

Stream Assessment Report for Little Manatee River in Hillsborough County, Florida

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INTRODUCTION

This assessment was conducted to update existing physical and ecological data for Little Manatee River on the [Hillsborough County Water Atlas](#). The project is a collaborative effort between the University of South Florida's Water Institute and Hillsborough County Stormwater Management Section. The project is funded by Hillsborough County. The project has, as its primary goal, the rapid assessing of up to 150 lakes and streams in Hillsborough County during a five-year period. The product of these investigations will provide the County, property owners and the general public a better understanding of the general health of Hillsborough County lakes and streams, in terms of shoreline development, water quality, morphology (bottom contour, volume, area, etc.) and the plant biomass and species diversity. These data are intended to assist the County and its citizens to better manage lakes and streams.



Figure 1. The Little Manatee River near US Highway 301.

BACKGROUND

The Little Manatee River flows westward approximately 51 miles in Hillsborough County to its mouth in Tampa Bay. This assessment focuses on the region between US Highway 301 and Interstate 75. At Interstate 75, the Little Manatee River is a tidal system with fluctuating salinity levels and typified by salt marsh vegetation species. At US Highway 301, the Little Manatee River is a fresh water dominant system.

The first section of the report provides the results of the overall morphological assessment of the stream. Primary data products include: a contour (bathymetric) map of the stream, area, volume and depth statistics, and the water level at the time of assessment. These data are useful for evaluating trends and for developing management actions such as plant management where depth and stream volume are needed.

The second section provides the results of the vegetation assessment conducted on the stream. These results can be used to better understand and manage vegetation in the stream. A list is provided with the different plant species found at various sites along the stream. Potentially invasive, exotic (non-native) species are identified in a plant list and the percent of exotics is presented in a summary table. Watershed values provide a means of reference.

The third section provides the results of the water quality sampling of the stream. Both field data and laboratory data are presented. The water quality index (WQI)ⁱ is used to develop a general stream health statement, which is calculated for both the water column with vegetation and the water column if vegetation were removed. These data are derived from the water chemistry and vegetative submerged biomass assessments and are useful in understanding the results of certain stream vegetation management practices.

The intent of this assessment is to provide a starting point from which to track changes in the stream, and where previous comprehensive assessment data is available, to track changes in the stream's general health. These data can provide the information needed to determine changes and to monitor trends in physical condition and ecological health of the stream.

Section 1: Stream Morphology

Bathymetric Mapⁱⁱ. Table 1 provides the stream's morphologic parameters in various units. The bottom of the stream was mapped using a Lowrance HDS 5 with Wide Area Augmentation System (WAAS)ⁱⁱⁱ enabled Global Positioning System (GPS) with fathometer (bottom sounder) to determine the boat's position, and bottom depth in a single measurement. The result is an estimate of the stream's area, mean and maximum depths, and volume and the creation of a bottom contour map (Figure 2 through Figure 10). Besides pointing out the deeper fishing holes in the stream, the morphologic data derived from this part of the assessment can be valuable to overall management of the stream vegetation as well as providing flood storage data for flood models.

ⁱ The water quality index is used by the Water Atlas to provide the public with an estimate of their stream resource quality. For more information, see end note 1.

ⁱⁱ A bathymetric map is a map that accurately depicts all of the various depths of a water body. An accurate bathymetric map is important for effective herbicide application and can be an important tool when deciding which form of management is most appropriate for a water body. Stream volumes, hydraulic retention time and carrying capacity are important parts of stream management that require the use of a bathymetric map.

ⁱⁱⁱ WAAS is a form of differential GPS (DGPS) where data from 25 ground reference stations located in the United States receive GPS signals from GPS satellites in view and retransmit these data to a master control site and then to geostationary satellites. For more information, see end note 2.

Table 1. Stream Morphologic Data (Area, Depth and Volume)

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	10,692,436	993,359.8	245.5	0	0
Mean Depth	3.92	1.19	0	0	0
Maximum Depth	15.0	4.57	0	0	0
Volume (cubic)	33,915,186	960,371	0	778.6	253,704,968
Gauge (relative)	3.43	1.05	0	0	0

