted during other sampling events on the lake including white water lily (*Nymphaea odorata*), longleaf pondweed (*Potamogeton nodosus*), invasive water chestnut (*Trapa natans*), widgeon grass (*Ruppia maritima*), and two unidentified species (one a sedge, the other a broadleaf pondweed).

The aquatic macrophyte species dominance and Shannon-Weiner diversity[1] varied from May to October. The lowest diversity was found in May and October (1.7) while the highest diversity was found in July and August (2.0) (Table 4). Eleven species were identified in the community assessment in May through August, nine species were identified in September, and eight were identified in October.

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[1] A diversity index is a parameter that describes assemblage structure. Diversity combines information on the number of species in an assemblage (richness) and their relative abundance (evenness). Shannon diversity is the most widely applied diversity index in aquatic systems and is useful as a comparative index.

The number of species observed in Onondaga Lake changed little from month to month; however, the percent occurrence of each species changed depending on the sampling month (Table 5). Curly-leaf pondweed (*P. crispus)* had the highest percent occurrence in June, followed by common waterweed (*E. canadensis)* in July, and Eurasian water milfoil (*M. spicatum)* in August. Four aquatic macrophytes (Eurasian water milfoil, common waterweed, coontail [*C. demersum*], and slender naiad [*N. flexilis*]) dominated the community from August through October.

3.2.2 Biomass

Over 1,600 g (wet weight) of macrophytes was collected from 82 different sites in the lake from May to October 2008 for biomass analysis (although samples were not collected from each location every month due to changes in plant growth and distribution of species). Macrophytes were not commonly seen growing in greater than 9.8 ft. (3.0 m) of water; the deepest macrophytes found during the 2008 season were at 13.8 ft. (4.2 m). Macrophyte biomass was highest in the month of June for root and shoot, collectively, with 23 percent of the total root/shoot biomass collected over the sampling period (Table 6).

Lake-wide macrophyte biomass was dominated by *P. crispus* in May, with approximately 52 percent of the total biomass. *P. crispus* biomass peaked in June and sharply dropped in proceeding months, appearing to make a slight rebound in October (Table 7). For the month of June, *P. crispus, E. canadensis, and P. pusillus* comprised over 70 percent of the total biomass. *E. canadensis* was the dominant macrophyte species collected in July, September, and October. In August, *Najas spp*. was the dominant species, comprising 34 percent of the total biomass for that month.

Average monthly biomass was used to compare the aquatic macrophyte biomass in the different SMUs. Biomass was lowest in May in all SMUs. The average monthly biomass was highest in SMUs 5 and 4 throughout the sampling season (Table 8). The month of peak biomass also varied among SMUs (Table 8), with SMU 7 recording the highest biomass overall in August (primarily due to one sample with dense *N. flexilis* and *M. spicatum*),

3.2.3 Spatial Extent

Distribution of the dominant and abundant species was mapped for July through October based on presence or absence at each point location (Figures 12 to 15). Spatial extent was not assessed in May and June due to the sampling methodology used in those months. Modifications were made in July to allow estimation of spatial extent. In addition, data from the point surveys in July through October were used to estimate overall macrophyte distribution (all species) around the lake (Figures 16-19). Based on the point data collected in 2008, there were approximately 434 acres of aquatic macrophytes in July, 374 acres in August, 309 acres in September, and 288 acres in October. This is consistent with the County's AMP data which showed 314 acres of aquatic macrophytes in August 2008.

3.2.4. SMU 5 Habitat Enhancement Evaluation

SMU 5 was further evaluated with a focus on water depths of 2 to 7 ft., consistent with the water depth range envisioned in the ROD for habitat enhancement activities. Within SMU 5, during July and August, there were approximately 160 acres of macrophytes within the 2 to 7 ft. (0.61-1.13 m) water depth range, resulting in approximately 73 percent coverage in this area. Based on the County's data from August 2008, there were approximately 205 acres of macrophytes in this same depth range resulting in approximately 93 percent coverage within the 2 to 7 ft. (0.61.13 m) water depth range.

3.2.5 Summary

The aquatic macrophyte study provided the data necessary to characterize the composition and seasonality of various species within the lake. Additional studies may be necessary to assess any temporal changes in the macrophyte community prior to the start of the remedy. Based on the 2008 macrophyte survey data, habitat enhancement activities in SMU 5, which were designed to stabilize calcite deposits and oncolites and promote submerged macrophyte growth are not necessary. Macrophytes continue to cover a sufficient portion of SMU 5 to provide optimal largemouth bass habitat, confirming that habitat enhancement activities may not be necessary.

A substrate evaluation was to be conducted along the transects at each of the biomass locations. However, due to time constraints, this study was delayed until 2009 and will be reported in the Phase V PDI Addendum 1 – Habitat Data Summary Report.

3.3 SUBSTRATE SUITABILITY STUDY

Pools were placed at the three locations in July 2008, with 9 pools per location in shallow water (2-3 ft) and 9 per location in deeper water (4-5 ft.), for a total of 18 pools per location (Figure 20). The pools were assessed bi-weekly (total of 5 events) from mid-August to early October for fish use using minnow traps and macrophyte coverage based on the Daubenmire classification:

1. <5 percent coverage
2. 5-25 percent coverage
3. 25-50 percent coverage
4. 50-75 percent coverage
5. 75-95 percent coverage
6. >95 percent coverage.

Macroinvertebrate colonization in each pool was assessed in October 2008. In addition, control samples were collected adjacent to each pool (just beyond the area built up around the pool) to assess the source population available to colonize the pools. Due to the similarity of the native substrate within each location, a subsample of control samples was evaluated with two control samples per depth at each location selected.

An additional assessment of macroinvertebrate colonization, fish nesting, macrophyte coverage, and grain size and TOC content was conducted in June 2009. The results for those surveys are provided in the Phase V PDI Addendum 1 – Habitat Data Summary Report.

3.3.1 Minnow Traps

Minnow traps (one per pool) were placed at each site on five different sampling events from August to October. There was no difference in fish capture between substrate types (Table 9). A total of seven species of juvenile fish were captured in the minnow traps. Species included: *Lepomis spp*. (bluegill and pumpkinseed), rockbass (*Ambloplites rupestris*), largemouth bass, smallmouth bass, banded killifish (*Fundulus diaphanus*) and tessellated darter (*Etheostoma olmstedi*). The most fish were captured from pools at the Ninemile site for a total of 374 fish. There was no difference in fish capture between substrate types at this location (Table 9). More fish were captured in pools containing a mixture of sand and gravel at Bloody Brook and Willow Bay, whereas more fish were captured on the gravel/cobble pools at the Ninemile site (Table 9). All species were captured at each of the sites except for smallmouth bass and largemouth bass. Largemouth bass were only captured at the Ninemile site, and smallmouth bass were only captured at Bloody Brook and Willow Bay.

3.3.2 Aquatic Macrophytes

The presence of macrophytes was noted as each minnow trap was pulled. Throughout the duration of sampling, rooted macrophytes were seen in only one pool. This was not unexpected, since pools were placed later in the growing season when macrophyte colonization is not as likely due to seasonal constraints. During the second round of sampling (August 28, 2008), a very small amount (<5 percent cover) of *E. canadensis* and *C. demersum* was observed growing in a sand pool at Willow Bay. However, by the third round of sampling (September 10, 2008), the macrophytes were no longer present. At the conclusion of the minnow trap sampling, all 54 pools had a Daubenmire cover class of 1 (indicating no macrophyte coverage).

3.3.3 Macroinvertebrate Data

Several pools were washed ashore during September at the Bloody Brook location; therefore, samples were only collected from five shallow pools and eight deep pools. At Ninemile Creek, two pools were inadvertently missed during sampling, the shallow location sand/gravel substrate replicate 1 and deep location, gravel/cobble substrate replicate 1. Attempts were made to sample these two pools during the spring 2009 final sample collection (data provided in the Phase V PDI Addendum 1 – Habitat Data Summary Report).

Organisms from eight orders were identified from within the pools (Table 10). Generally, the control areas outside the pools had a higher dominance of gastropods and amphipods compared to each of the pools at all locations and of all substrate types (Tables 11, 12, 13). At

Bloody Brook, Trichoptera was identified from several pools with larger substrate (gravel/cobble and sand/gravel), and none was identified in the control areas (Table 11). There were differences among substrate types with gastropods and oligochates dominating sand substrate, and bivalves and diptera dominating sand/gravel substrates. The gravel/cobble substrate was more variable among replicates; Diptera and oligochaetes dominated shallow pools, and Diptera and bivalves dominated deep pools (Table 11).

At the Sawmill Creek location, all pools were dominated by Diptera, regardless of substrate type. Control locations had a lower percentage of Diptera and were dominated by gastropods at the shallow locations and amphipods at the deep location (Table 12). Gastropods also dominated control samples at Ninemile Creek but had very low presence in the pools (Table 13). Among the substrate types, Diptera dominated in most pools with bivalves dominant in deep sand/gravel pools (Table 13).

3.3.4 Summary

Overall, the pools worked very well and appeared to contain all the substrate initially placed at the start of the program. The pools placed at the Ninemile site and Sawmill Creek location all appeared to contain the substrate initially placed in them. However, the higher wave energies at the Bloody Brook site were evident. By the end of the sampling program in this area, several pools, with the exception of the gravel/cobble substrate, had a large portion of sediment missing. Three pools were washed ashore before the fourth round of sampling (one containing sand; two sand/gravel mix) and several pools remained in the water, but were empty. However, the objectives of the study were met providing a better understanding of substrate suitability in the lake. Further discussion on what this study means for selecting the appropriate substrate material will be provided as part of the habitat layer design in the Intermediate and/or Final Design Report.

SECTION 4

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TABLES

TABLE 1

PHYSICAL CHARACTERISTICS OF CENTRARCHID NESTS IN ONONDAGA LAKE, JUNE 2008

Species	Count	Average Water depth at nest center (m)	Average nest Depth (cm)	Maximum nest depth (cm)	Average nest length perpendicular to shore (cm)	Average nest length parallel to shore (cm)	Average nest slope (cm/m)	Maximum nest slope (cm/m)	General shoreline slope (cm/m)	Other cover types within 1.5 m
PKSD	30	0.67	4.2	8	67.3	69.3	1.3	4.3	3.7	Vegetation; logs
BG	30	0.64	6.9	10	55.8	55.8	1.4	2.05	2.1	Woody debris, vegetation
LMB	27	0.92	6.1	14	80.7	84.1	1.1*	6.5*	3.8*	Vegetation; tires, concrete beam; metal stakes
SMB	14	0.97	7.2	16	105.8	123.1	0.6*	3.25*	3.15*	Vegetation, logs/sticks, cinder block

Note: PKSD = pumpkinseed, BG= bluegill, LMB = largemouth bass, SMB= smallmouth bass

*excludes one nest located on a steep slope in the marina

TABLE 2

AVERAGE SEDIMENT COMPOSITION OF CENTRARCHID NESTS AND VISUALLY ESTIMATED SUBSTRATE COMPOSITION OF AREA ADJACENT TO NESTS IN ONONDAGA LAKE, JUNE 2008

Species	Count	Percent sand outside nest	Percent gravel/pebble outside nest	Percent embeddedness outside nest	Percent sand in nests	Percent gravel in nests	Percent pebble in nests	Percent calcium carbonate in nests	Percent embeddedness inside nest
PKSD	30	83.5	16.5	35.2	30.9	45.5	8.2	14.9	0.7
BG	30	92.5	7.5	70.8	36.9	43.3	23.1	5.2	0.0
LMB	27	78.9	21.1	52.3	37.3	50.7	27.5	19.9	6.5
SMB	14	72.1	27.9	39.7	23.9	50.5	32.9	18.0	1.8

Note: PKSD = pumpkinseed, BG= bluegill, LMB = largemouth bass, SMB= smallmouth bass
Substrate size based on modified Wentworth scale: pebble 16-64 mm (0.6 – 2.5 inches); gravel 2-16 mm (0.08 – 0.6 inches); sand 0.0625 – 2 mm (0.002 – 0.08 inches)

TABLE 3

MACROPHYTE SPECIES IDENTIFIED DURING SAMPLING IN 2008

Species	Common Name	Dominance level
*Myriophyllum spicatum**	Eurasian water milfoil	Abundant
Elodea canadensis	Common waterweed	Abundant
Ceratophyllum demersum	Coontail	Abundant
Potamogeton pusillus	Small pondweed	Abundant
*Potamogeton crispus**	Curly-leaf pondweed	Abundant
Najas flexilis	Slender naiad	Abundant
Stuckenia pectinata	Sago pondweed	Common
Potamogeton foliosus	Leafy pondweed	Common
Heteranthera dubia	Water stargrass	Common
Lemna minor	Duckweed	Uncommon
Sagittaria latifolia	Common arrowhead	Uncommon
Vallinseria americana	Wild celery	Uncommon
Chara	Stonewort	Uncommon
Spirodela polyrhiza	Great duckweed	Uncommon
**species are considered invasive*		

TABLE 4

SHANNON WEINER DIVERSITY OF ONONDAGA LAKE AQUATIC MACROPHYTES IN 2008

Month	Diversity	Number of species
May	1.7	11
June	1.9	11
July	2.0	11
August	2.0	11
September	1.8	9
October	1.7	8

TABLE 5

ABUNDANT AND COMMON MACROPHYTE SPECIES IN ONONDAGA LAKE

Percent Occurrence by Month in 2008

Species	Common Name	May	June	July	August	September	October
M. spicatum	Eurasian water milfoil	15.9	20.8	27.5	28.2	21.2	19.4
E. canadensis	Common waterweed	8.3	16.4	34.5	32.8	22.2	14.4
C. demersum	Coontail	2.4	4.6	18.9	28.9	21.7	17.4
N. flexilis	Slender naiad	2.7	3.1	13.4	20.4	11.1	8.8
P. crispus	Curly-leaf pondweed	21.7	30.5	13.6	3.9	5.0	3.5
P. pusillus	Small pondweed	5.4	13.0	23.2	4.9	0.8	0
P. foliosus	Leafy pondweed	0.2	12.9	6.3	4.9	2.8	0
S. pectinata	Sago pondweed	6.3	7.2	7.6	3.6	1.0	1.5
H. dubia	Water stargrass	0.1	0.3	2.0	6.2	5.0	2.8

TABLE 6

TOTAL MACROPHYTE BIOMASS BY MONTH

Month	Shoot biomass (g wet weight)	Root biomass (g wet weight)	Shoot biomass (g dry weight)	Root biomass (g dry weight)
May	107	29	15	7
June	321	62	51	11
July	262	14	43	3
August	282	24	44	4
September	328	4	51	0.5
October	222	4	34	0.4

TABLE 7

TOTAL MACROPHYTE BIOMASS BY SPECIES AND MONTH (G DRY WEIGHT)

Species	**May**		**June**		**July**		**August**		**Sept**		**Oct**	
	Shoot	**Root**	**Shoot**	**Root**	**Shoot**	**Root**	**Shoot**	**Root**	**Shoot**	**Root**	**Shoot**	**Root**
C. demersum	0.9		2.1	0.1	1.3	0.01	4.4		5.6		7.7	
Chara											1.9	
E. canadensis	2.0	0.7	9.8	2.26	14.1	1.0	16.7	0.5	28.1	0.4	17.3	0.1
H. dubia					0.1		0.1		2.0		0.1	
M. spicatum	1.7	1.0	7.0	2.04	6.8	0.1	6.4	1.4	1.9	0.01	3.5	0.1
N. flexilis	1.0	0.1	4.0	0.6	8.9	0.01	14.9	1.4	12.6		2.8	
P. crispus	7.9	4.3	13.1	1.7	2.8	0.8	0.8	0.3	0.3	0.1	0.8	0.2
P. foliosus			0.004		0.1	0.8	0.01		0.1		0.01	
P. pusillus	1.5	1.1	12.6	3.8	5.1	0.1	0.1					
S. pectinata	0.1	0.01	1.1	0.7	3.7	0.2	0.3	0.01				
Unknown	0.1		0.9									

Blanks indicate no samples collected from area.

TABLE 8

MEAN MONTHLY BIOMASS OF MACROPHYTES BY SMU
(G DRY WEIGHT PER CORE)

	May		June		July		August		September		October	
SMU	**Above**	**Below**	**Above**	**Below**	**Above**	**Below**	**Above**	**Below**	**Above**	**Below**	**Above**	**Below**
1					0.56	0.56	0.70		0.32	0.01	0.49	
2					0.11	0.02	0.32		0.24	0.01	0.75	
3					0.57		0.52	0.00	0.62		0.45	0.02
4	0.15	0.18	0.34	0.25	0.39	0.03	0.20	0.03	0.73	0.06	0.82	
5	0.21	0.17	0.38	0.17	0.43	0.07	0.49	0.25	0.80	0.15	0.36	0.04
6					0.21	0.15	0.27	0.27	0.73	0.04	0.45	0.01
7					0.23	0.10	1.01	1.18	0.14		0.43	0.01

Blanks indicate no samples collected from area.

TABLE 9

NUMBER OF FISH CAPTURED BY SUBSTRATE TYPE

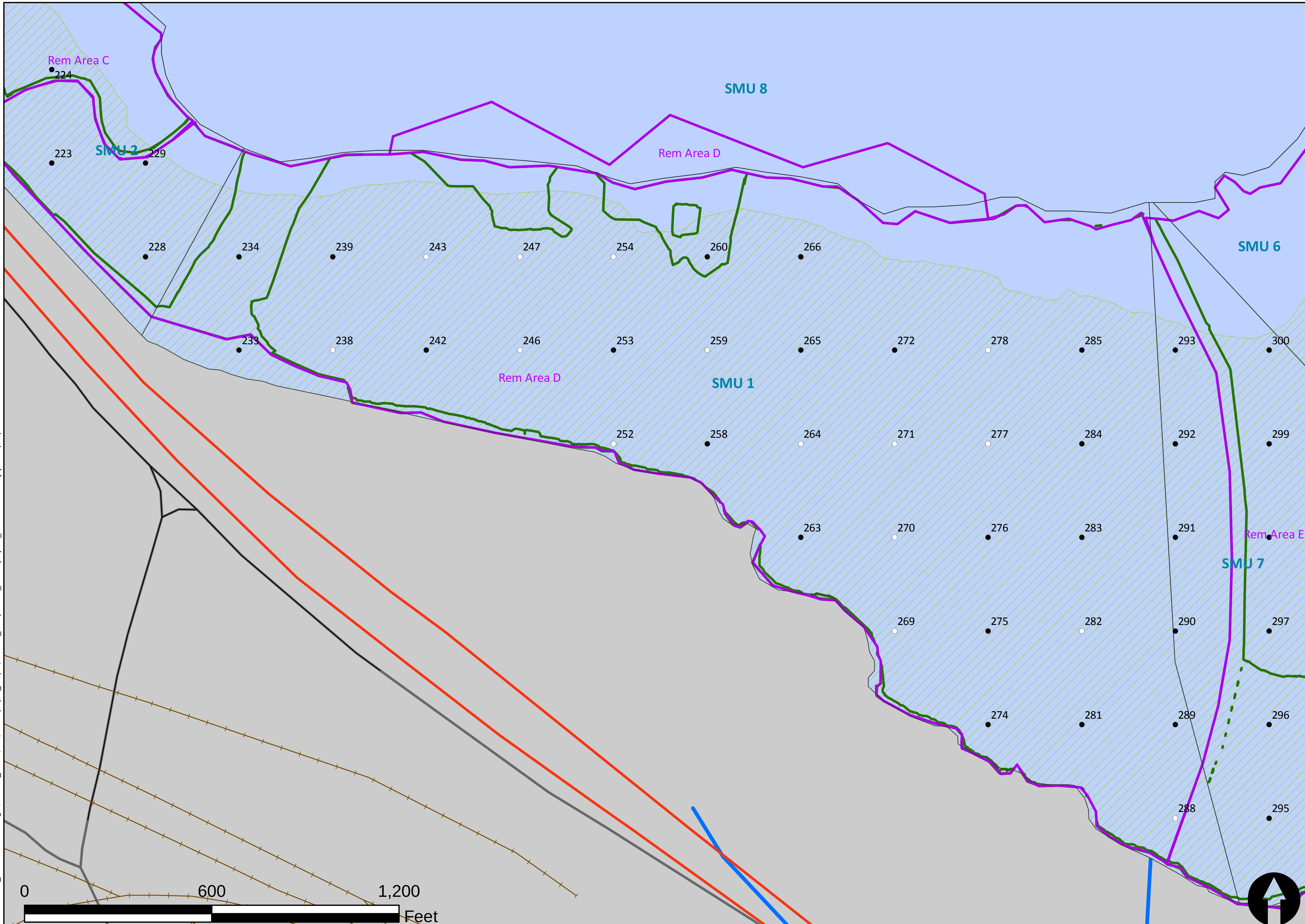
Location	Sand	Sand/Gravel	Gravel/Cobble	Total
Bloody Brook	6	20	7	33
Sawmill Creek	16	38	21	75
Ninemile Creek	132	112	134	378
Total	154	170	162	486

TABLE 10

TAXA IDENTIFIED FROM WADING POOLS IN OCTOBER 2008

Order	Family	Genus	Species
Trichoptera			
	Hydroptilidae	*Hydroptila*	
	Leptoceridae	*Oecetis*	
Diptera	Chironomidae		
		Chironomus	
		Cryptochironomus	
		Dicrotendipes	
		Pseudochironomus	
		Tanytarsi	
		Paratanytarsus	
		Polypedilum	
		Orthocladiinae	
		Procladius	
Amphipoda			
	Gammaridae	*Gammarus*	
Bivalvia	Dreissenoidea	*Dreissena*	*polymorpha*
			rostriformis-bugensis
	Sphaeridae	*Musculium*	
		Pisidium	
Gastropoda			
	Bithynidae	*Bithynia*	*tentaculata*
	Lymnaeidae		
		Fossaria	
		Stagnicola	
	Hydrobiidae	*Amnicola*	*limosa*
	Physidae	*Physa*	
	Planorbidae		
		Gyralus	
			circumstriatus
		Menetus	*dilatatus*
	Valvatidae	*Valvata*	*bicarinata*
			piscinalis
			tricarinata
Oligochaeta			
	Lumbriculidae		
	Naididae		
	Tubificidae		
Hirudinea			
Platyhelminthes			

FIGURES



LOCATOR

LEGEND

Locations

- Community Samples
- Biomass Samples*
- Railroad

Roads

- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 1.