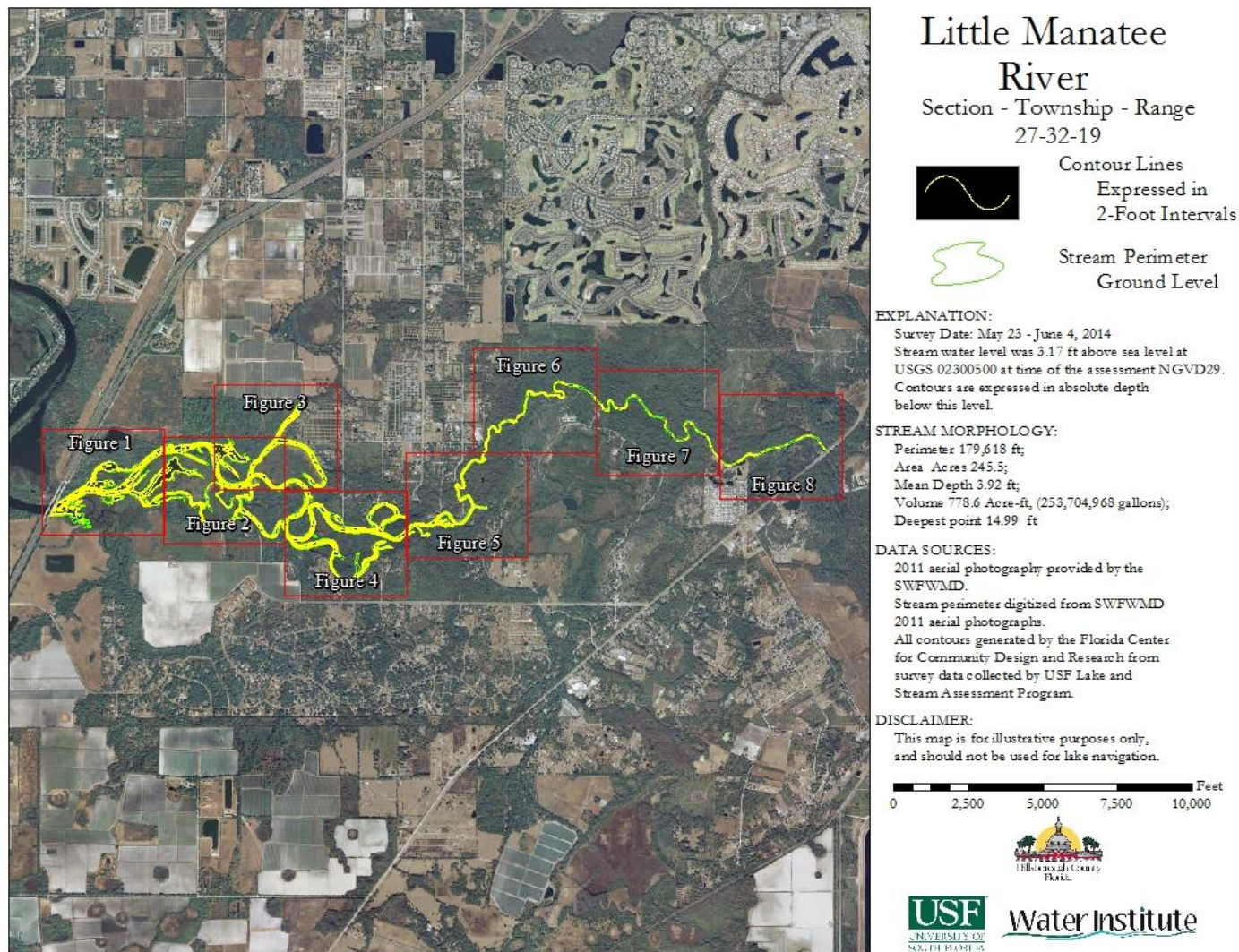


Figure 2. 2014 2-Foot Bathymetric Contour Map Overview for Little Manatee River

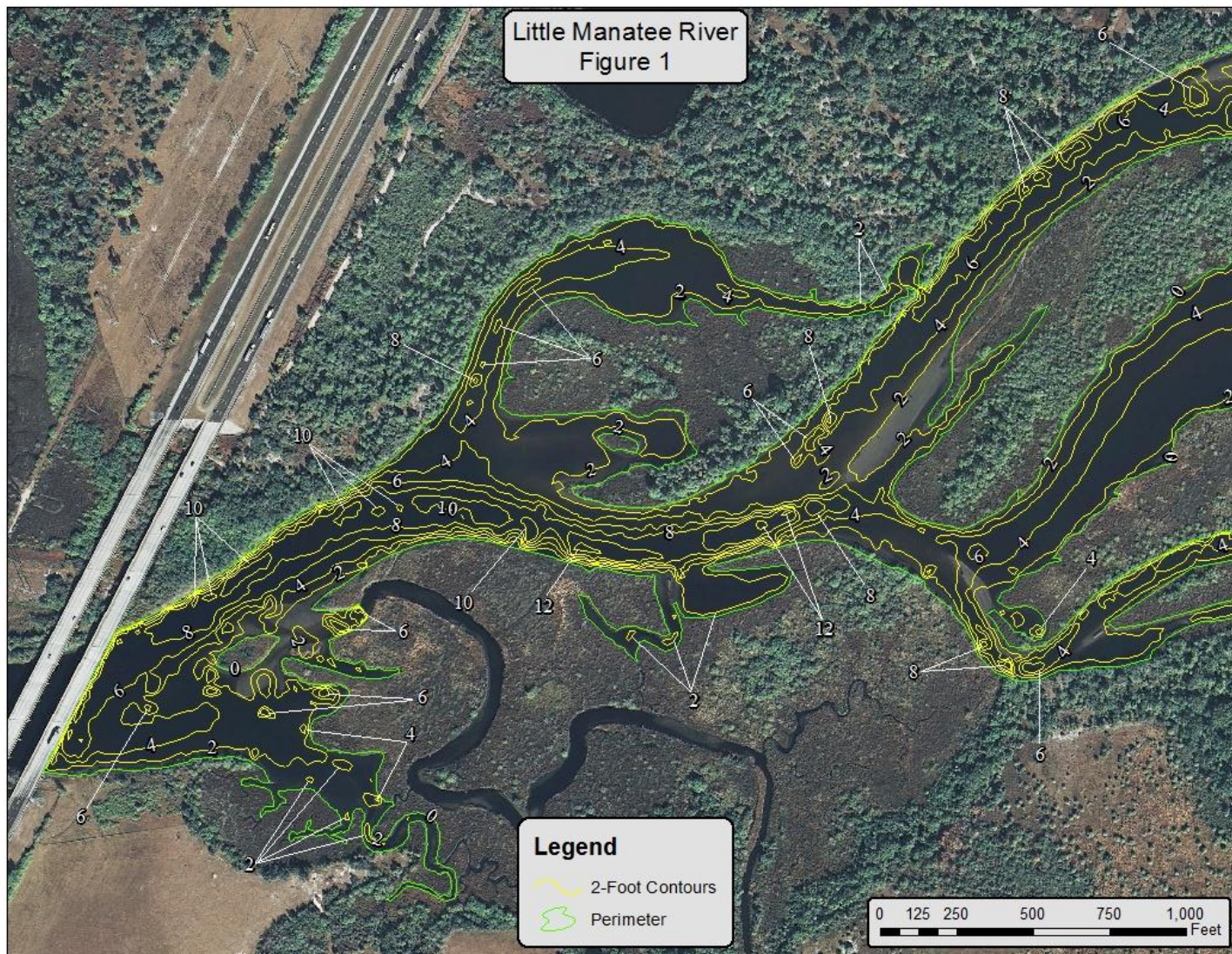


Figure 3 2014 2-Foot Bathymetric Contour Map for Little Manatee River Figure 1

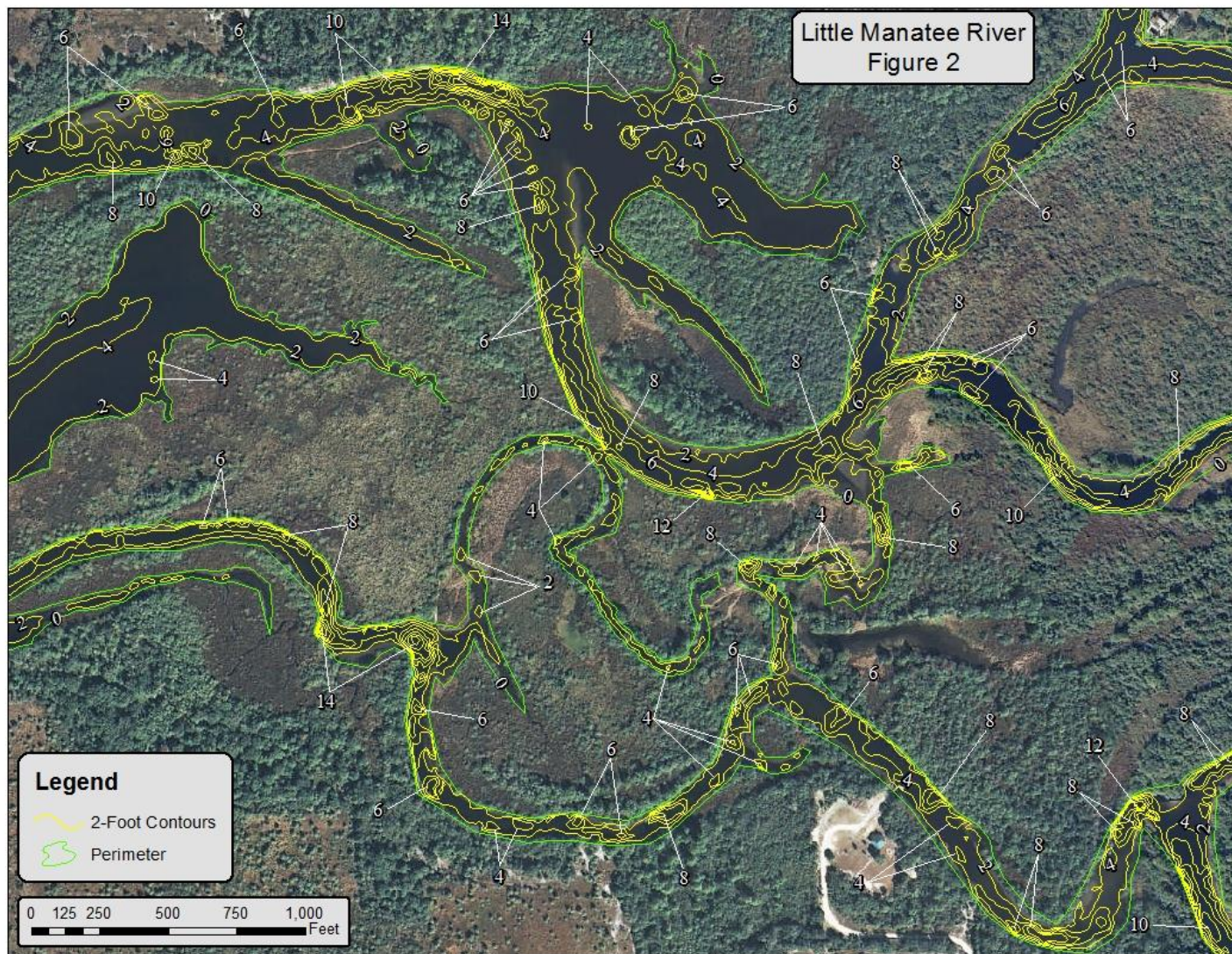


Figure 4 2014 2-Foot Bathymetric Contour Map for Little Manatee River Figure 2

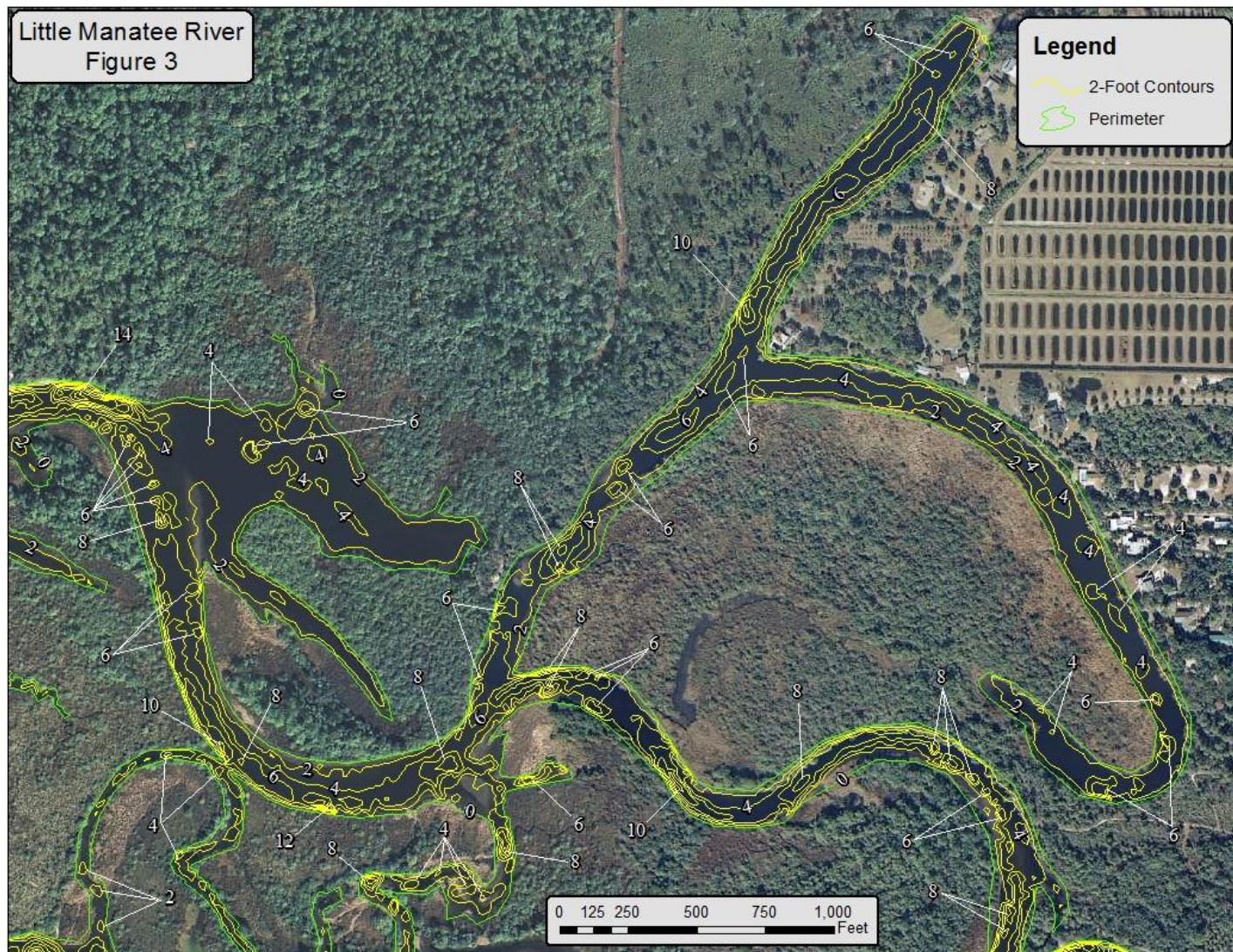


Figure 5 2014 2-Foot Bathymetric Contour Map for Little Manatee River Figure 3

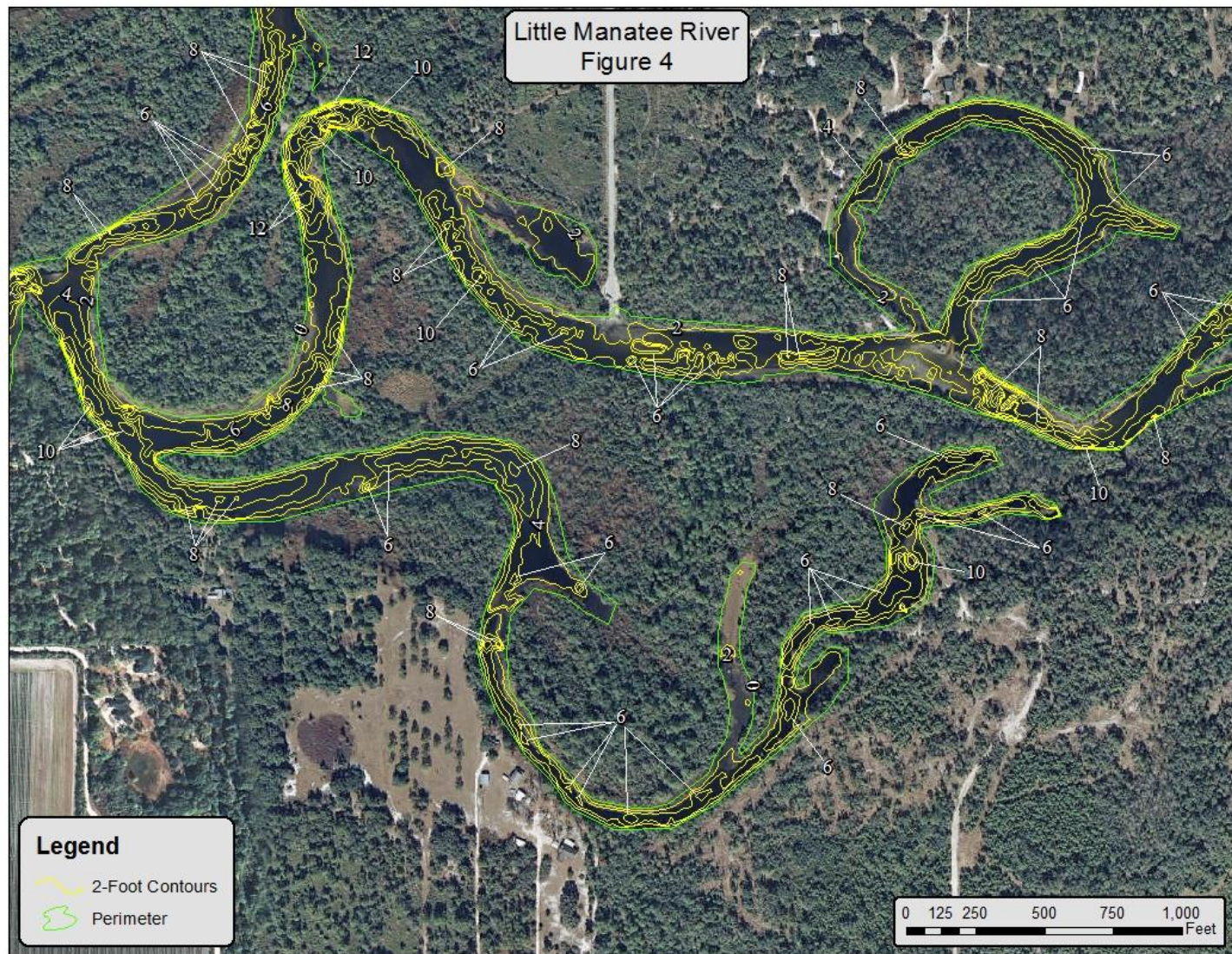


Figure 6 2014 2-Foot Bathymetric Contour Map for Little Manatee River Figure 4

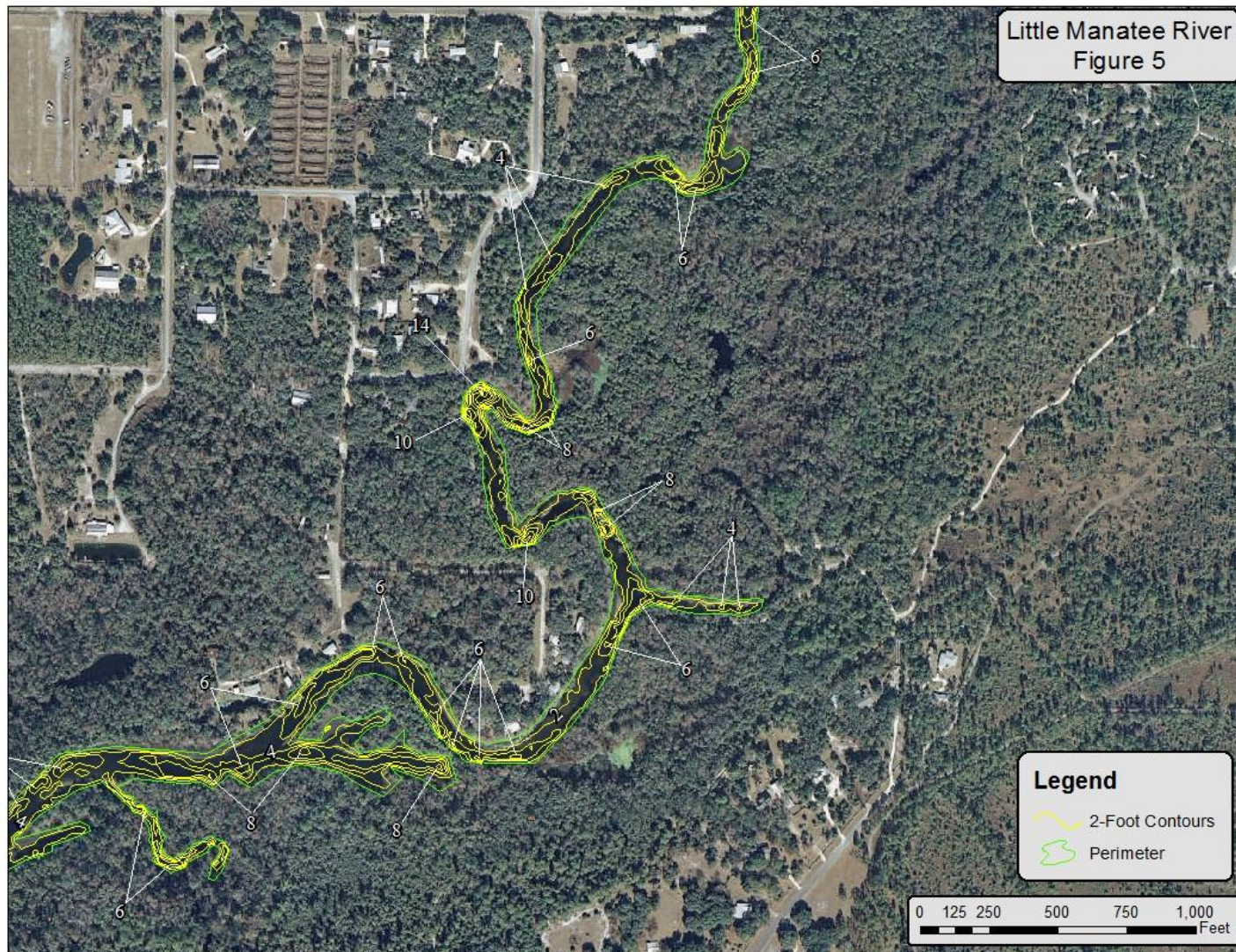


Figure 7 2014 2-Foot Bathymetric Contour Map for Little Manatee River Figure 5

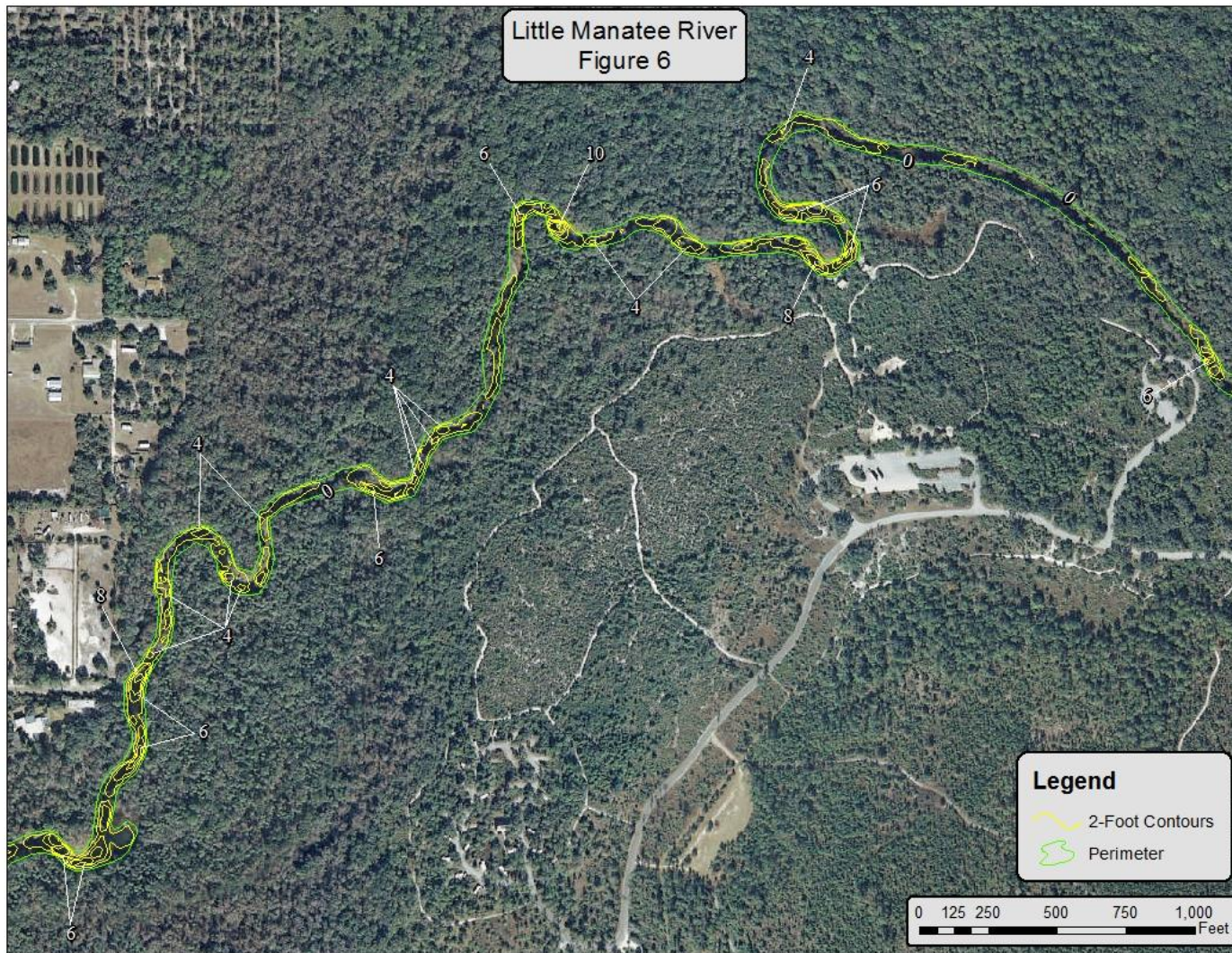


Figure 8 2014 2-Foot Bathymetric Contour Map for Little Manatee River Figure 6

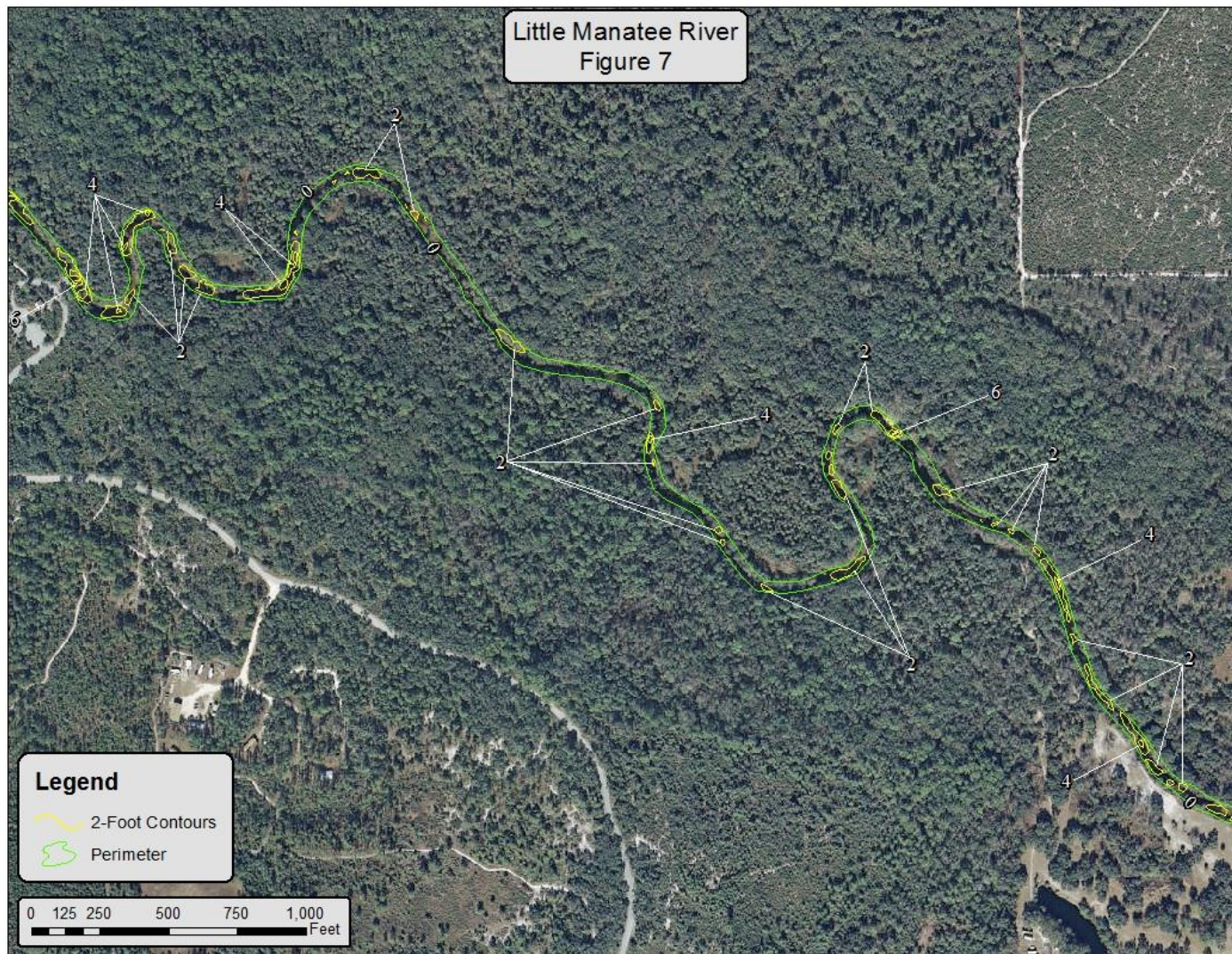


Figure 9 2014 2-Foot Bathymetric Contour Map for Little Manatee River Figure 7

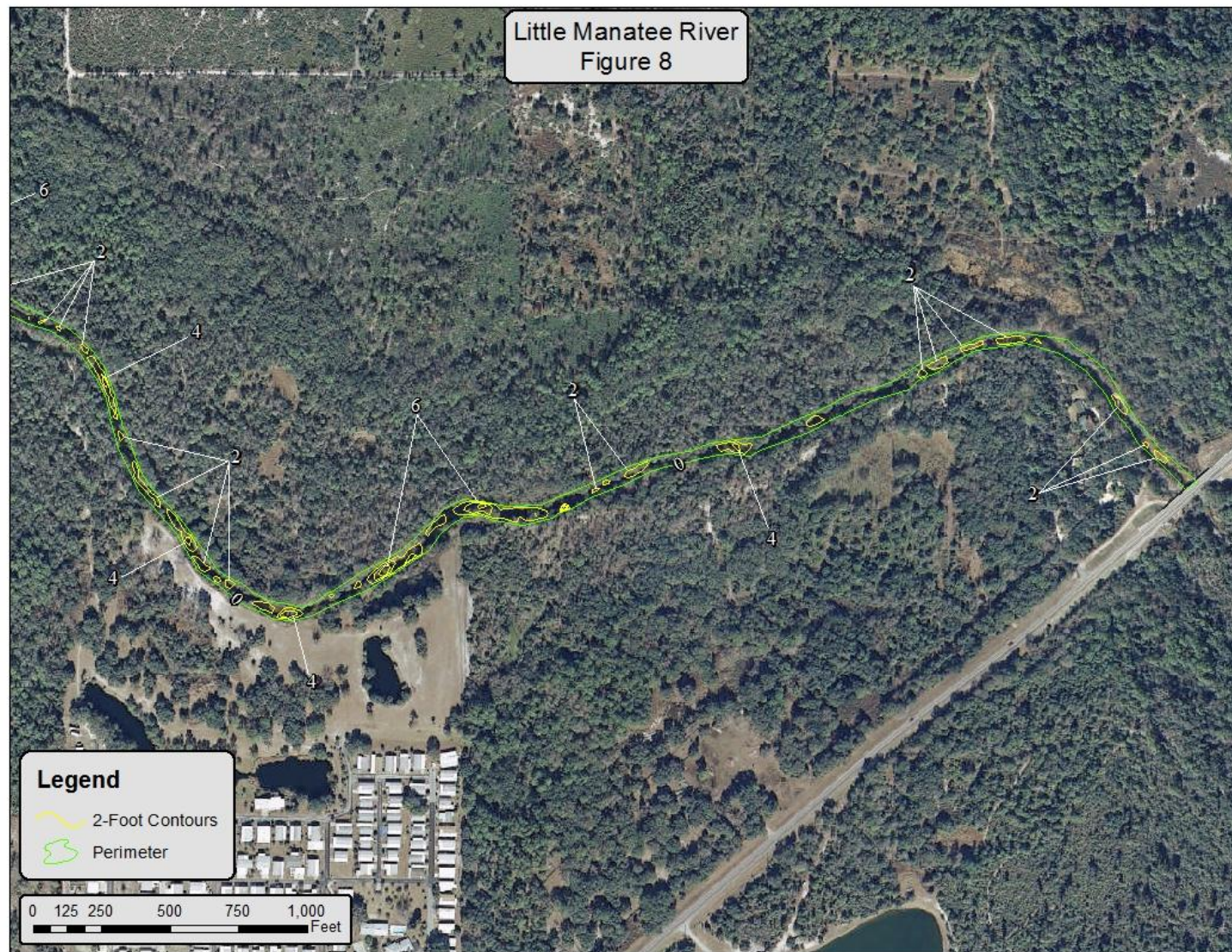


Figure 10 2014 2-Foot Bathymetric Contour Map for Little Manatee River Figure 8

Section 2: Stream Ecology (Vegetation)

The stream's apparent vegetative cover and shoreline detail are evaluated using the latest stream aerial photograph as shown in and by use of WAAS-enabled GPS. Submerged vegetation is determined from the analysis of bottom returns from the Lowrance HDS 5 combined GPS/fathometer described earlier. As depicted in Figure 11, 85 vegetation regions have been assessed for in ~250 meter regions measured from the center of the stream. The vegetation assessment regions are set up from the downstream extent and work to the upstream extent. The region beginning and ending points are set using GPS and then loaded into a GIS mapping program (ArcGIS) for display. Each region is sampled in the three primary vegetative zones (emergent, submerged and floating)^{iv}. The latest high resolution aerial photos are used to provide shore details (docks, structures, vegetation zones) and to calculate the extent of surface vegetation coverage. The primary indices of submerged vegetation cover and biomass for the stream, percent area coverage (PAC) and percent volume inhabited (PVI), are determined by transiting the stream by boat and employing a fathometer to collect "hard and soft return" data. These data are later analyzed for presence and absence of vegetation and to determine the height of vegetation if present. The PAC is determined from the presence and absence analysis of 100 sites in the stream and the PVI is determined by measuring the difference between hard returns (stream bottom) and soft returns (top of vegetation) for sites (within the 100 analyzed sites) where plants are determined present.

The data collected during the site vegetation sampling include vegetation type, exotic vegetation, predominant plant species and submerged vegetation biomass. The total number of species from all sites is used to approximate the total diversity of aquatic plants and the percent of invasive-exotic plants on the stream (

^{iv} See end note 3.

Table 2). The Watershed value in Table 2 only includes lakes and streams sampled during the lake and stream assessment project begun in May of 2006. These data will change as additional lakes and streams are sampled.