Macrophyte Sampling Locations: SMU1.

Honeywell
PARSONS
ANCHOR QEA

090139-01 November 2010

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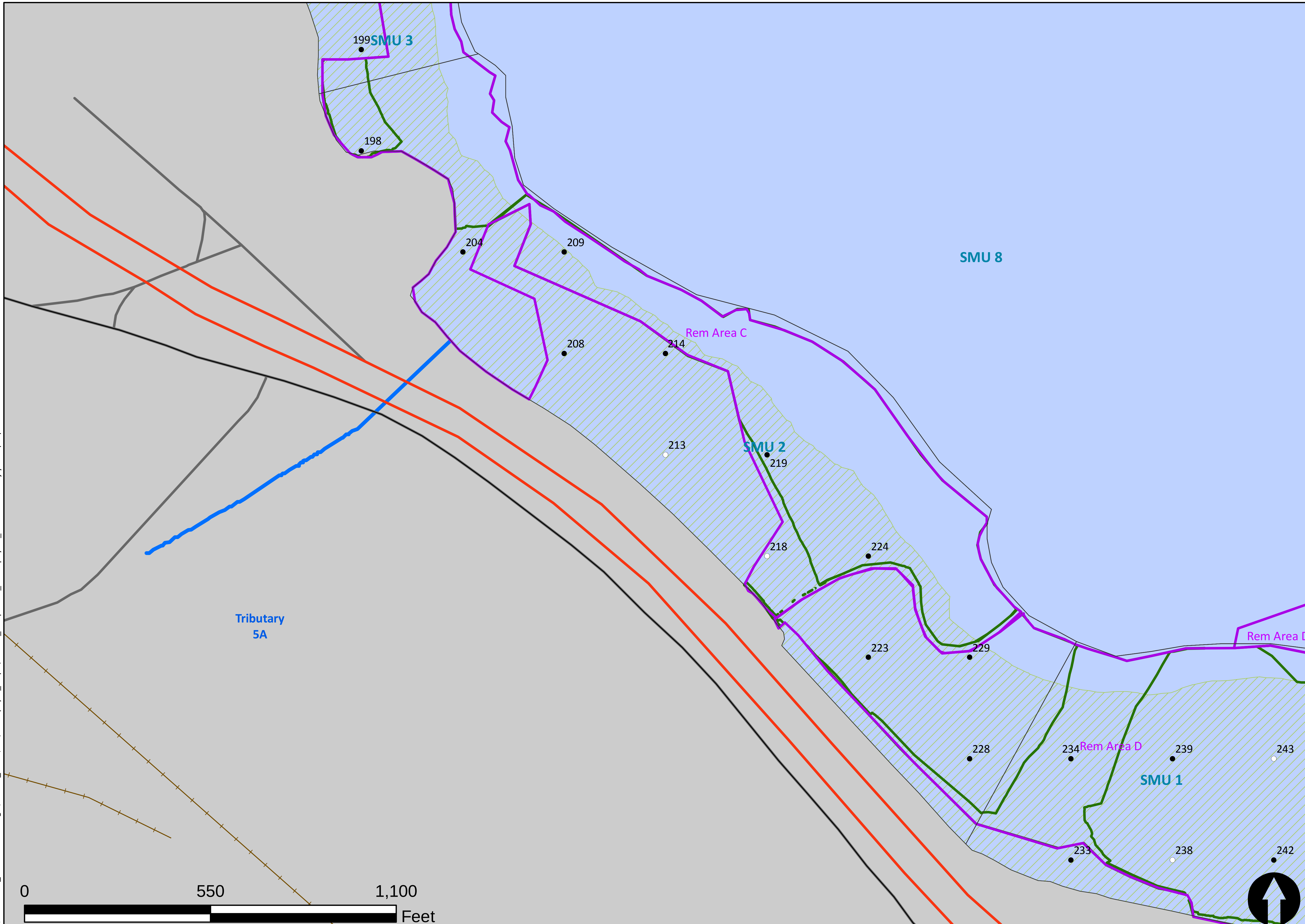

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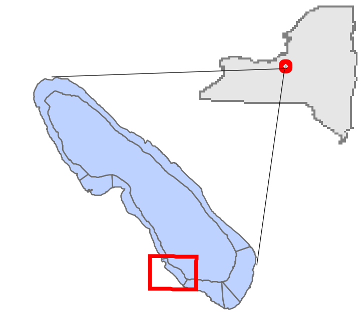

LEGEND

Locations
- Community Samples
- Biomass Samples*
- Railroad

Roads
- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 2.

Macrophyte Sampling Locations: SMU2.

Honeywell
PARSONS
ANCHOR QEA

090139-01 November 2010

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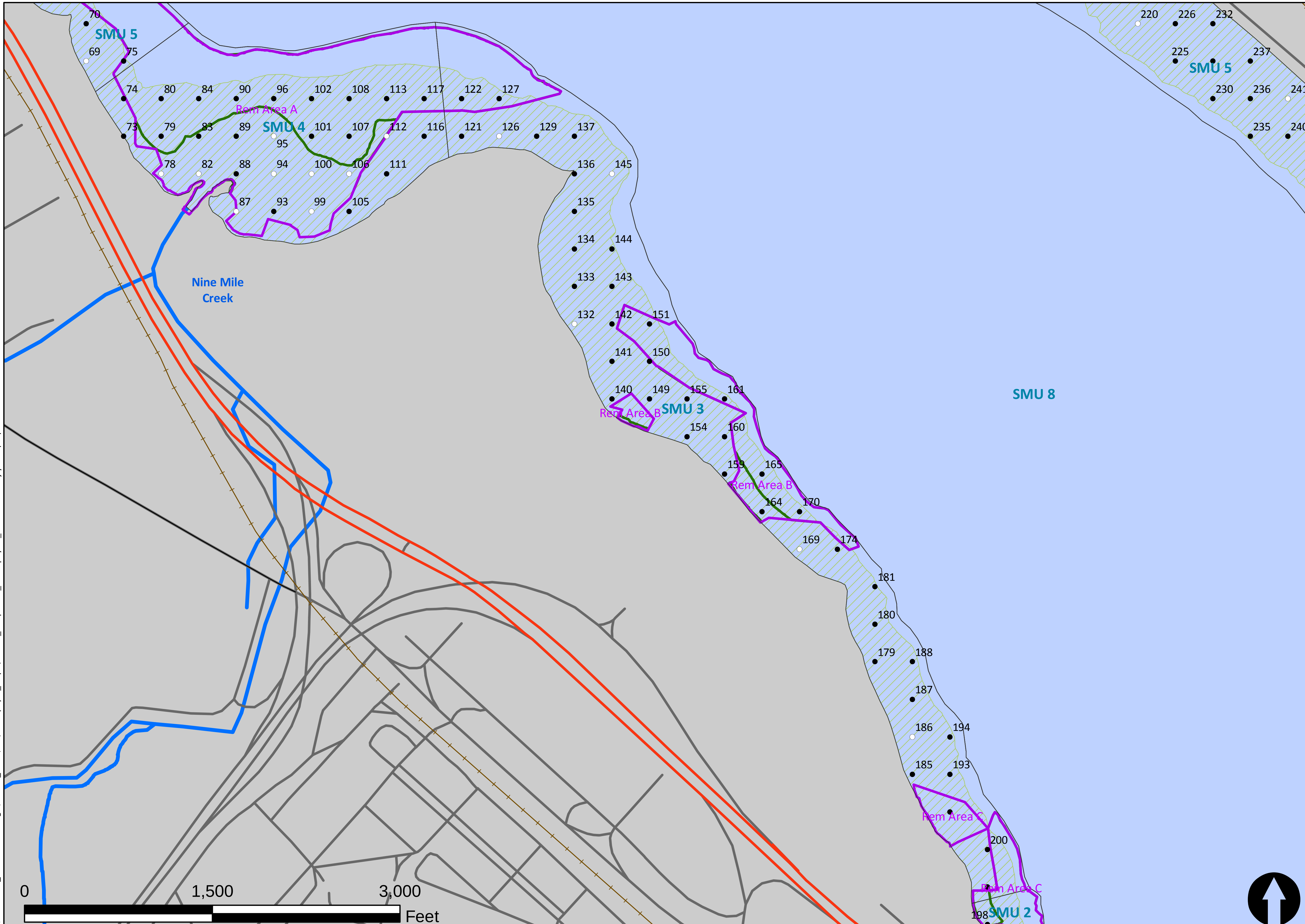

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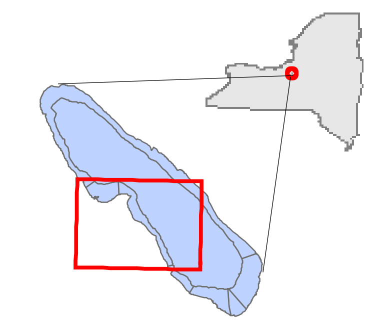

LEGEND

Locations

- Community Samples
- Biomass Samples*
- Railroad

Roads

- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 3.

Macrophyte Sampling Locations: SMU3.

Honeywell
PARSONS
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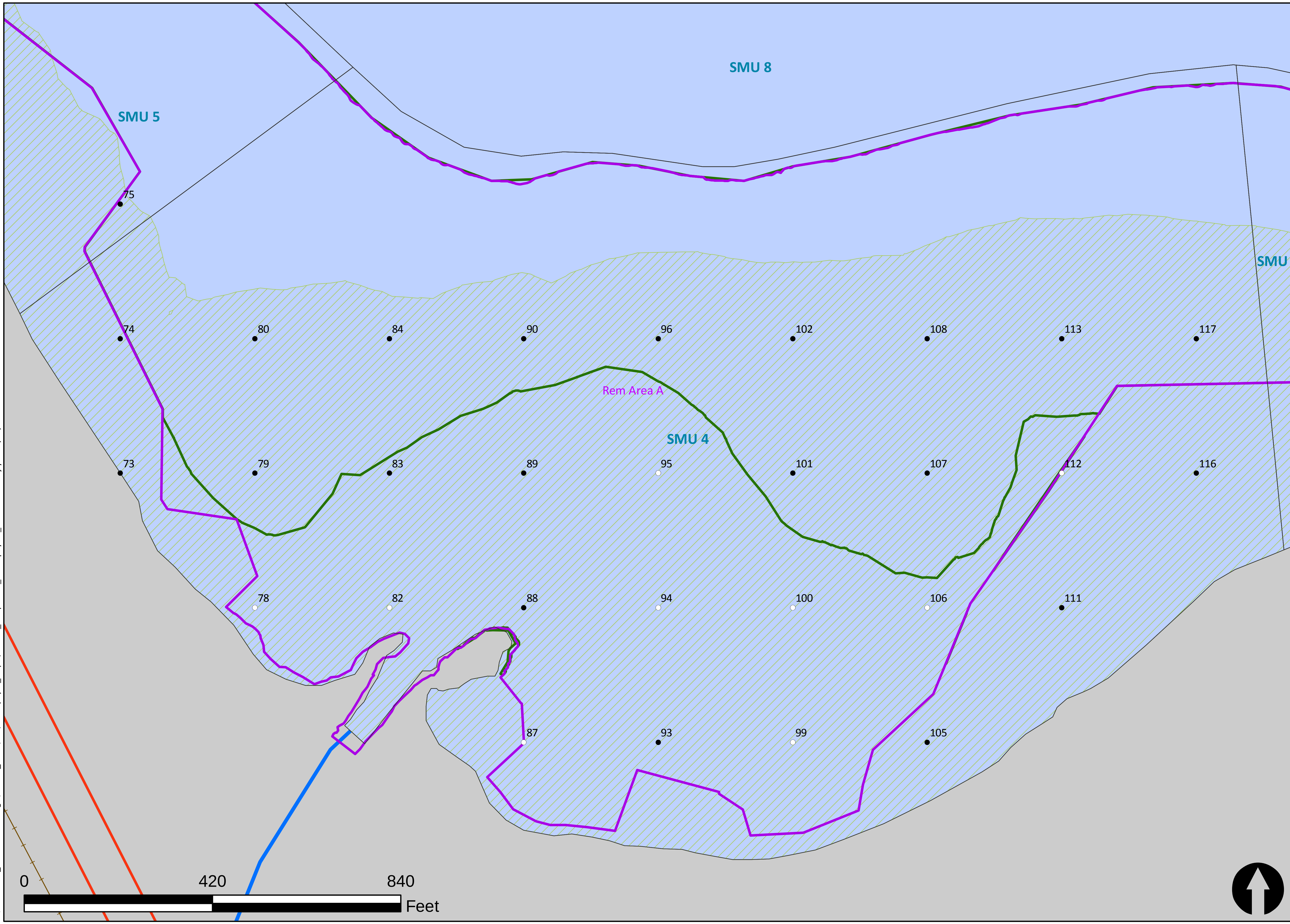

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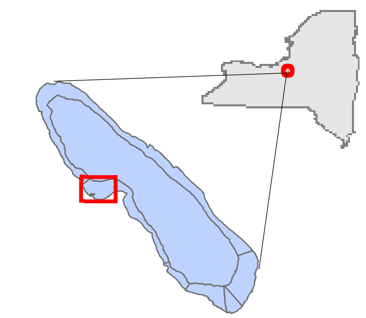


LEGEND

Locations

- Community Samples
- Biomass Samples*
- Railroad

Roads

- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

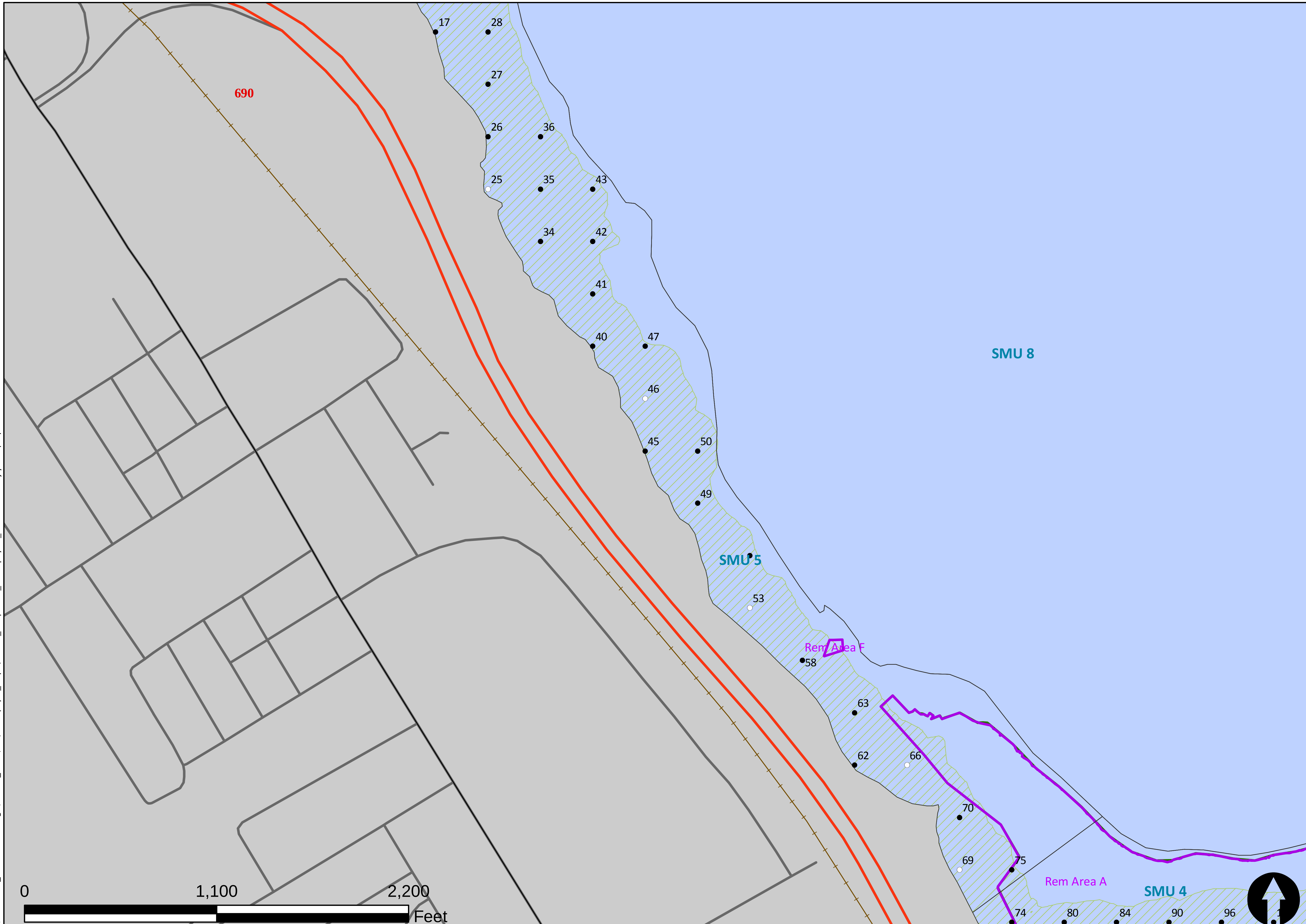
Figure 4.

Macrophyte Sampling Locations: SMU4.

Honeywell
PARSONS
ANCHOR QEA

090139-01

November 2010



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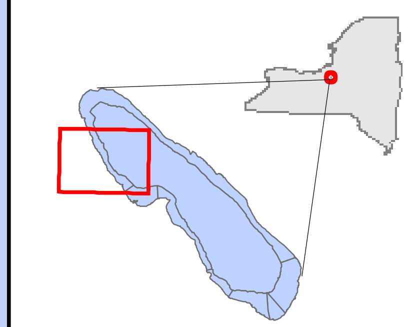

LEGEND

Locations
- Community Samples
- Biomass Samples*
- Railroad

Roads
- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 5.

Macrophyte Sampling Locations: SMU5.