Table 3 through Table 5 details the results from the 2014 aquatic plant assessment for the stream. These data are determined from the 85 sites used for intensive vegetation surveys. The tables are divided into Floating Leaf, Emergent and Submerged plants and contain the plant code, species, common name and presence (indicated by a 1) or absence (indicated by a blank space) of species and the calculated percent occurrence (number sites species is found/number of sites) and type of plant (Native, Non-Native, Invasive, Pest). In the "Type" category, the codes N and E0 denote species native to Florida. The code E1 denotes Category I invasive species, as defined by the [Florida Exotic Pest Plant Council](#) (FLEPPC); these are species "that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives." The code E2 denotes Category II invasive species, as defined by FLEPPC; these species "have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species." Use of the term invasive indicates the plant is commonly considered invasive in this region of Florida. The term "pest" indicates a plant (native or non-native) that has a greater than 55% occurrence in the stream and is also considered a problem plant for this region of Florida, or is a non-native invasive that is or has the potential to be a problem plant in the stream and has at least 40% occurrence. These two terms are somewhat subjective; however, they are provided to give stream property owners some guidance in the management of plants on their property. Please remember that to remove or control plants in a wetland (stream shoreline) in Hillsborough County the property owner must secure an [Application To Perform Miscellaneous Activities In Wetlands](#) permit from the [Environmental Protection Commission of Hillsborough County](#) and for management of in-stream vegetation outside the wetland fringe (for streams with an area greater than ten acres), the property owner must secure a [Florida Department of Environmental Protection Aquatic Plant Removal Permit](#).

Table 2. Total Diversity, Percent Exotics, and Number of Pest Plant Species

Parameter	Stream	Watershed
Number of Vegetation Assessment Sites	85	114
Total Plant Diversity (# of Taxa)	129	159
% Non-Native Plants	17	26
Total Pest Plant Species	1	2

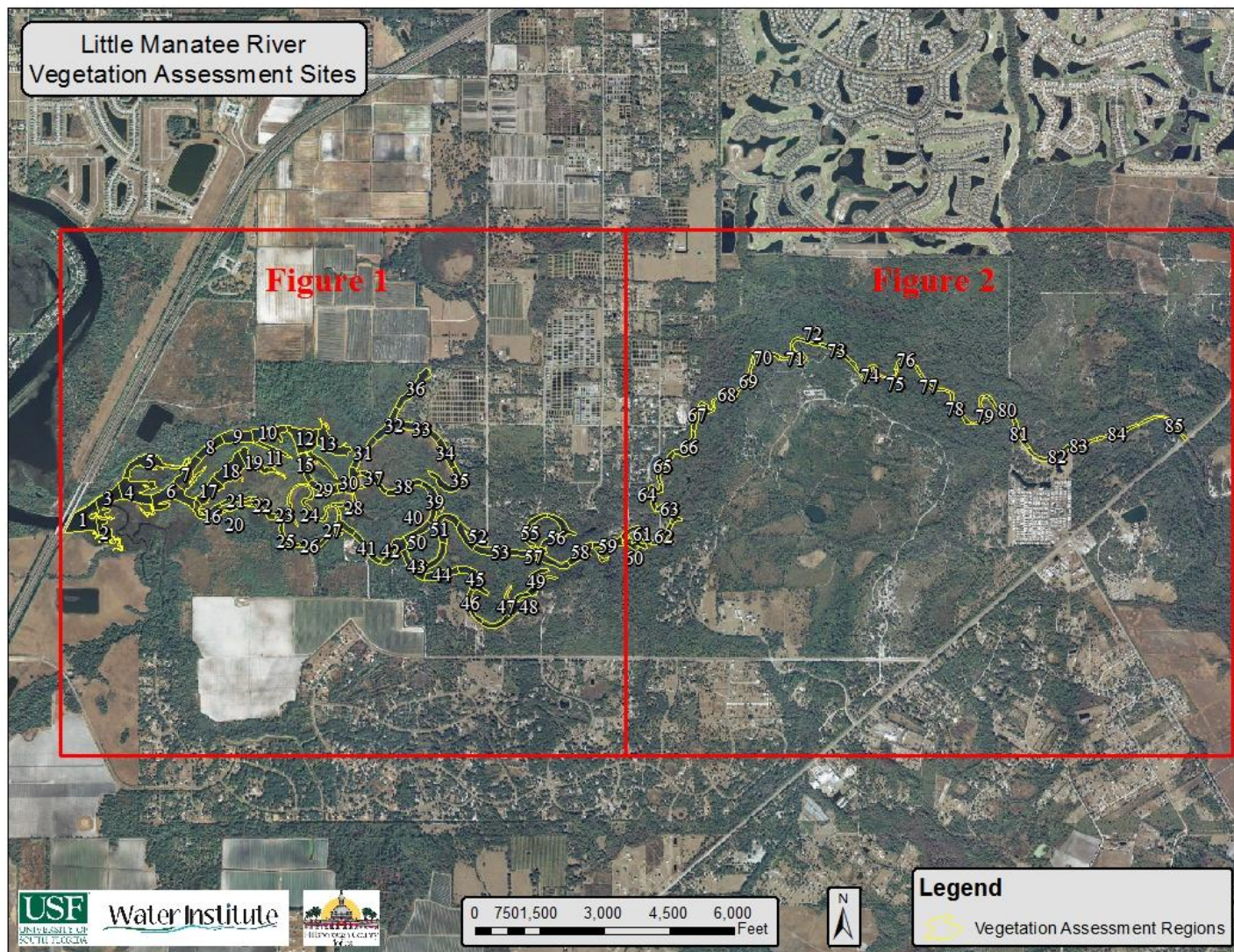


Figure 11. 2014 Vegetation Assessment Region Overview Map for the Little Manatee River

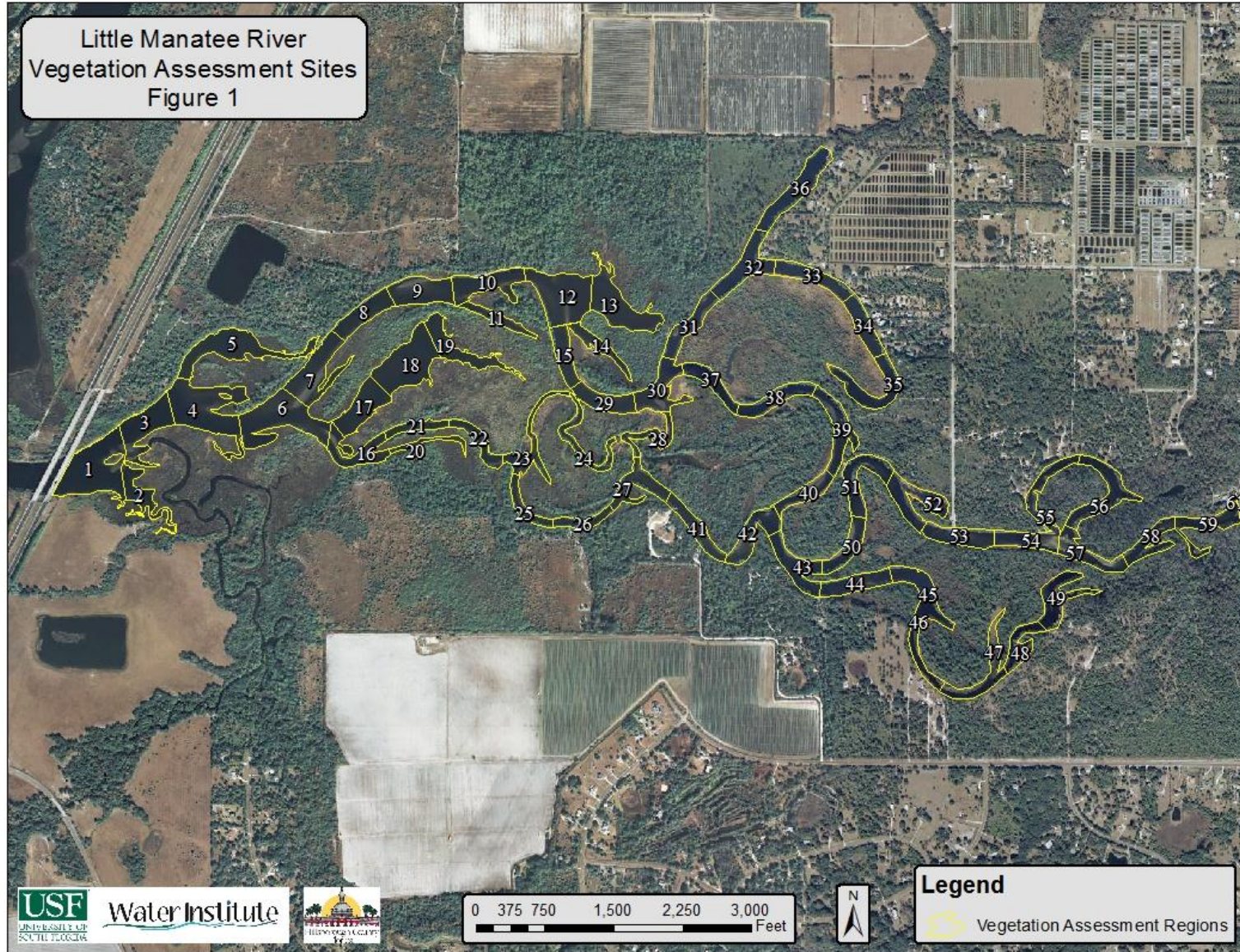


Figure 12 2014 Vegetation Assessment Region Overview Map for the Little Manatee River Figure 1