Honeywell
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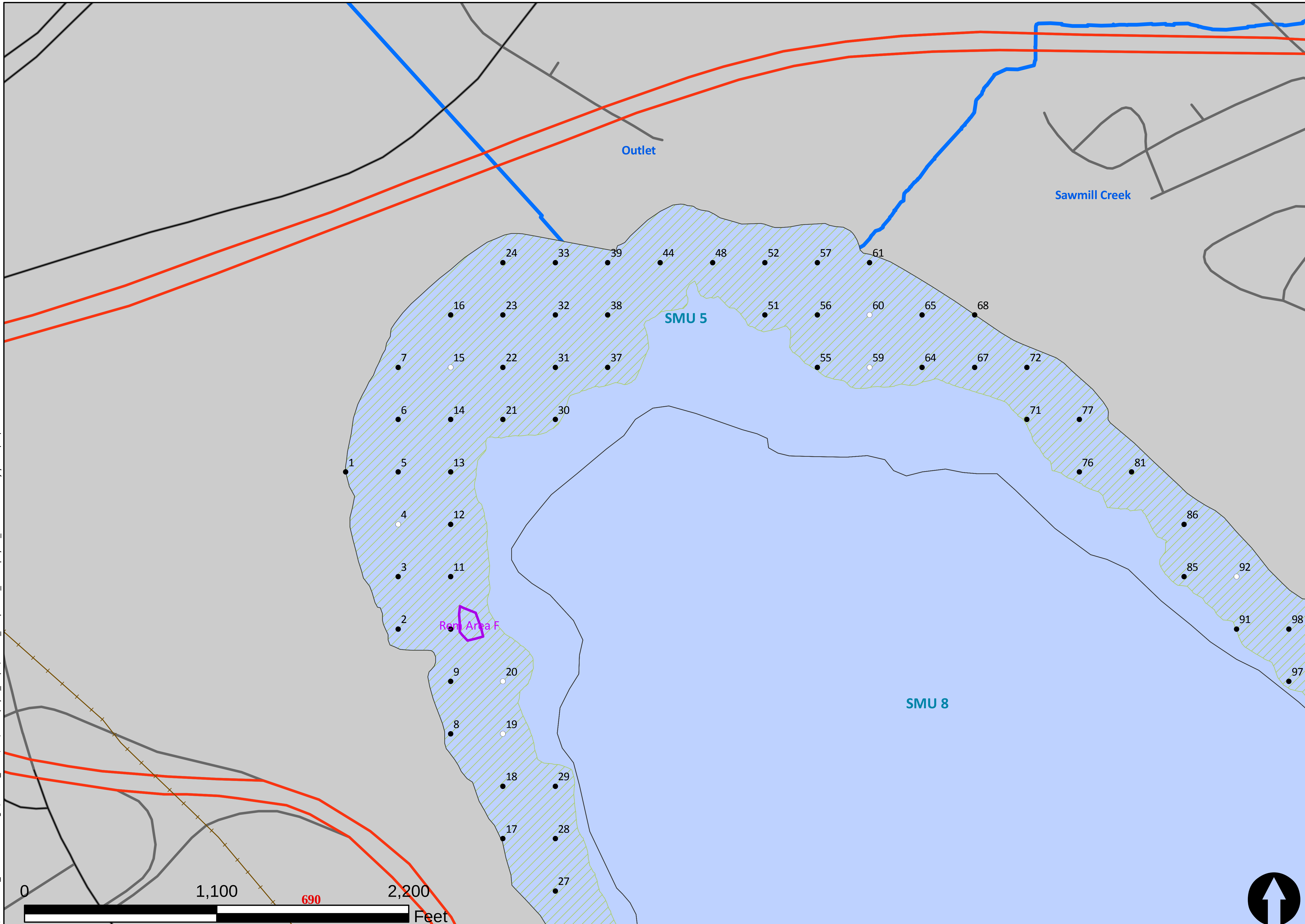

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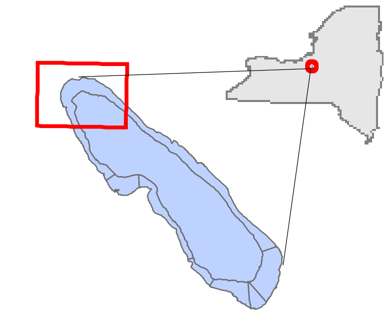

LEGEND

Locations

- Community Samples
- Biomass Samples*
- Railroad

Roads

- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 6.

Macrophyte Sampling Locations: SMU5.

Honeywell
PARSONS
ANCHOR QEA

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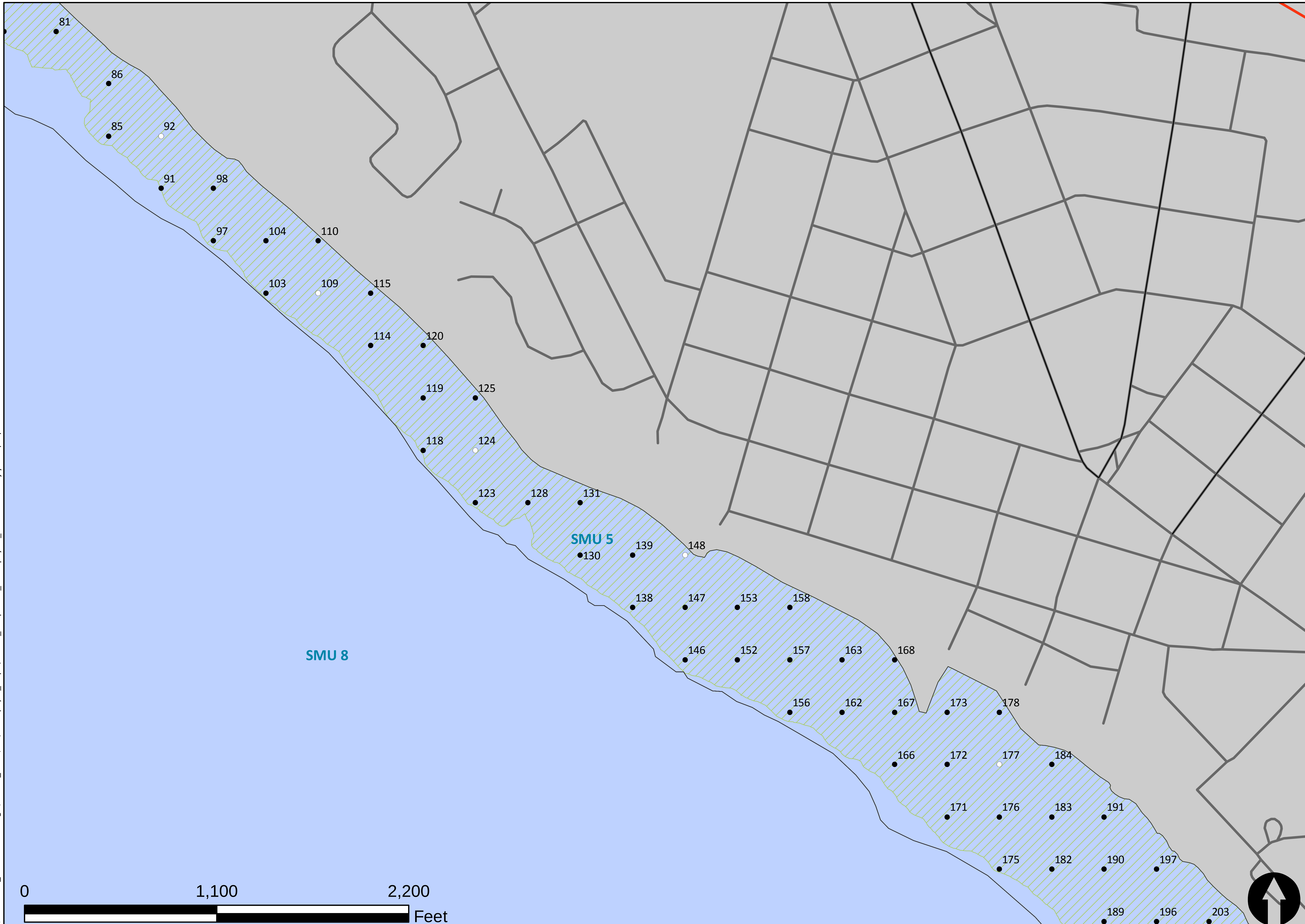

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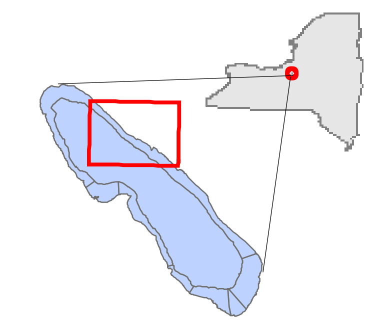

LEGEND

Locations

- Community Samples
- Biomass Samples*
- Railroad

Roads

- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 7.

Macrophyte Sampling Locations: SMU5.

Honeywell
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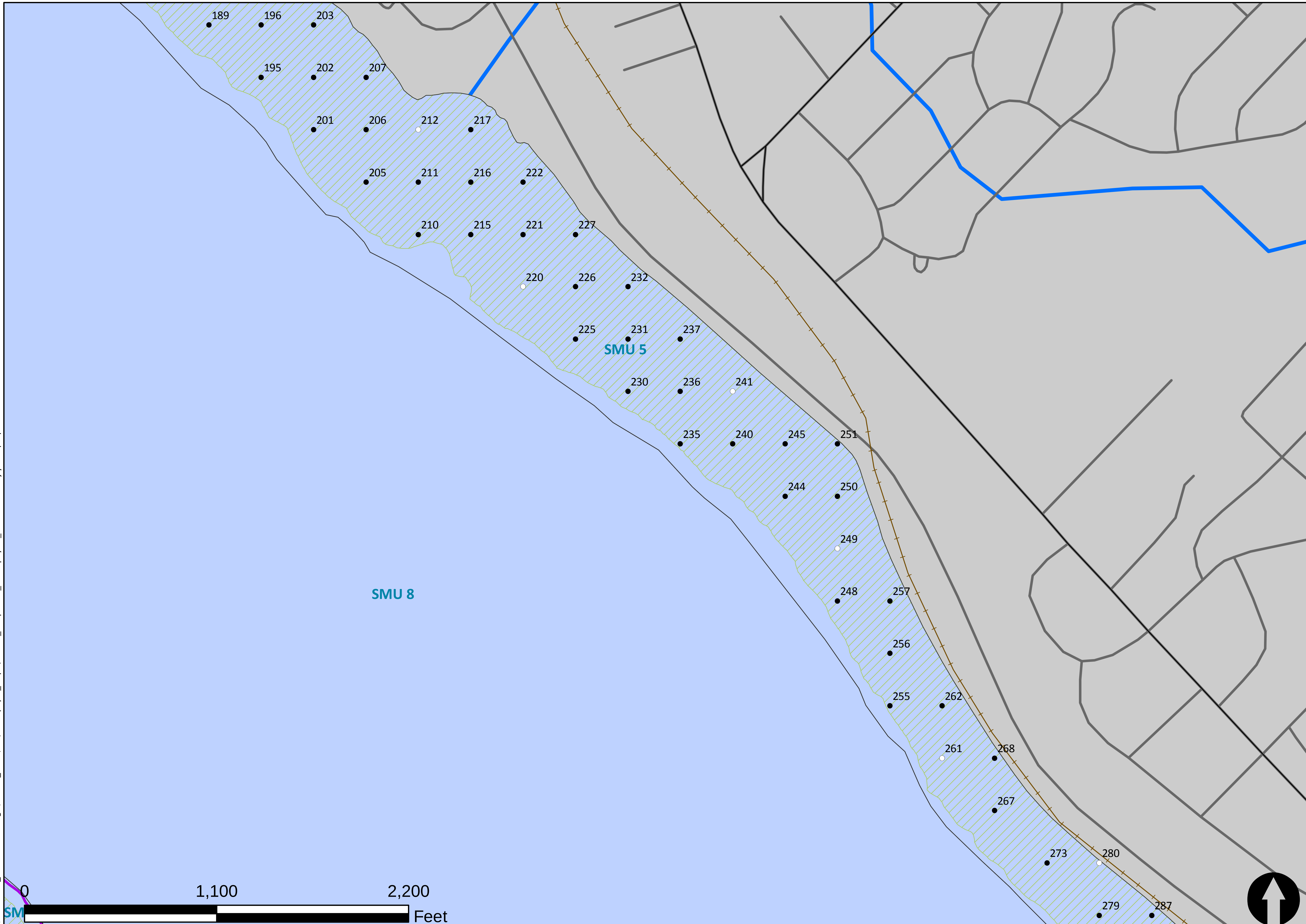

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 8.

Macrophyte Sampling Locations: SMU5.

Honeywell
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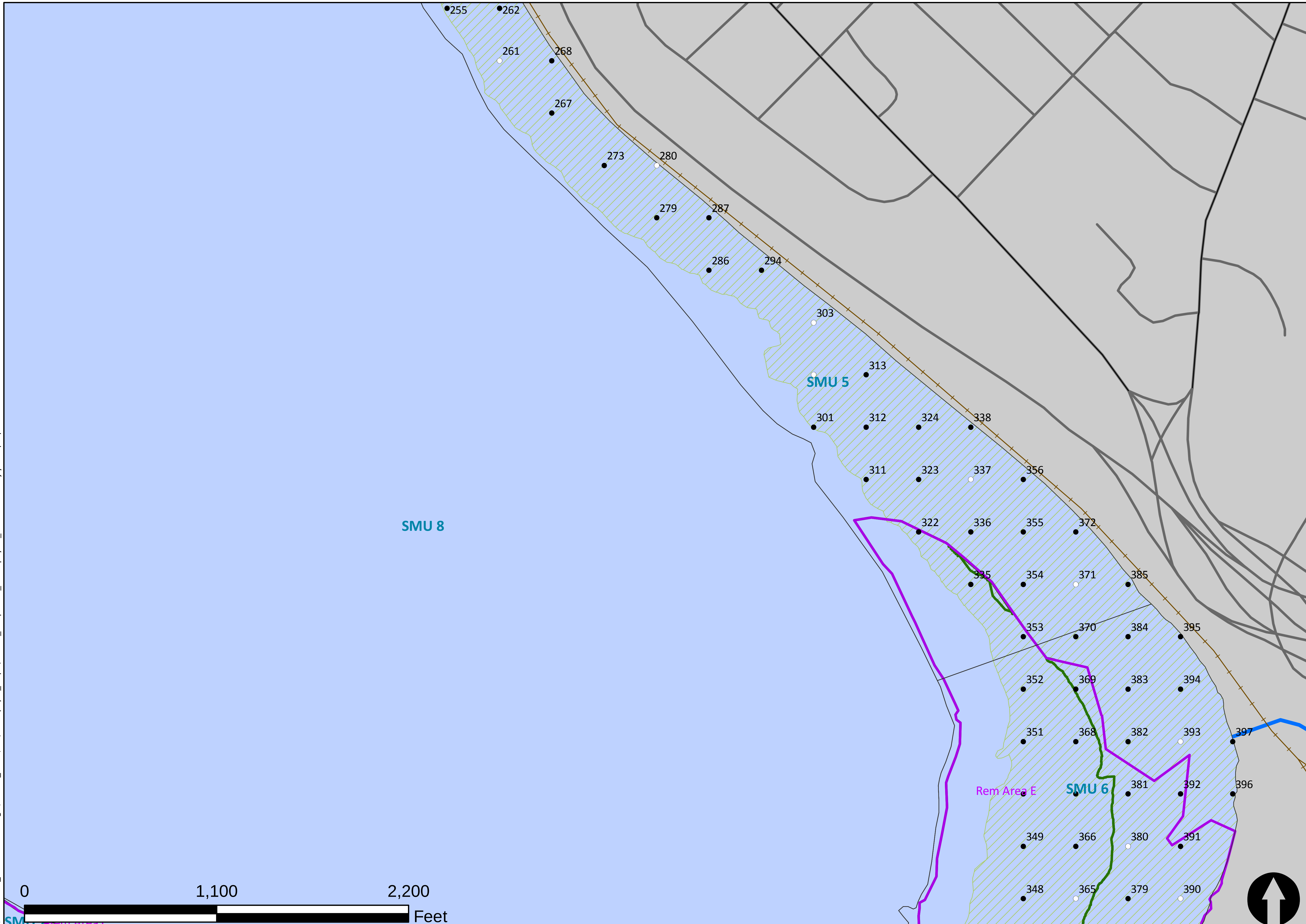

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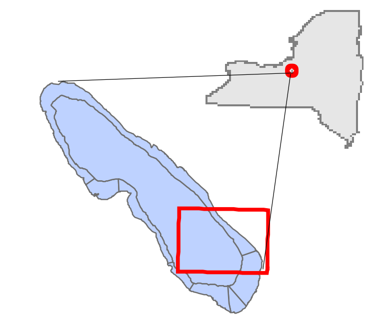

LEGEND

Locations

- Community Samples
- Biomass Samples*
- Railroad

Roads

- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 9.

Macrophyte Sampling Locations: SMU5.

Honeywell
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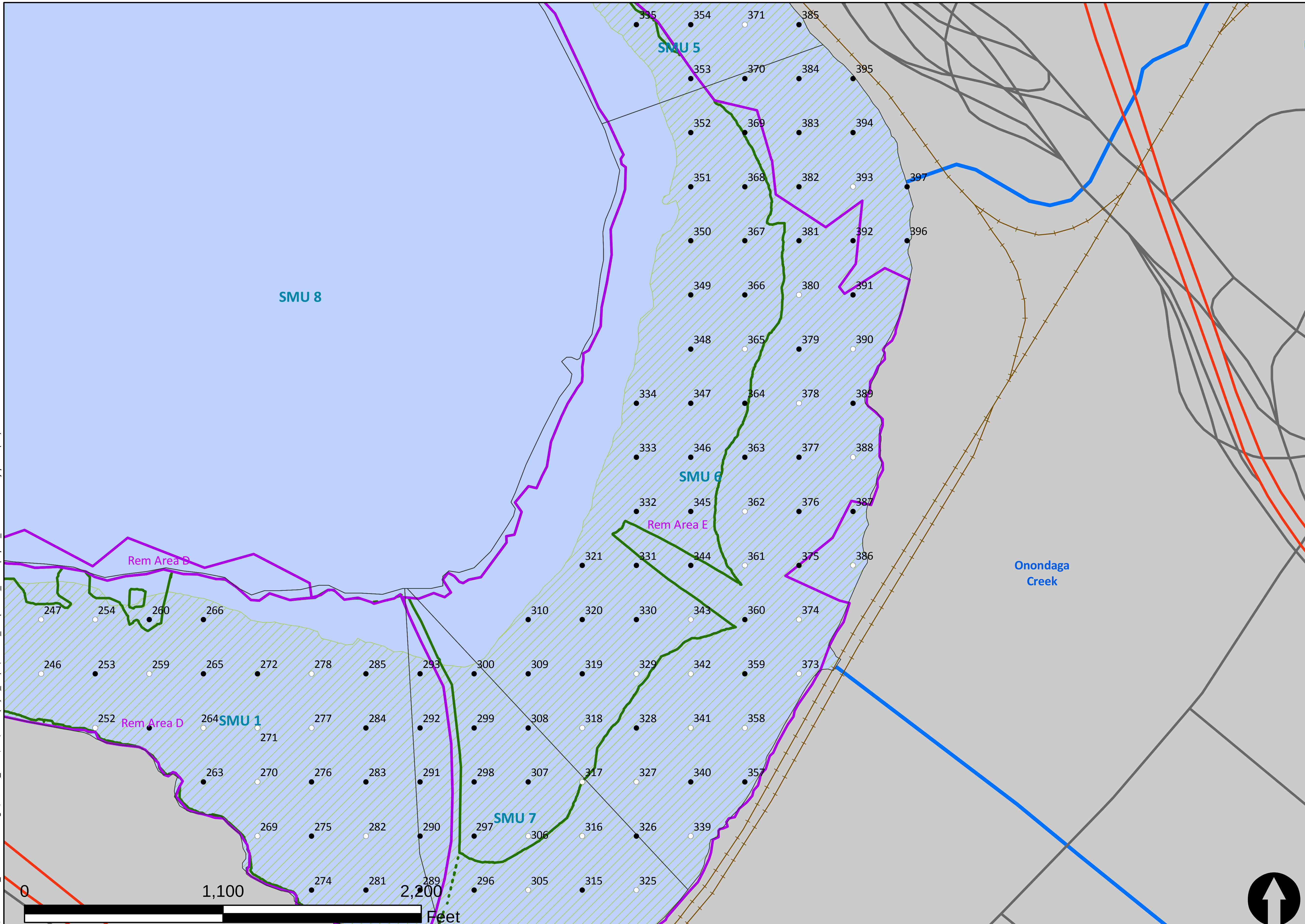

LOCATOR

LEGEND

Locations

- Community Samples
- Biomass Samples*
- Railroad

Roads

- Road
- Highway/Interstate
- Remediation Area Boundary
- SMU Boundaries
- Cap Only
- Tributaries
- Shore to 7m bathymetry

Notes:
Dredging and capping areas have not been finalized.
** Indicated as white dots on the map.*

Figure 10.

Macrophyte Sampling Locations: SMU6.

Honeywell
PARSONS
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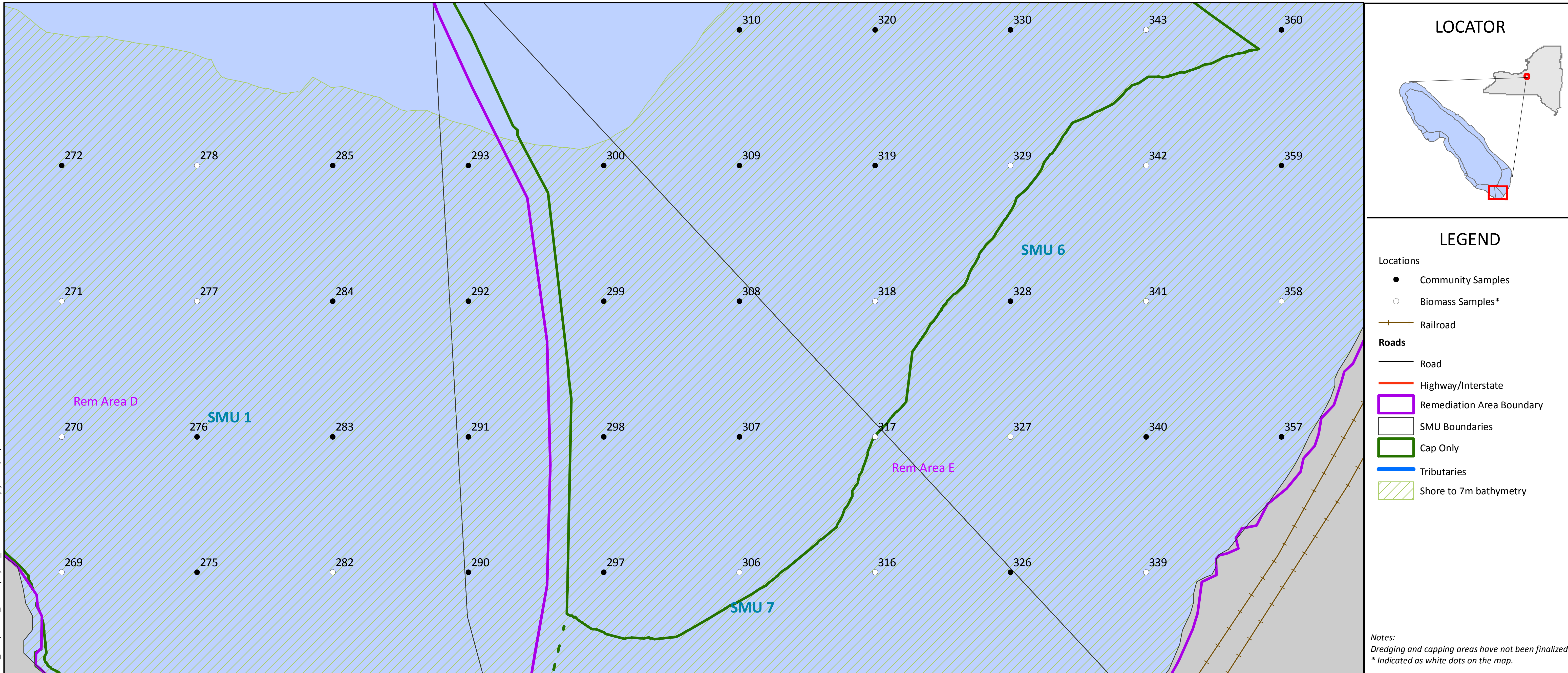

Figure 11.

Macrophyte Sampling Locations: SMU7.

Honeywell
PARSONS
ANCHOR QEA

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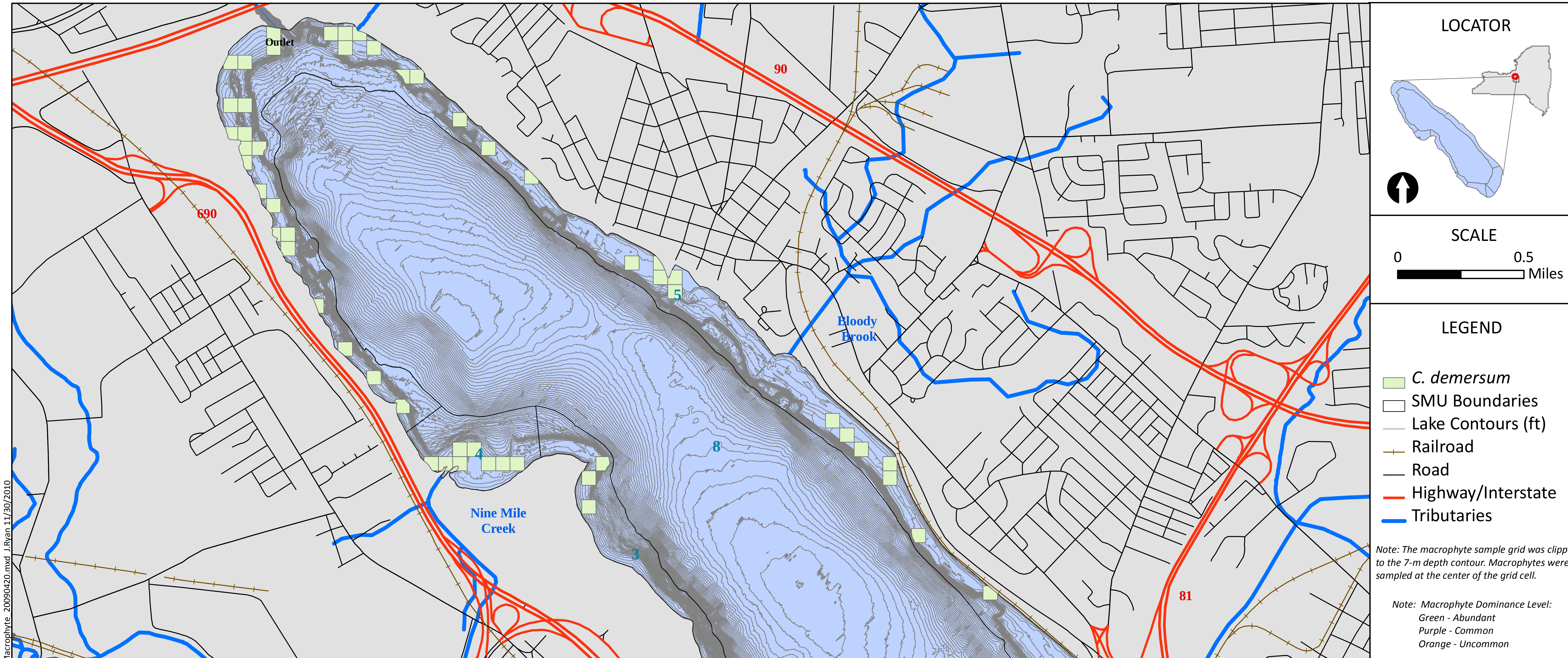

Figure 12a.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Ceratophyllum demersum*.

Honeywell
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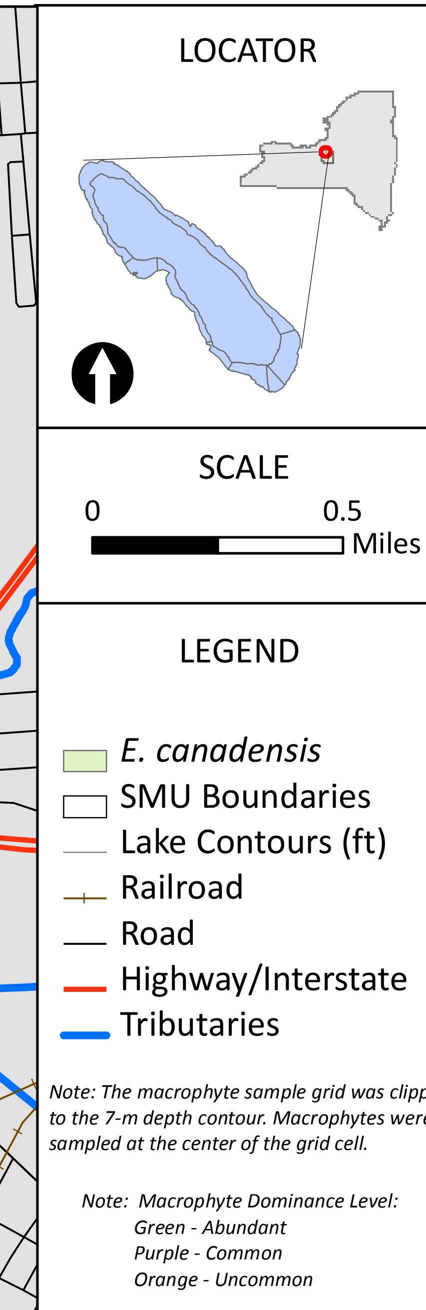

Figure 12b.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Elodea canadensis*.

Honeywell
PARSONS
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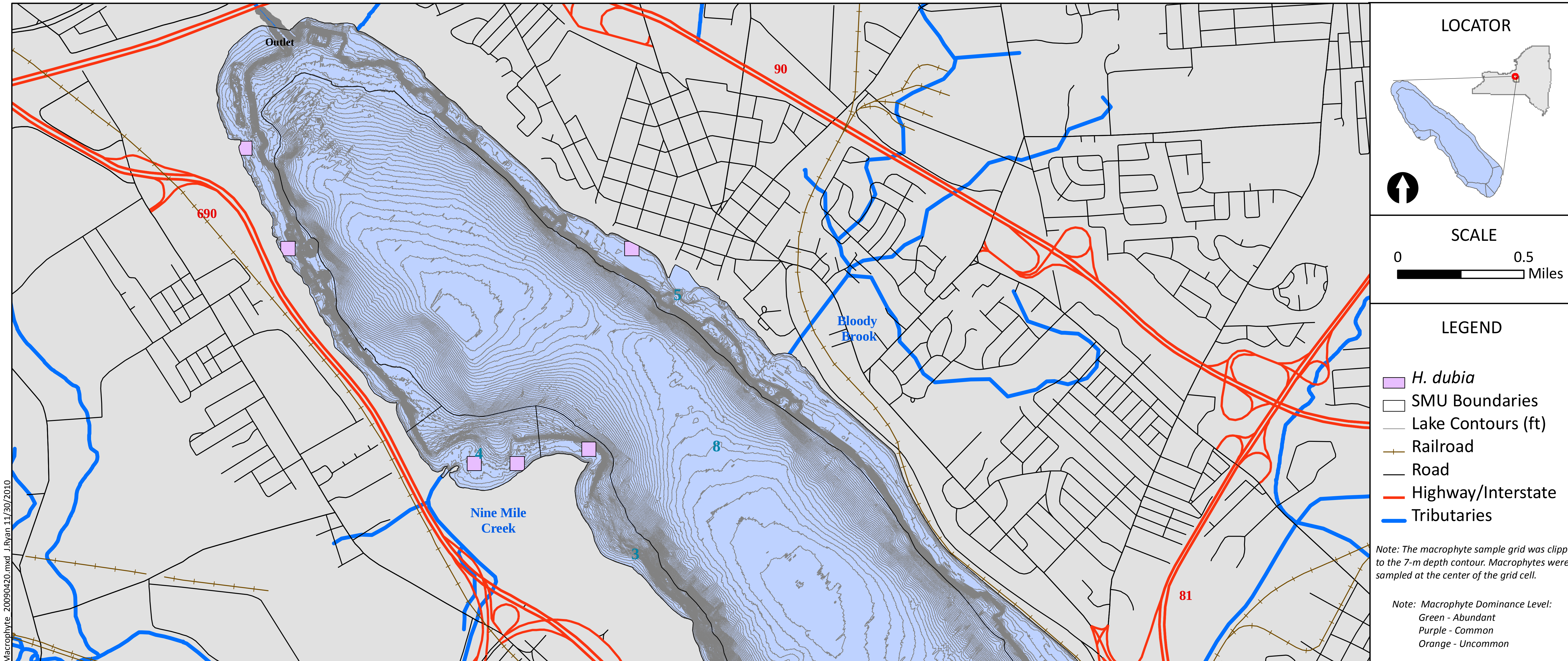

Figure 12c.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Heteranthera dubia*.

Honeywell
PARSONS
ANCHOR QEA

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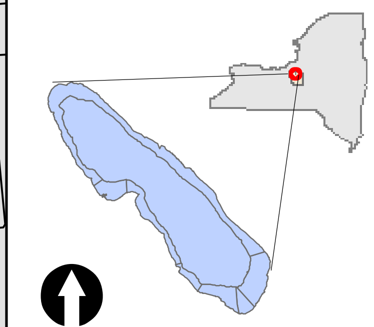
LOCATOR



SCALE

0 0.5 Miles

LEGEND

L. minor
SMU Boundaries
Lake Contours (ft)
Railroad
Road
Highway/Interstate
Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 12d.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Lemna minor*.

Honeywell
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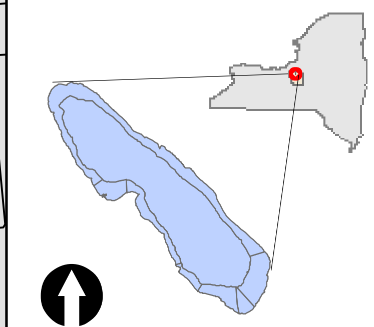
LOCATOR



SCALE

0 0.5 Miles

LEGEND

M. spicatum
SMU Boundaries
Lake Contours (ft)
Railroad
Road
Highway/Interstate
Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 12e.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Myriophyllum spicatum*.

Honeywell
PARSONS
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LOCATOR

SCALE

0 0.5 Miles

LEGEND

- *N. flexilis*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 12f.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Najas flexilis*.

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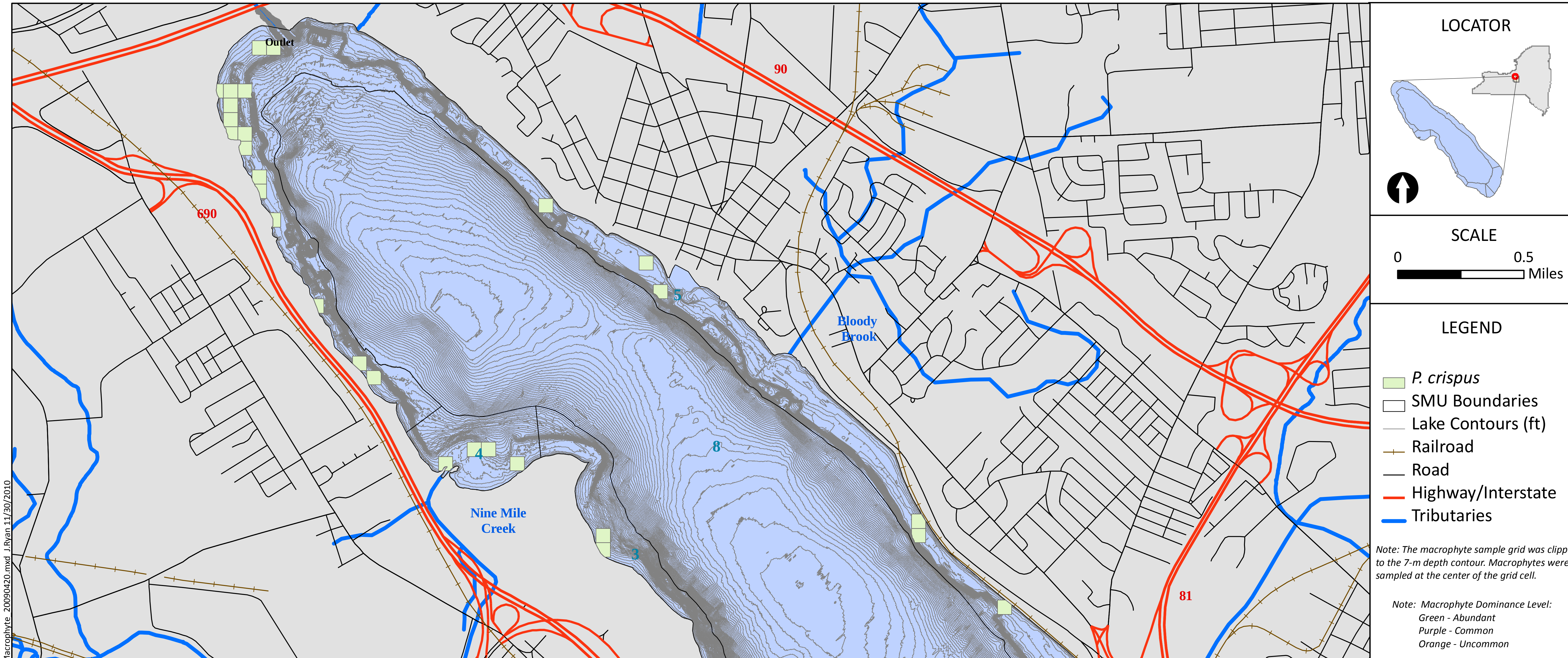

Figure 12g.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Potamogeton crispus*.

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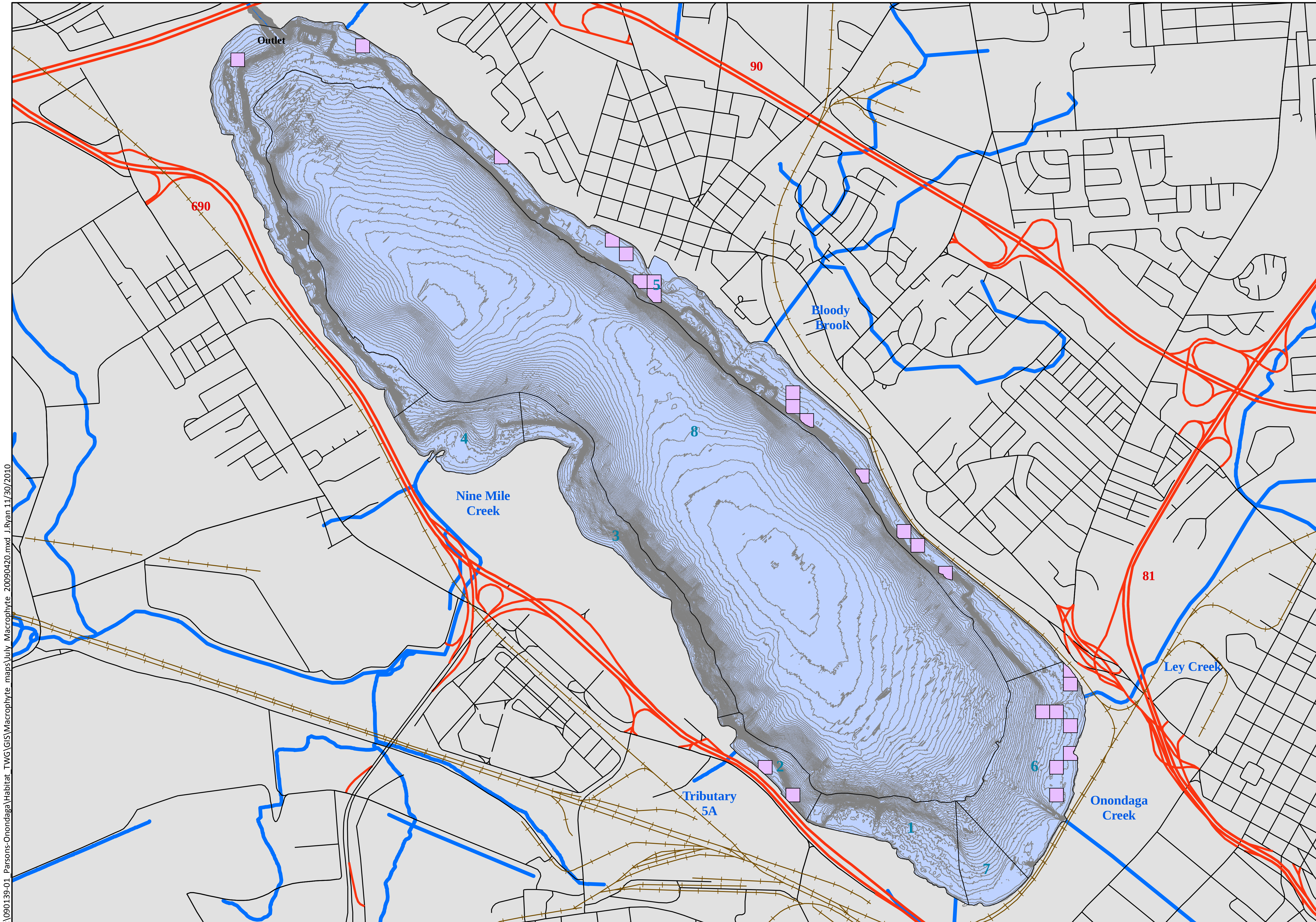

LOCATOR

SCALE

0 0.5 Miles

LEGEND

- *P. foliosus*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 12h.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Potamogeton foliosus*.

Honeywell
PARSONS
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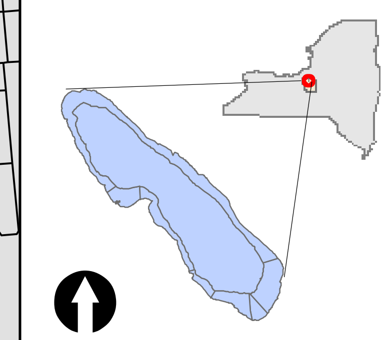
LOCATOR



SCALE

0 0.5 Miles

LEGEND

- *P. pusillus*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

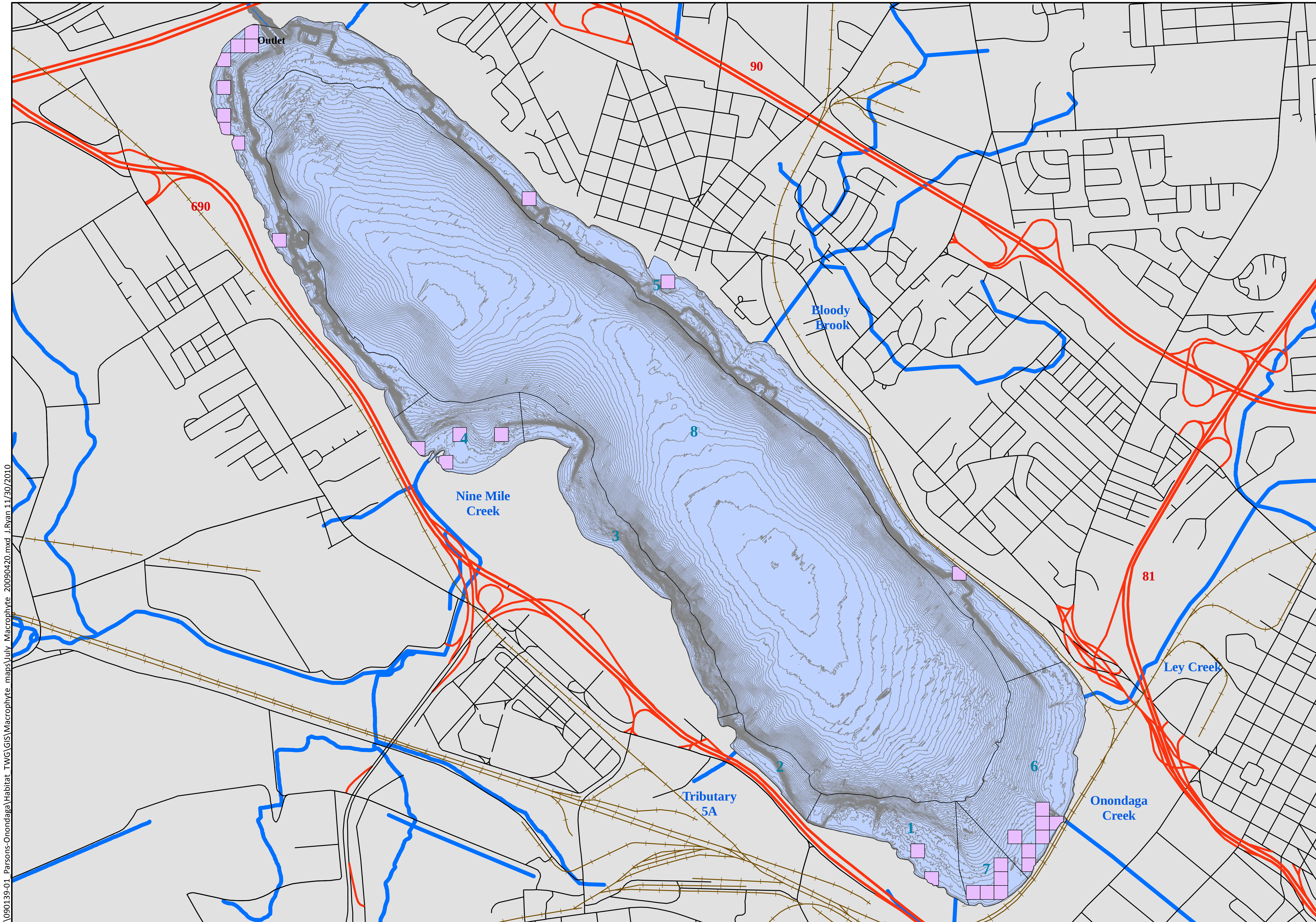
Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

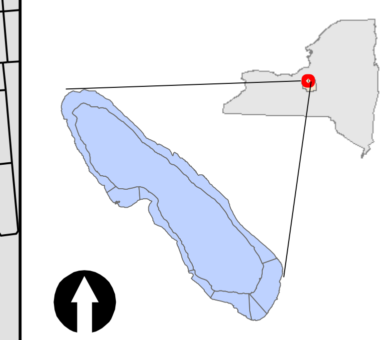
Figure 12i.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Potamogeton pusillus*.

Honeywell
PARSONS
ANCHOR QEA

090139-01 November 2010





SCALE

0 0.5 Miles

LEGEND

- *S.pectinata*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 12j.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Stuckenia pectinata*.

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LOCATOR

SCALE

0 0.5 Miles

LEGEND

- V. americana
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 12k.

Macrophyte sample grid results in Onondaga Lake in July 2008: *Vallisneria americana*.

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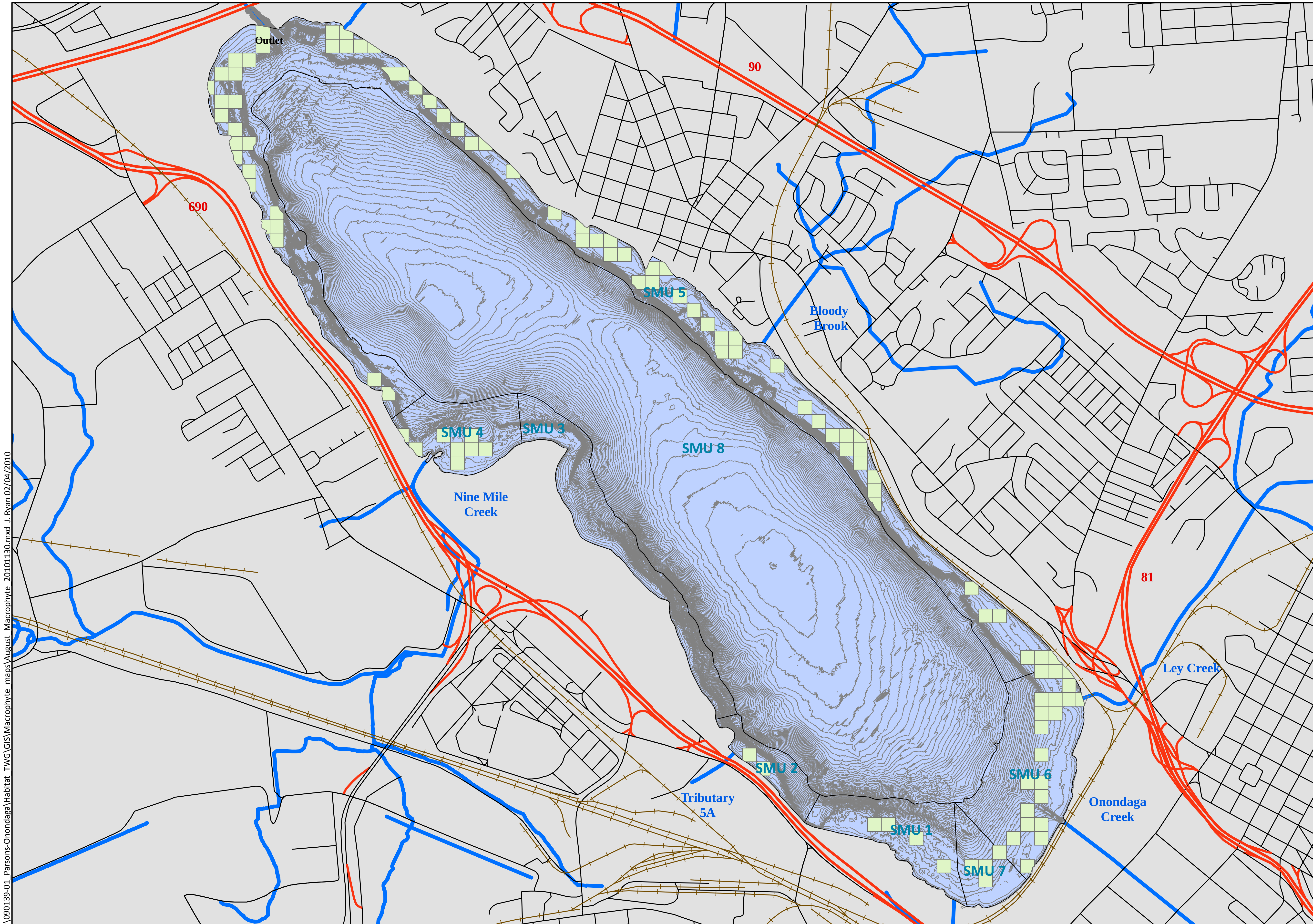

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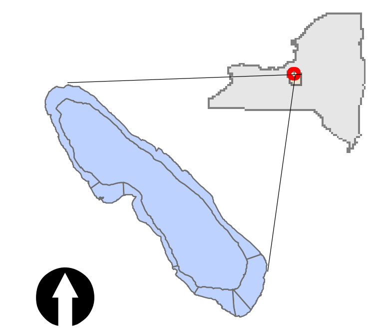

SCALE

0 0.5 Miles

LEGEND

- *C. demersum*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13a.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Ceratophyllum demersum*.

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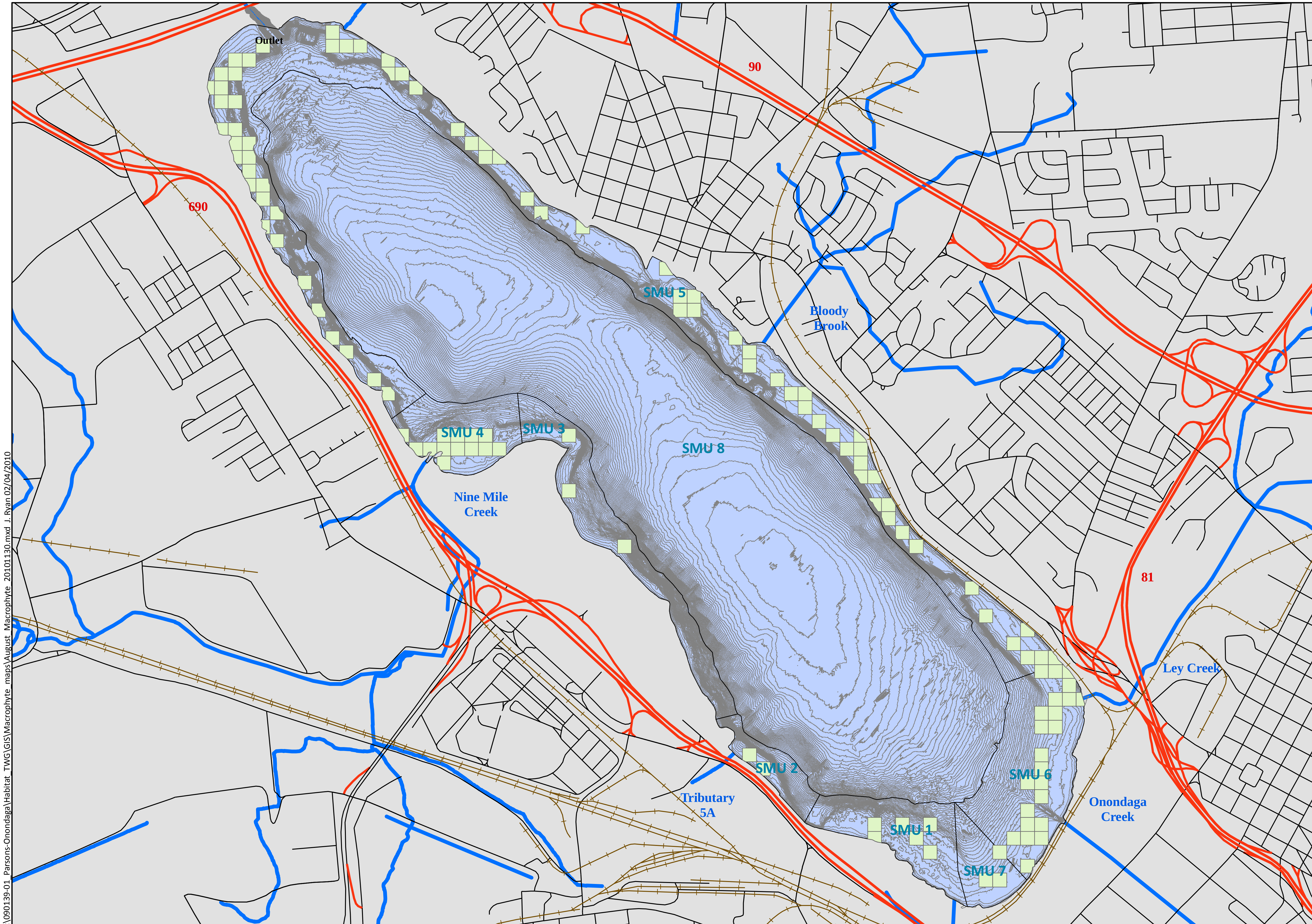

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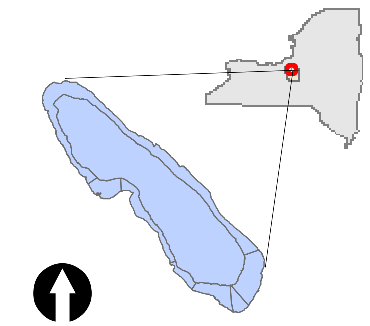

SCALE

0 0.5 Miles

LEGEND

- *E. canadensis*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13b.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Elodea canadensis*.

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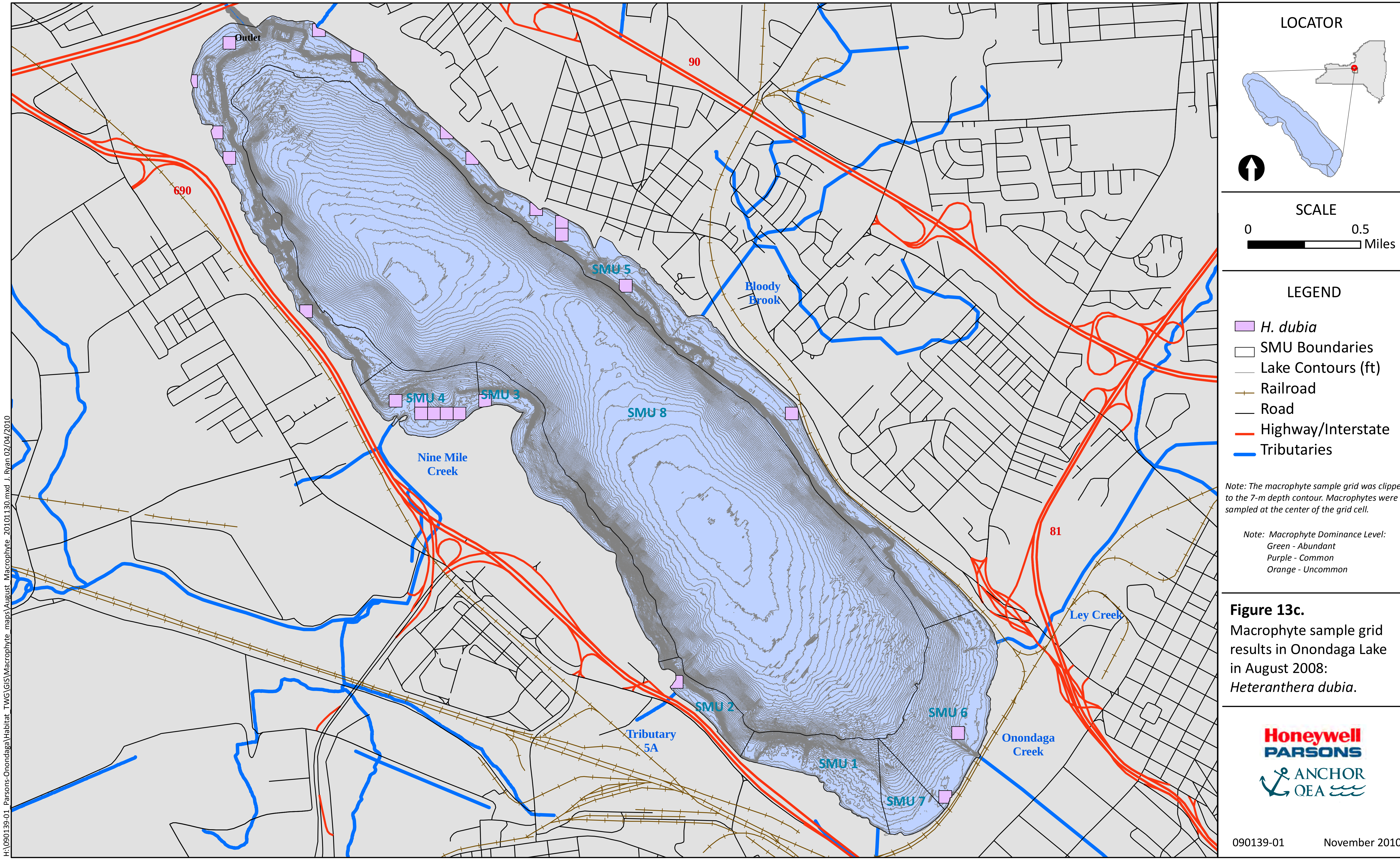
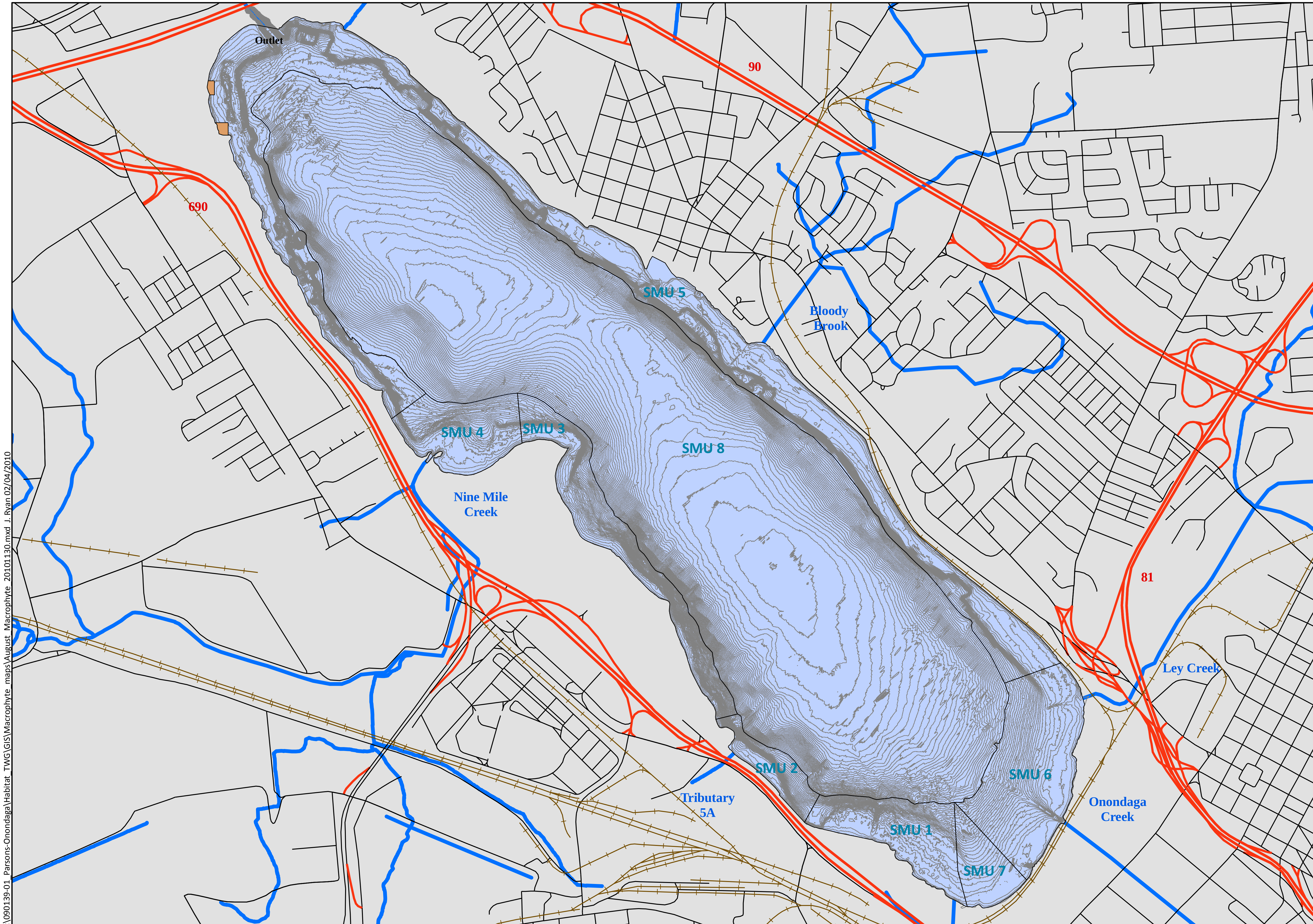


Figure 13c. Macrophyte sample grid results in Onondaga Lake in August 2008: *Heteranthera dubia*.



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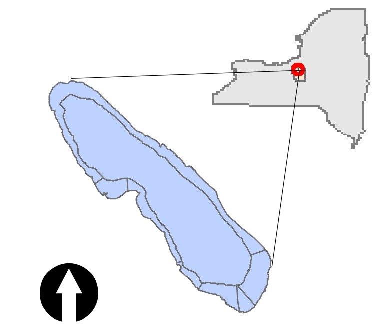

SCALE

0 0.5 Miles

LEGEND

L. minor
SMU Boundaries
Lake Contours (ft)
Railroad
Road
Highway/Interstate
Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13d.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Lemna minor*.

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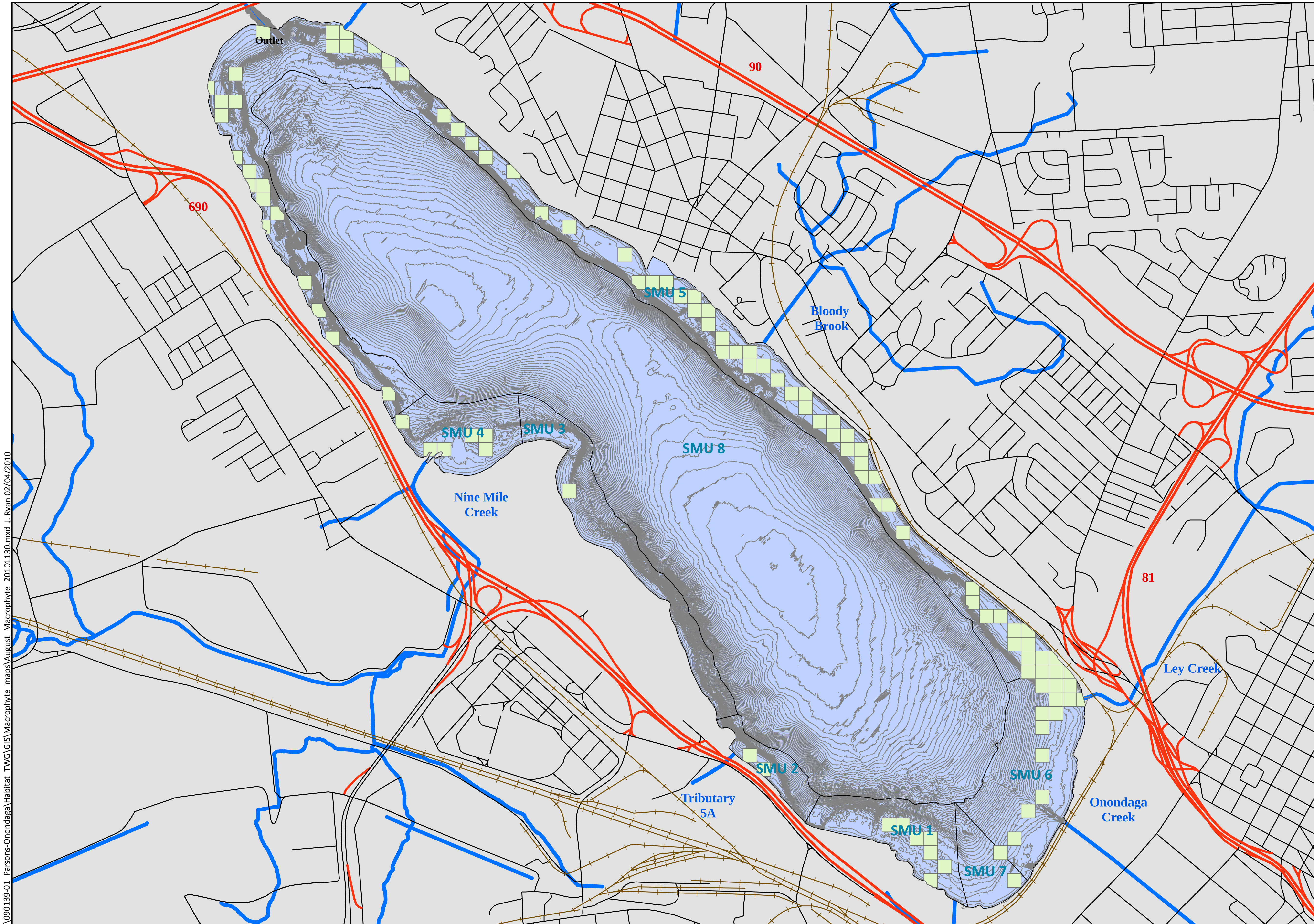

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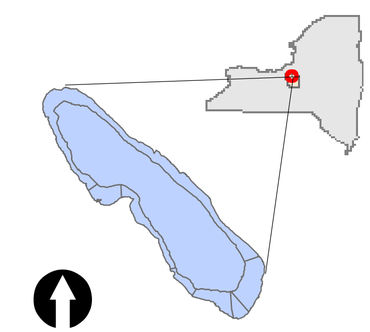

SCALE

0 0.5 Miles

LEGEND

- *M. spicatum*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13e.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Myriophyllum spicatum*.

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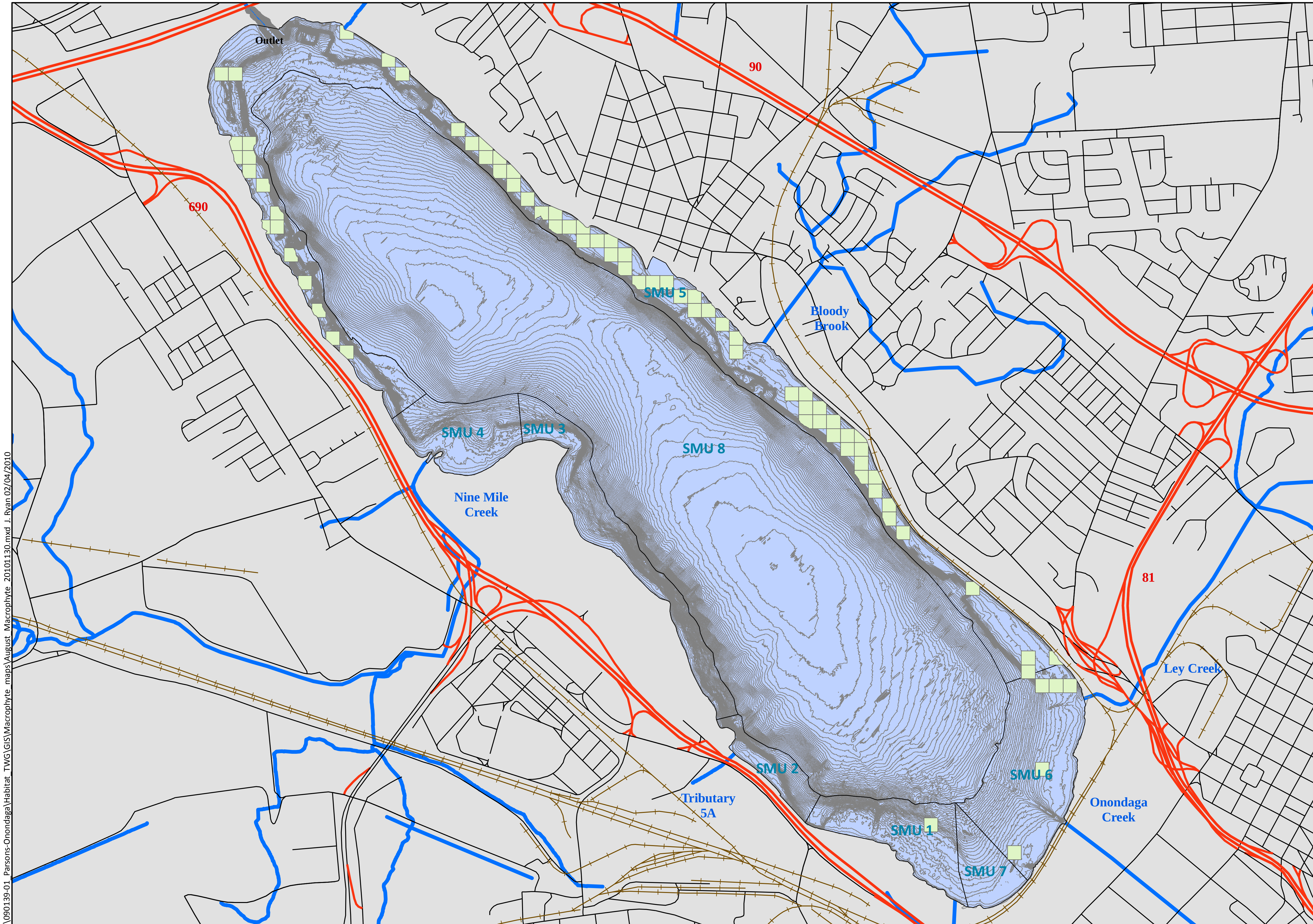

LOCATOR

SCALE

0 0.5 Miles

LEGEND

N. flexilis
SMU Boundaries
Lake Contours (ft)
Railroad
Road
Highway/Interstate
Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13f.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Najas flexilis*.

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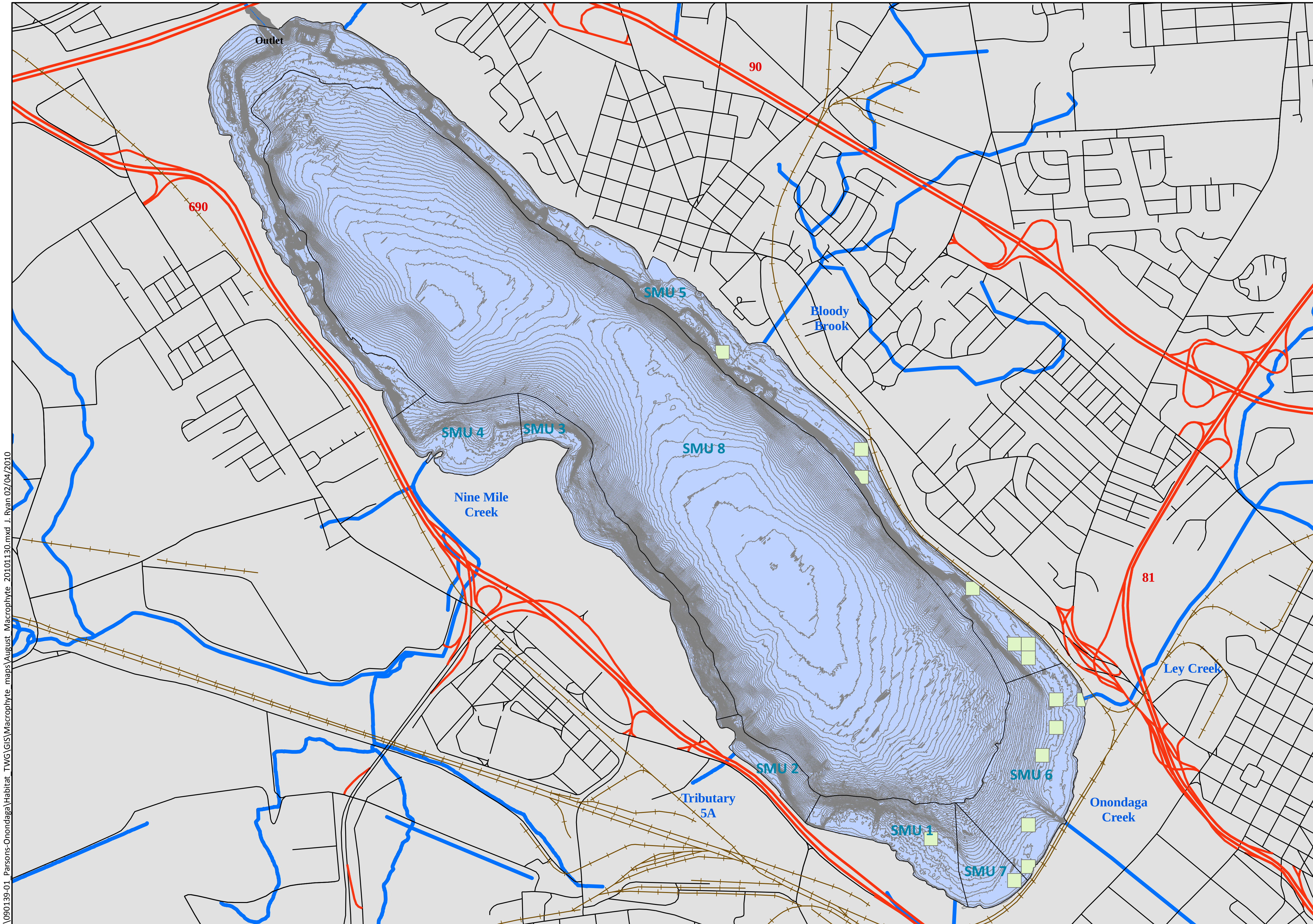

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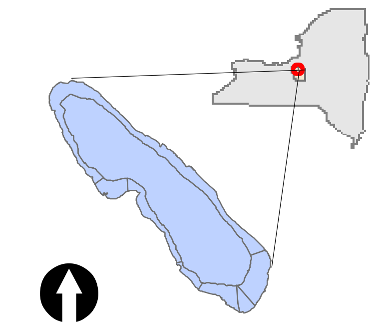

SCALE

0 0.5 Miles

LEGEND

- *P. crispus*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13g.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Potamogeton crispus*.

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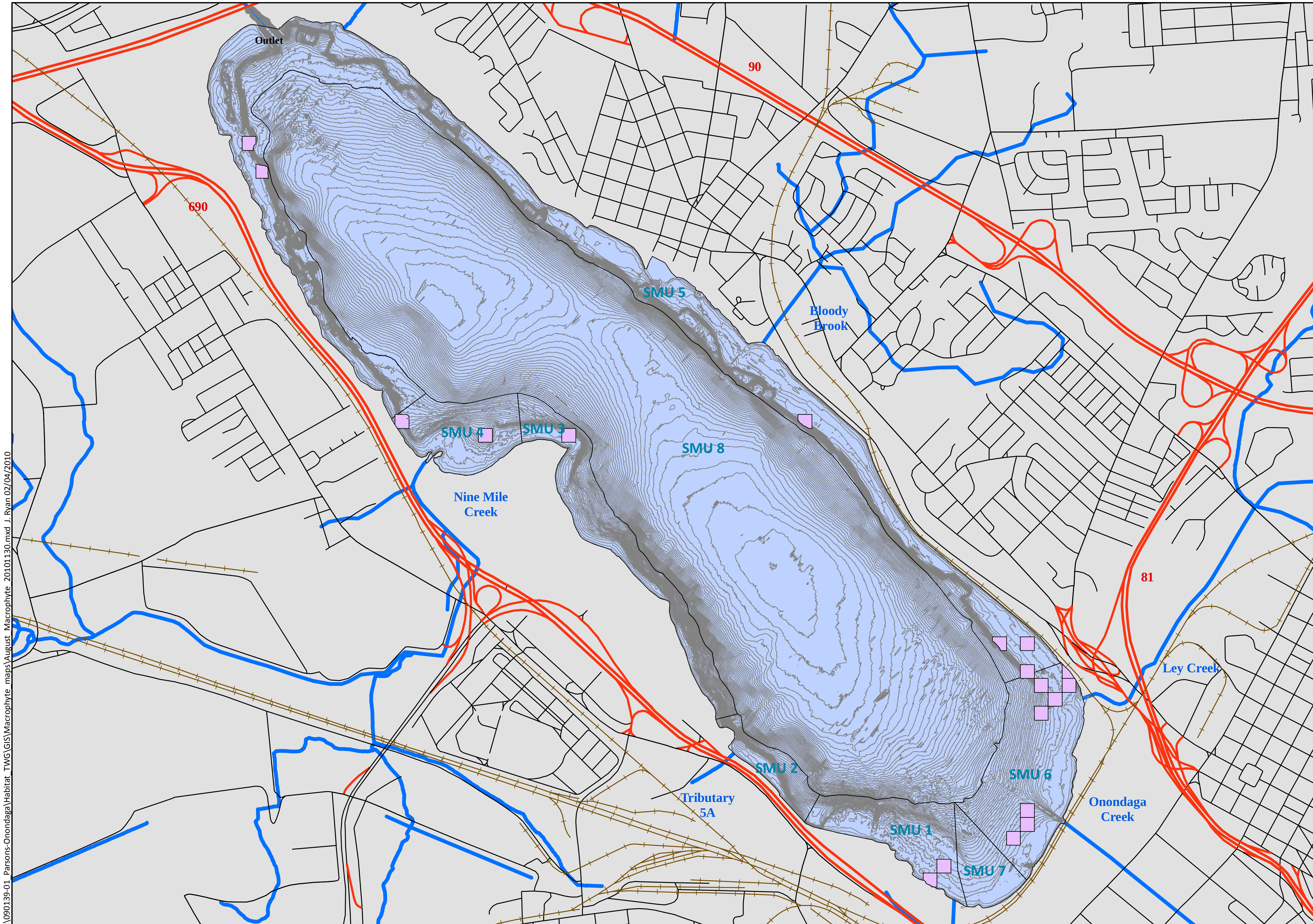

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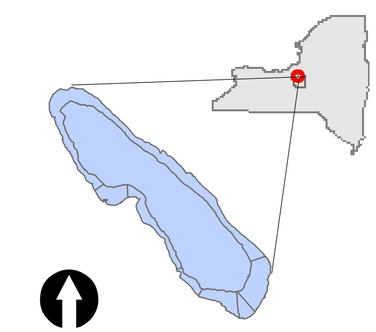

SCALE

0 0.5 Miles

LEGEND

P. foliosus
SMU Boundaries
Lake Contours (ft)
Railroad
Road
Highway/Interstate
Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13h.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Potamogeton foliosus*.

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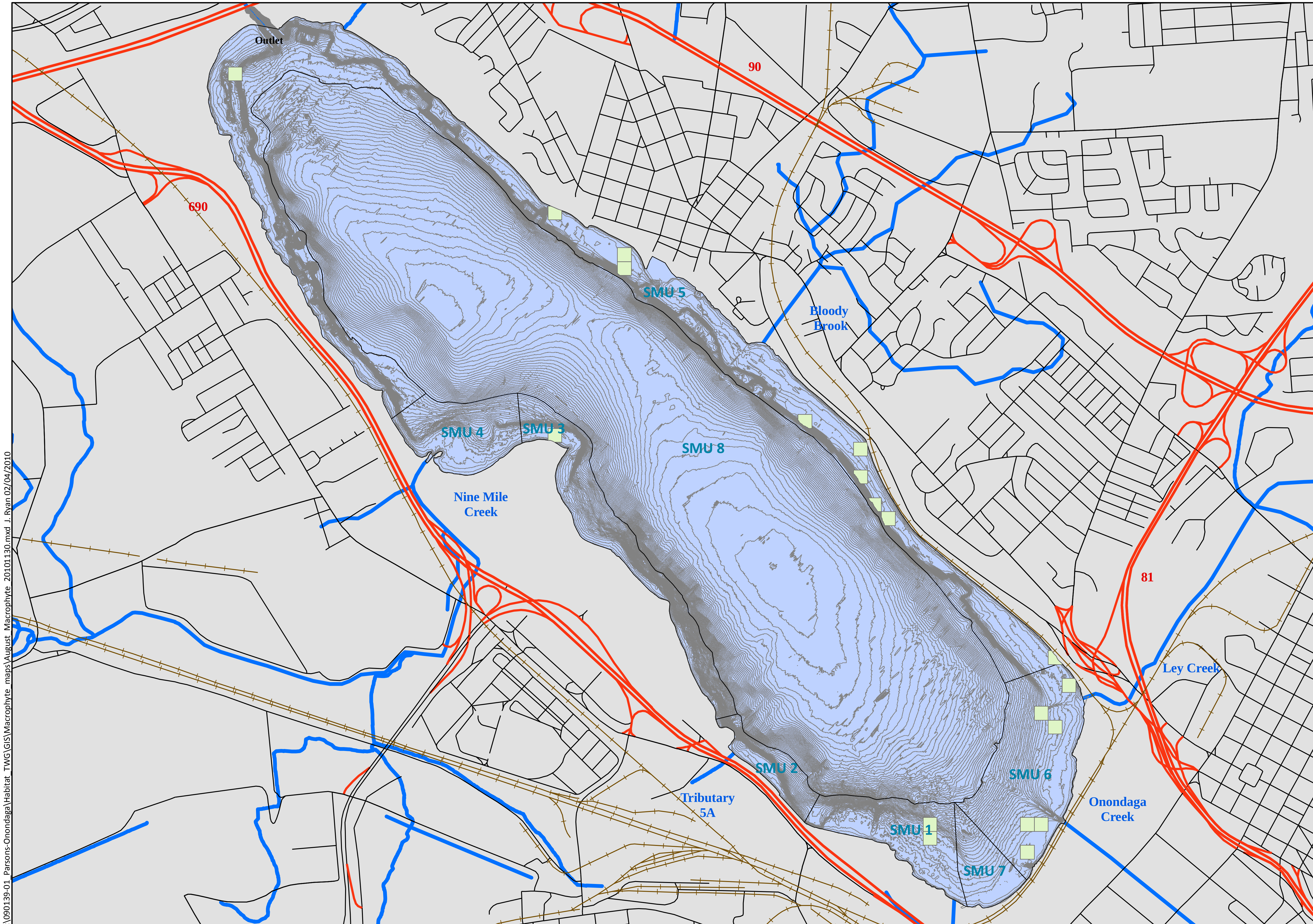

LEGEND

- *P. pusillus*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13i.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Potamogeton pusillus*.

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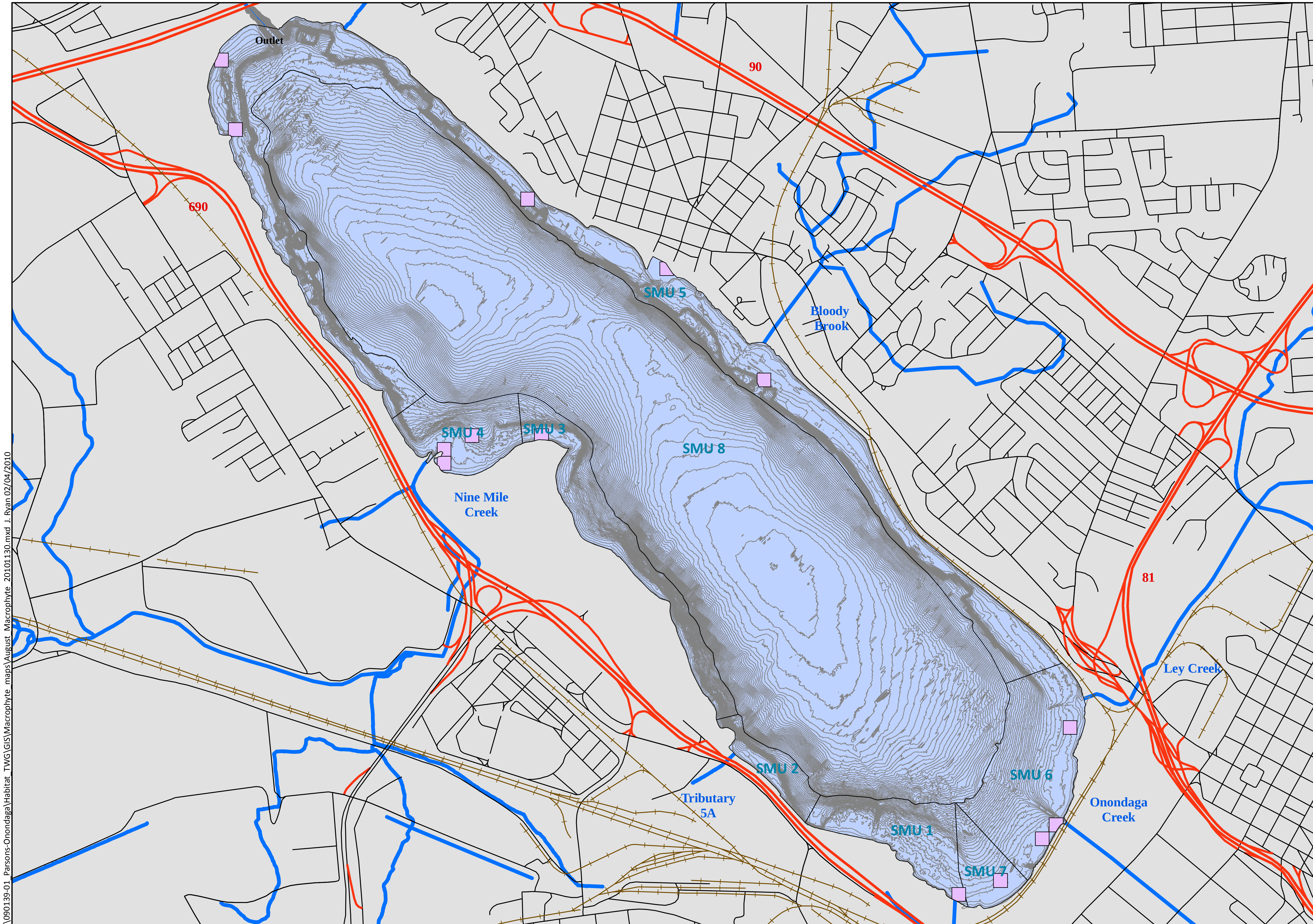

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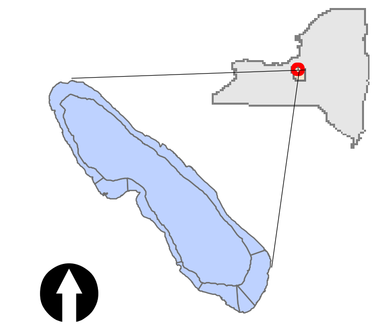

SCALE

0 0.5 Miles

LEGEND

- *S. pectinata*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13j.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Stuckenia pectinata*.

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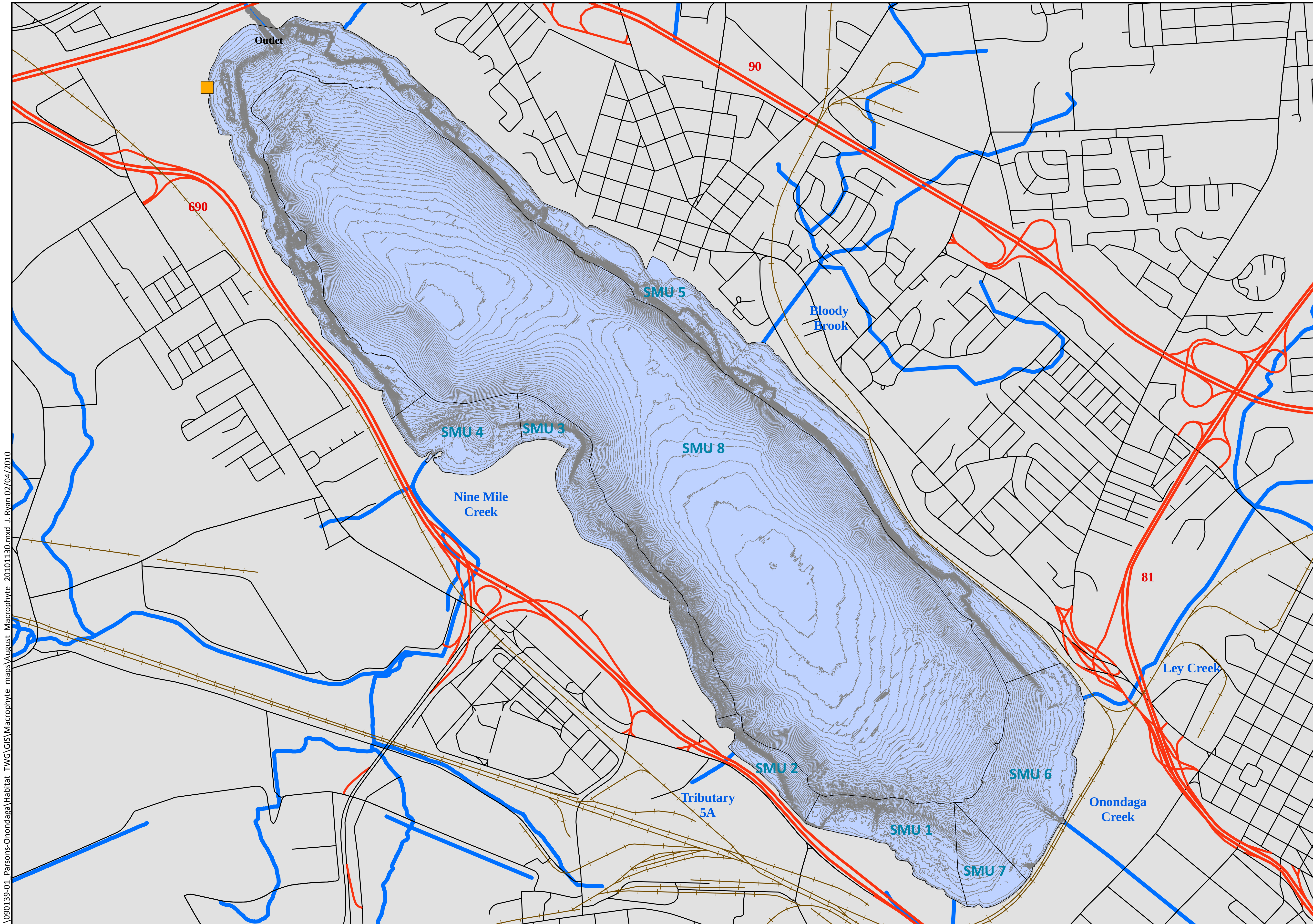

LEGEND

- *S. polyrhiza*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 13k.
Macrophyte sample grid results in Onondaga Lake in August 2008: *Spirodela polyrhiza*.

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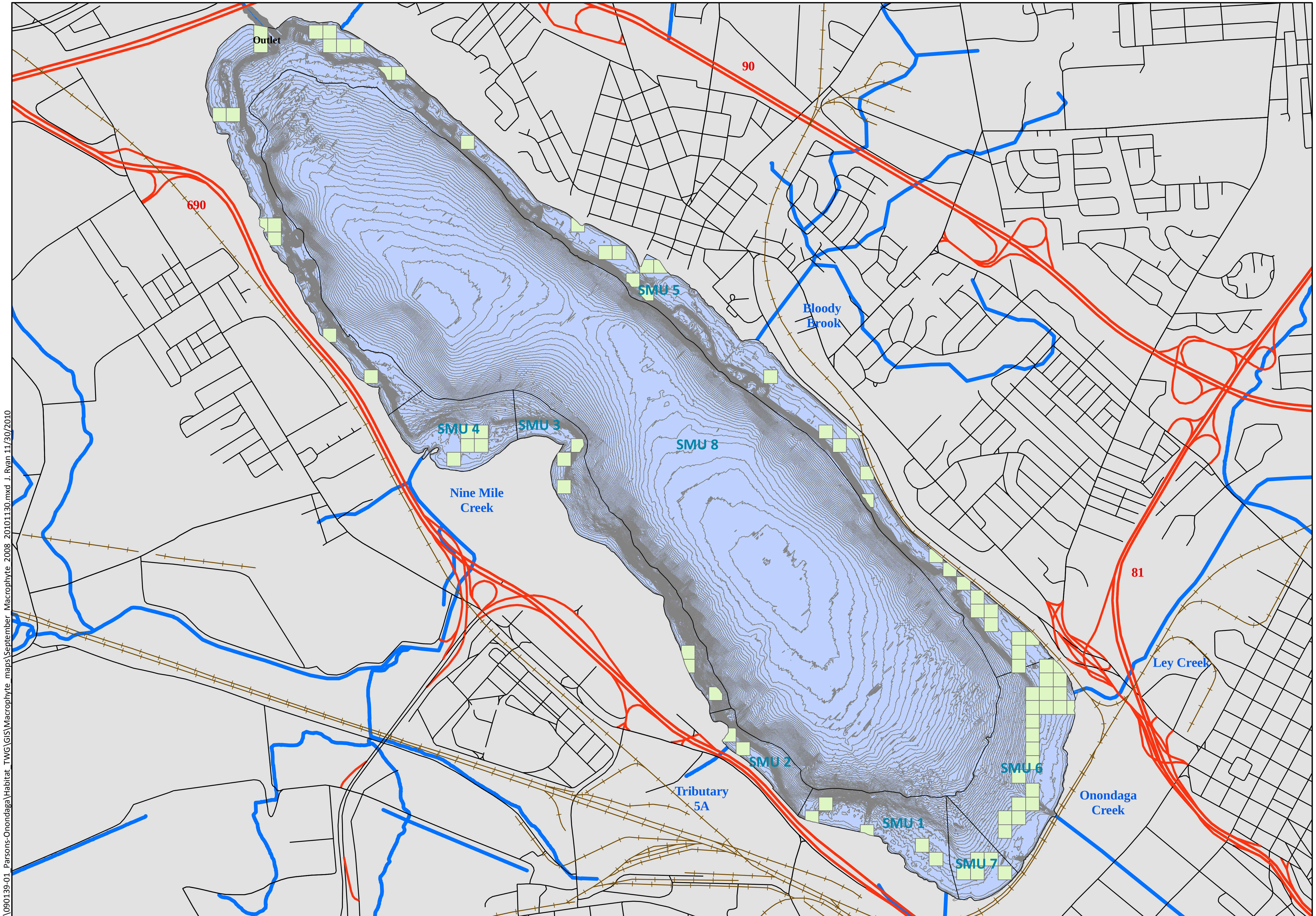

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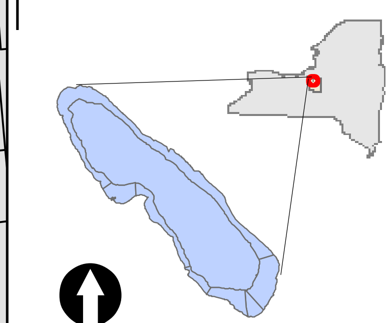
LOCATOR



SCALE

0 0.5 Miles

LEGEND

- *C. demersum*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 14a.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Ceratophyllum demersum*.

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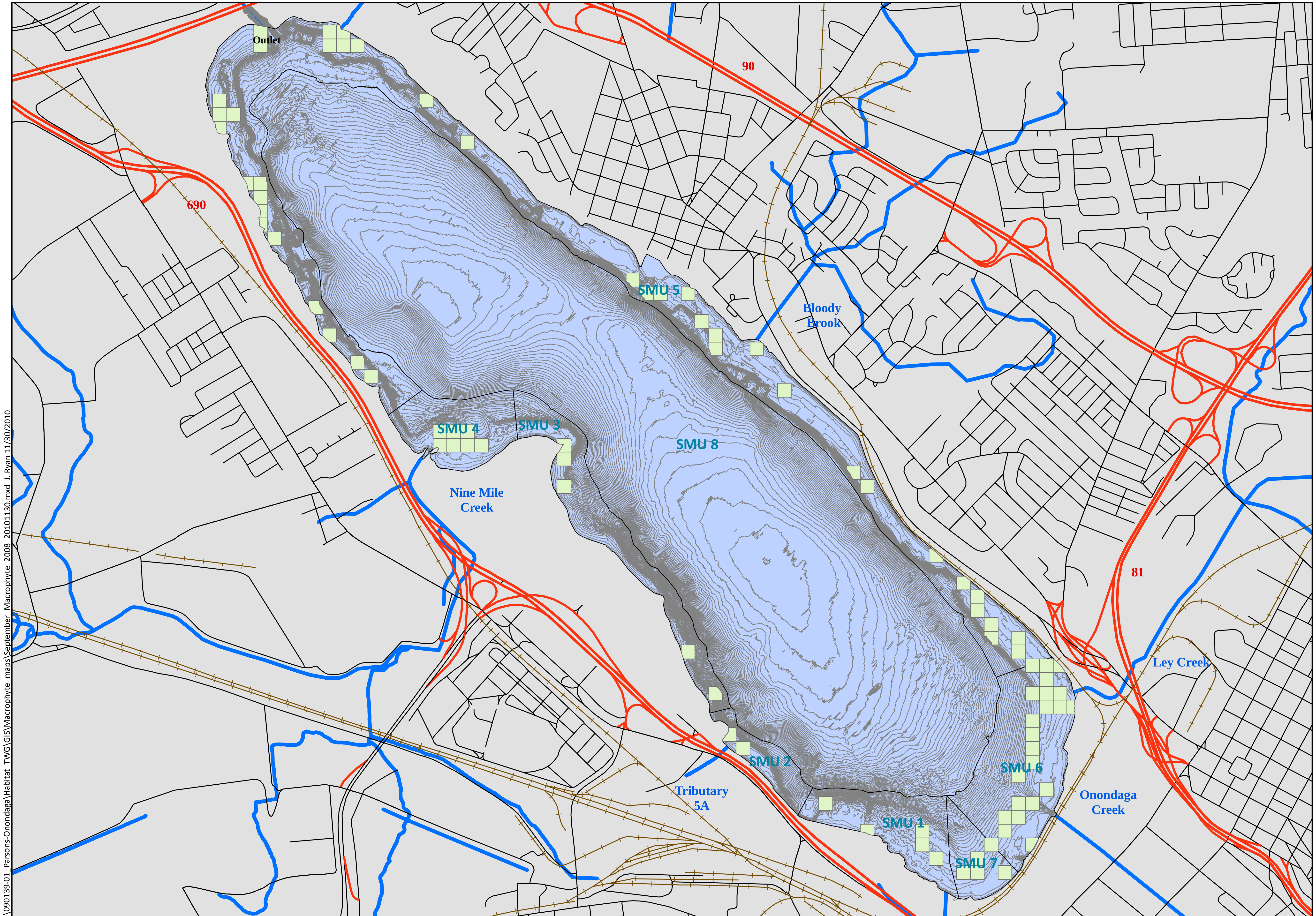

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 14b.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Elodea canadensis*.

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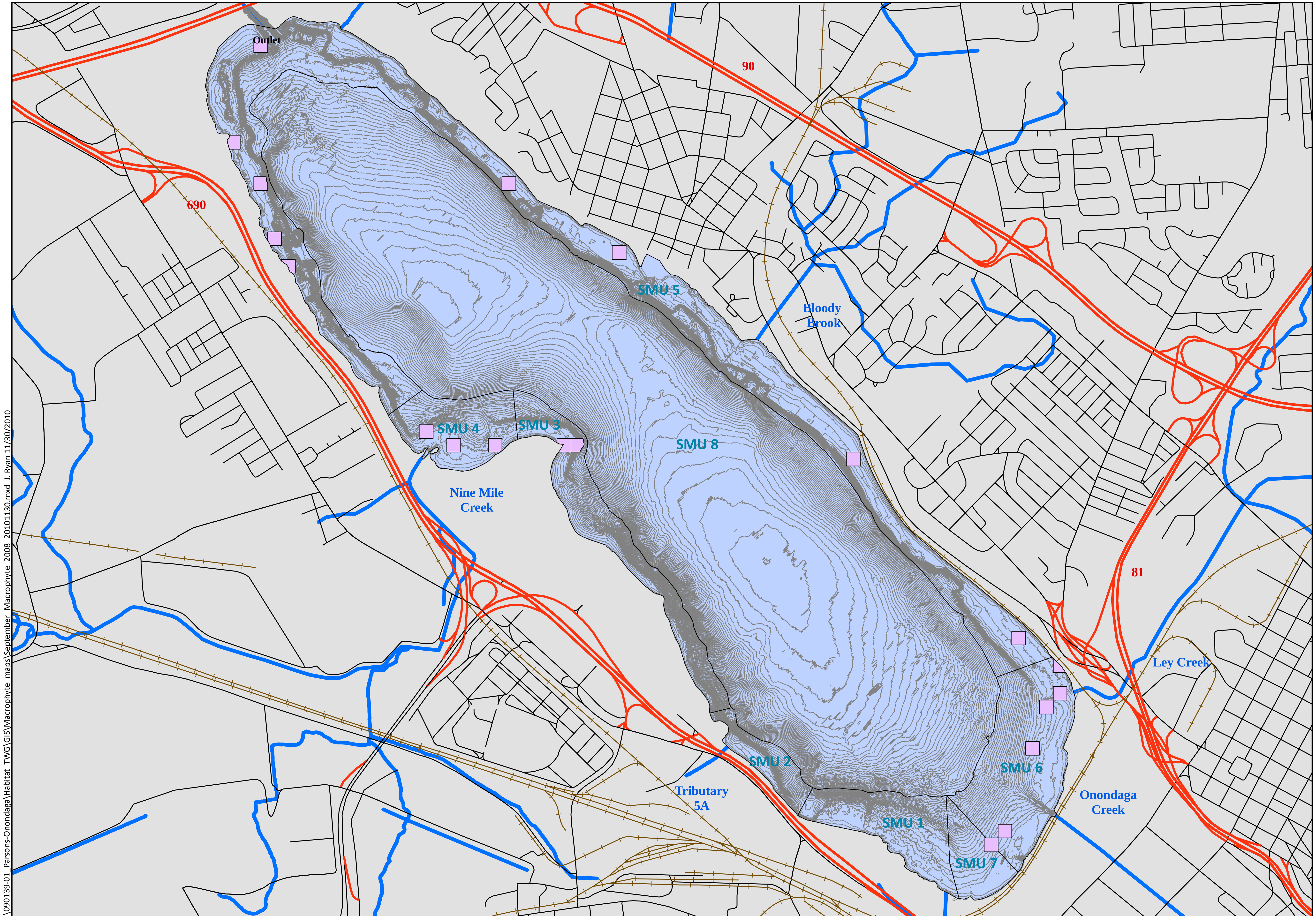

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LOCATOR

SCALE

0 0.5 Miles

LEGEND

- *H. dubia*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 14c.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Heteranthera dubia*.

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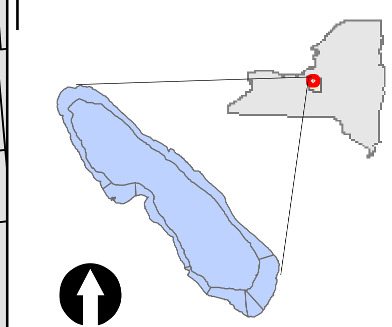
LOCATOR



SCALE

0 0.5 Miles

LEGEND

- *M. spicatum*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 14d.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Myriophyllum spicatum*.

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Figure 14e.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Najas flexilis*.

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LOCATOR

SCALE

0 0.5 Miles

LEGEND

- *P. crispus*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 14f.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Potamogeton crispus*.

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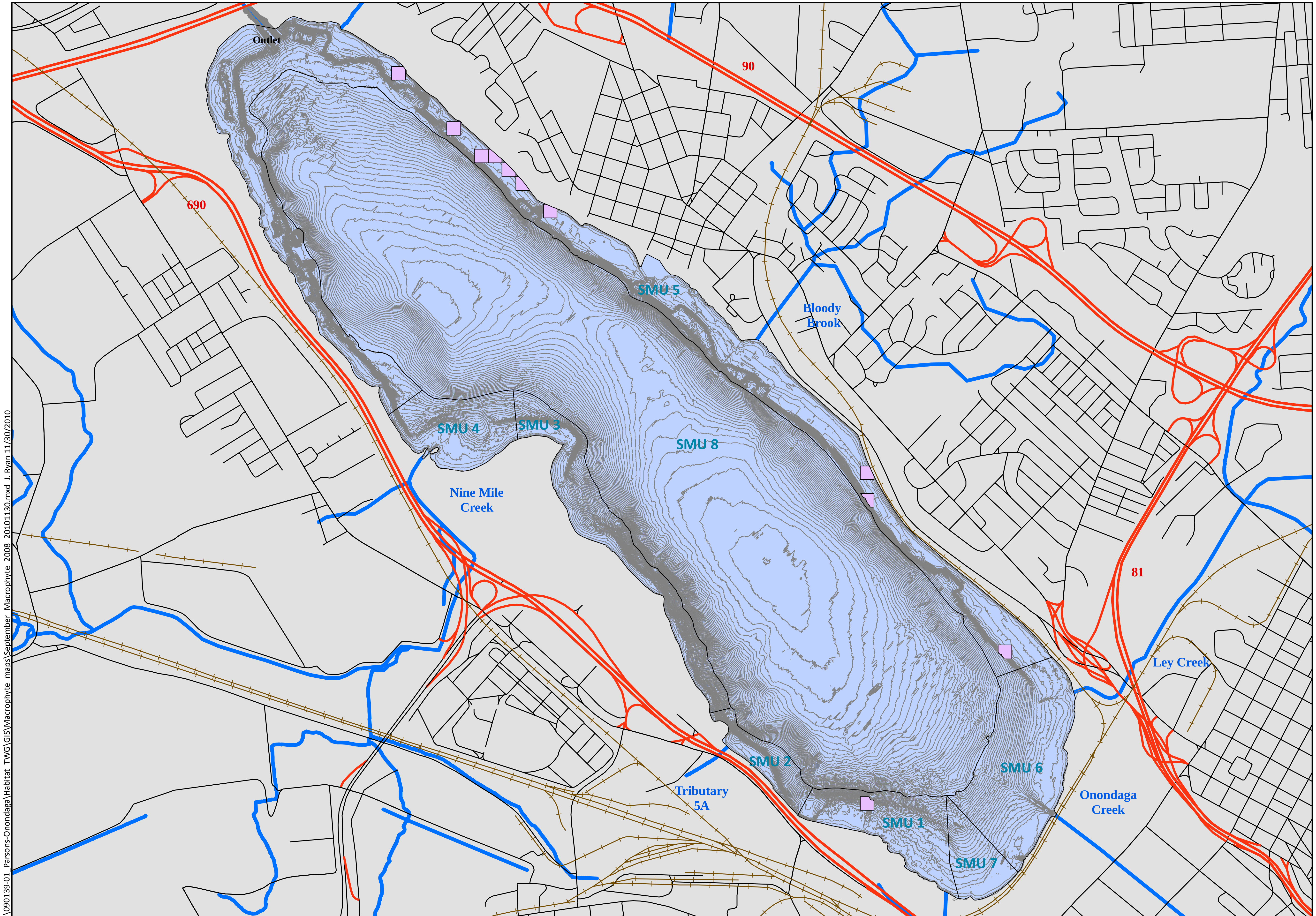

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LOCATOR

SCALE

0 0.5 Miles

LEGEND

- *P. foliosus*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 14g.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Potamogeton foliosus*.

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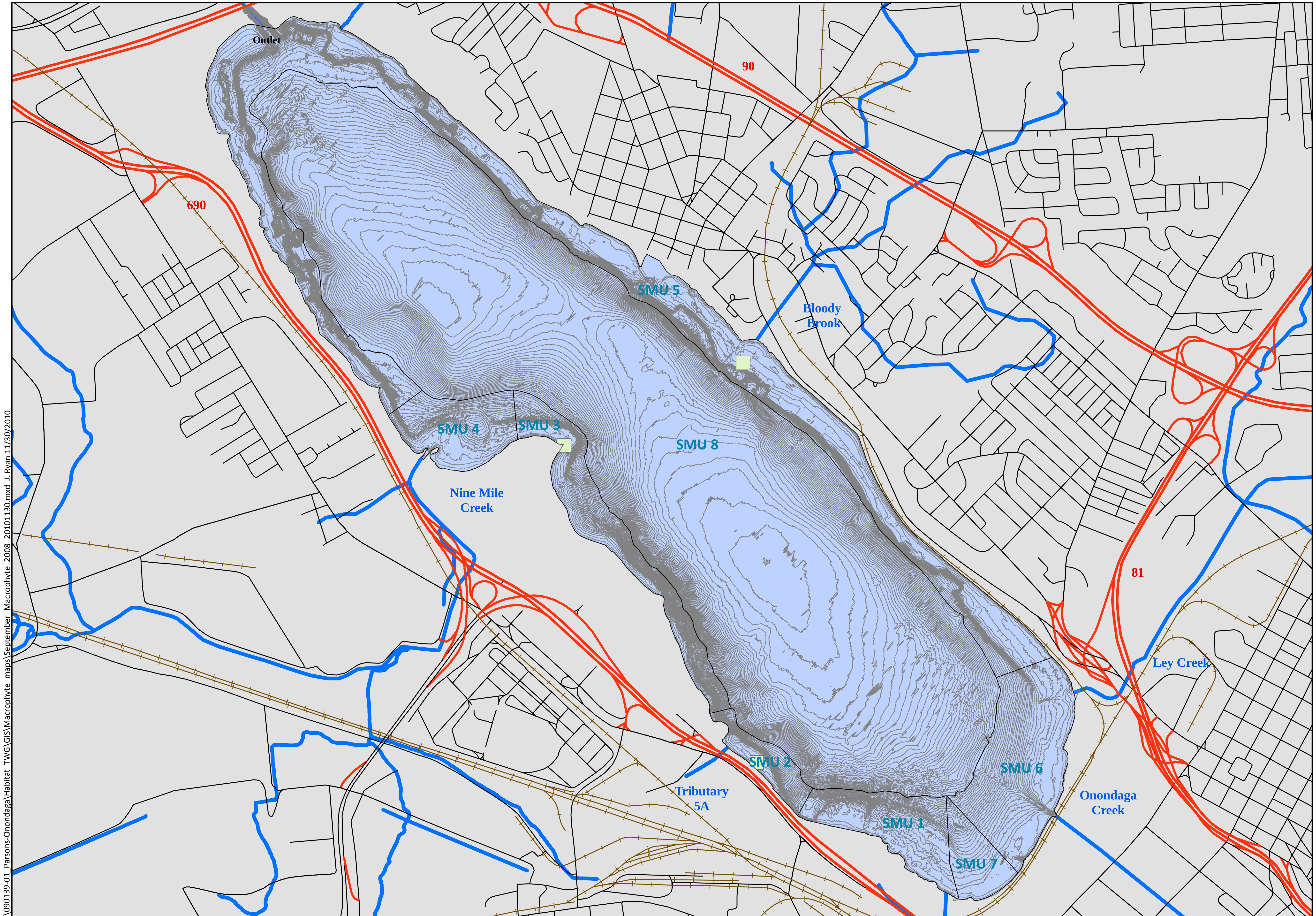
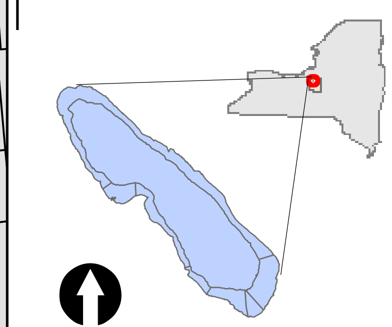


LOCATOR



SCALE

0 0.5 Miles

LEGEND

- *P. pusillus*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 14h.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Potamogeton pusillus*.

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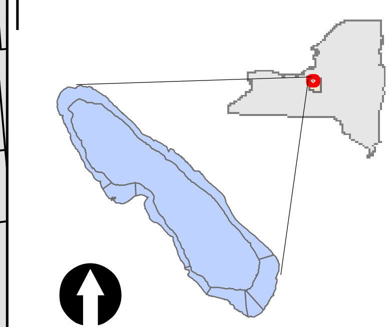

SCALE

0 0.5 Miles

LEGEND

- *S. pectinata*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 14i.

Macrophyte sample grid results in Onondaga Lake in September 2008: *Stuckenia pectinata*.

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LOCATOR

SCALE

0 0.5 Miles

LEGEND

C. demersum
SMU Boundaries
Lake Contours (ft)
Railroad
Road
Highway/Interstate
Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 15a.

Macrophyte sample grid results in Onondaga Lake in October 2008: *Ceratophyllum demersum*.

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Figure 15b.

Macrophyte sample grid results in Onondaga Lake in October 2008: *Elodea canadensis*.

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Figure 15c.

Macrophyte sample grid results in Onondaga Lake in October 2008: *Heteranthera dubia*.

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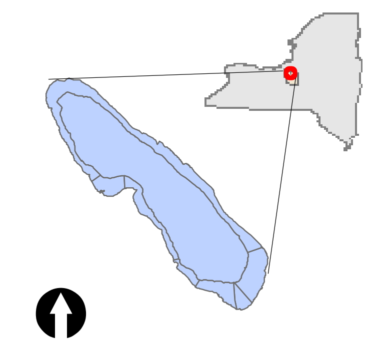
LOCATOR



SCALE

0 0.5 Miles

LEGEND

M. spicatum
SMU Boundaries
Lake Contours (ft)
Railroad
Road
Highway/Interstate
Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 15d.

Macrophyte sample grid results in Onondaga Lake in October 2008: *Myriophyllum spicatum*.

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LOCATOR

SCALE

0 0.5 Miles

LEGEND

- *N. flexilis*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 15e.

Macrophyte sample grid results in Onondaga Lake in October 2008: *Najas flexilis*.

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LOCATOR

SCALE

0 0.5 Miles

LEGEND

- *P. crispus*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 15f.

Macrophyte sample grid results in Onondaga Lake in October 2008: *Potamogeton crispus*.

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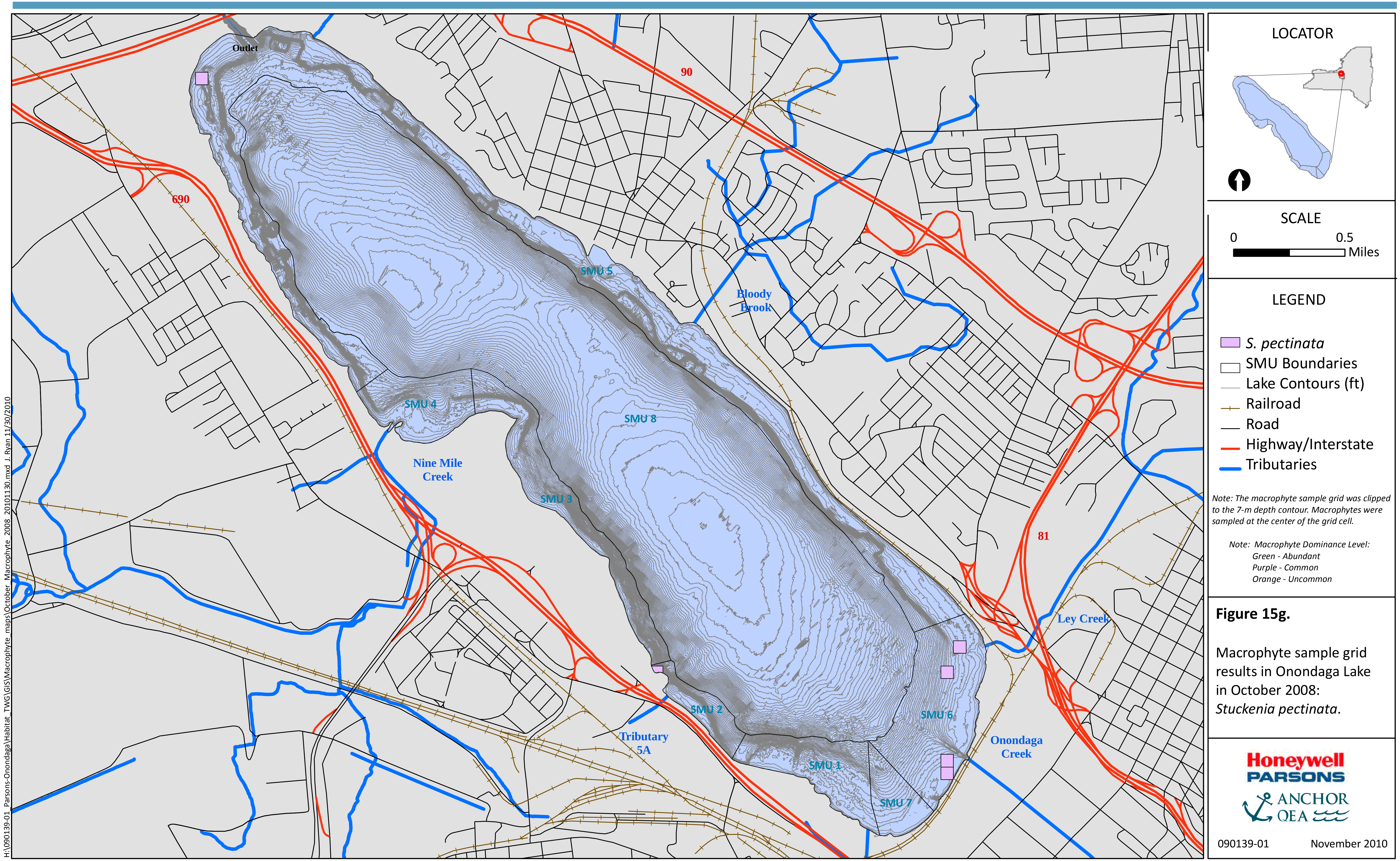

Figure 15g.

Macrophyte sample grid results in Onondaga Lake in October 2008: *Stuckenia pectinata*.

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LOCATOR

SCALE

0 0.5 Miles

LEGEND

- *Chara*
- SMU Boundaries
- Lake Contours (ft)
- Railroad
- Road
- Highway/Interstate
- Tributaries

Note: The macrophyte sample grid was clipped to the 7-m depth contour. Macrophytes were sampled at the center of the grid cell.

Note: Macrophyte Dominance Level:
Green - Abundant
Purple - Common
Orange - Uncommon

Figure 15h.

Macrophyte sample grid results in Onondaga Lake in October 2008: *Chara*.

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