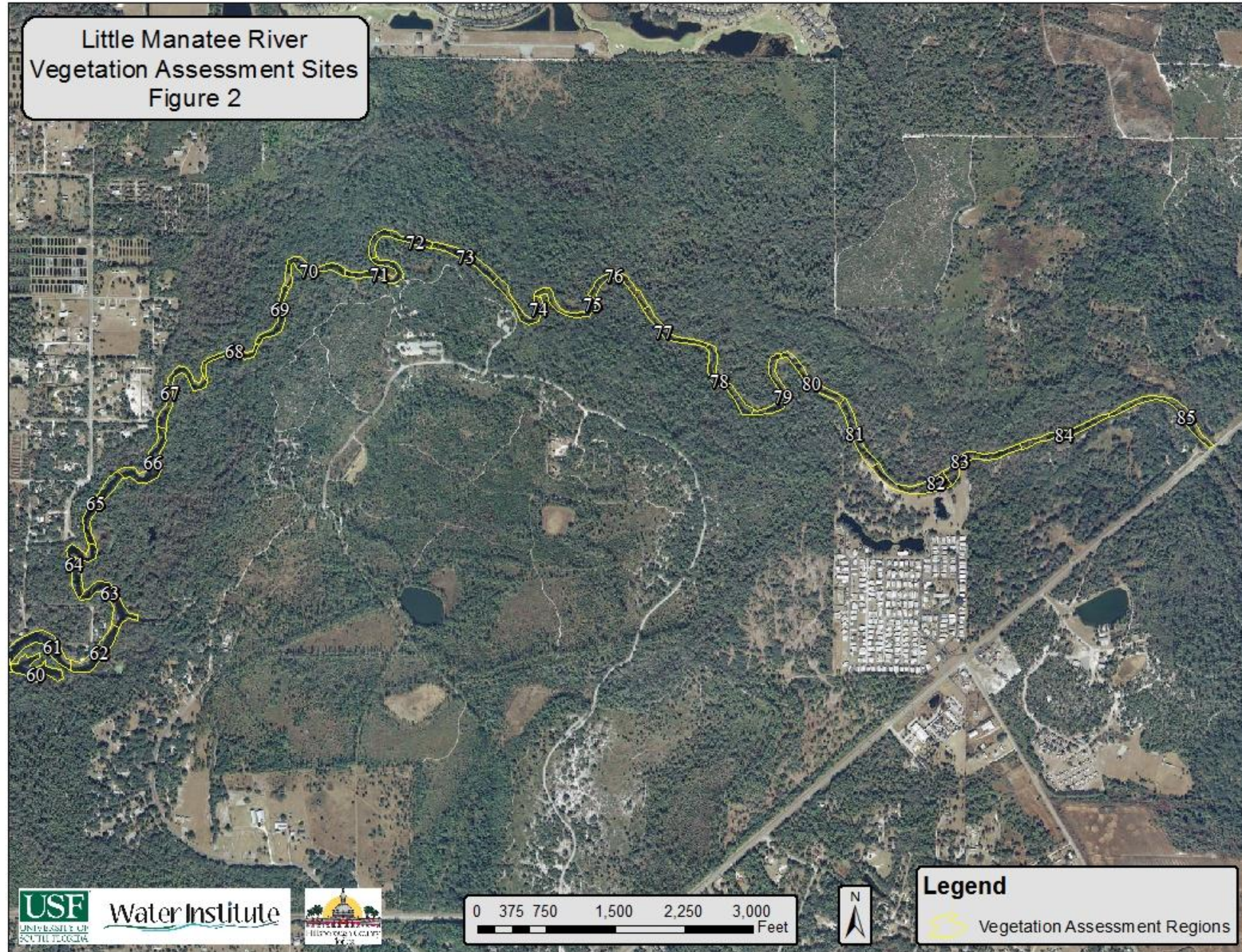


Figure 13 2014 Vegetation Assessment Region Overview Map for the Little Manatee River Figure 2

Table 3. List of Floating Leaf Zone Aquatic Plants Found

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
NLM	<i>Nuphar advena</i>	Spatterdock, Yellow Pondlily	34%	N, E0
LEN	<i>Lemna spp.</i>	Duckweed	24%	N, E0
SMA	<i>Salvinia minima</i>	Water Spangles, Water Fern	15%	E1



Figure 14. Spatterdock, *Nuphar advena*, in the freshwater portions of the Little Manatee River

Table 4. List of Emergent Zone Aquatic Plants Found

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
APS	<i>Alternanthera philoxeroides</i>	Alligator Weed	83%	E2
ADM	<i>Acrostichum danaeifolium</i>	Giant Leather Fern	75%	N, E0
CAM	<i>Crinum americanum</i>	Swamp lily	75%	N, E0
WAX	<i>Myrica cerifera</i>	Southern Bayberry; Wax Myrtle	68%	N, E0
BMA	<i>Urochloa mutica</i>	Para Grass	67%	E1
BHA	<i>Baccharis halimifolia</i>	Groundsel Tree; Sea Myrtle	65%	N, E0
ACS	<i>Symphyotrichum carolinianum</i>	Climbing Aster	64%	N, E0
DBA	<i>Dioscorea bulbifera</i>	Air Potato	62%	E1, P
TYP	<i>Typha spp.</i>	Cattails	61%	N, E0
CJE	<i>Cladium jamaicense</i>	Jamaica Swamp Saw Grass	60%	N, E0
HYE	<i>Hydrocotyle umbellata</i>	Manyflower Marshpennywort, Water Pennywort	60%	N, E0
RVS	<i>Rumex verticillatus</i>	Swamp Dock	57%	N, E0
SPO	<i>Sabal palmetto</i>	Sabal Palm, Cabbage Palm	57%	N, E0
STS	<i>Schinus terebinthifolius</i>	Brazilian Pepper	56%	E1
VRA	<i>Vitis rotundifolia</i>	Muscadine Grape	56%	N, E0
JRO	<i>Juncus roemerianus</i>	Needle Rush, Black Rush	55%	N, E0
AAS	<i>Amaranthus australis</i>	Southern Water Hemp	55%	N, E0
PRA	<i>Pluchea baccharis</i>	Rosy Camphorweed	54%	N, E0
SRS	<i>Serenoa repens</i>	Saw Palmetto	52%	N, E0
PBA	<i>Persea borbonia</i>	Redbay	52%	N,

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
				E0
JVA	<i>Juniperus virginiana</i>	Red cedar	51%	N, E0
PHS	<i>Polygonum hydropiperoides</i>	Mild Waterpepper; Swamp Smartweed	51%	N, E0
QGA	<i>Quercus geminata</i>	Sand Live Oak	51%	N, E0
QLA	<i>Quercus laurifolia</i>	Laurel Oak; Diamond Oak	51%	N, E0
CMA	<i>Cicuta maculata var. mexicana</i>	Spotted Water Hemlock	49%	N, E0
PIN	<i>Pinus spp.</i>	Pine Tree	47%	N, E0
LPA	<i>Ludwigia peruviana</i>	Peruvian Primrosewillow	45%	E1
SCV	<i>Schoenoplectus tabernaemontani</i>	Soft-stem Bulrush	43%	N, E0
ACE	<i>Acer rubrum</i>	Southern Red Maple	41%	N, E0
COS	<i>Cephalanthus occidentalis</i>	Buttonbush	40%	N, E0
LIQ	<i>Liquidambar styraciflua</i>	Sweetgum	37%	N, E0
BLS	<i>Blechnum serrulatum</i>	Swamp fern, Toothed Midsorus Fern	36%	N
RF	<i>Osmunda regalis var. spectabilis</i>	Royal Fern	34%	N, E0
SLA	<i>Sagittaria lancifolia</i>	Duck Potato	32%	N, E0
ICE	<i>Ilex cassine</i>	Dahoon Holly	32%	N, E0
PCA	<i>Pontederia cordata</i>	Pickereel Weed	31%	N, E0
BOC	<i>Boehmeria cylindrica</i>	Bog Hemp, False Nettle	31%	N, E0
PPA	<i>Physostegia purpurea</i>	Eastern False Dragonhead	31%	N, E0
QNA	<i>Quercus nigra</i>	Water Oak	30%	N,

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
				E0
SPB	<i>Spartina bakeri</i>	Sand Cordgrass	30%	N, E0
CEA	<i>Colocasia esculenta</i>	Wild Taro	30%	E1
FCA	<i>Fraxinus caroliniana</i>	Carolina Ash, Water Ash, Pop Ash	30%	N, E0
MSS	<i>Mikania scandens</i>	Climbing Hempvine	25%	N, E0
AAA	<i>Ampelopsis arborea</i>	Peppervine	25%	N, E0
SCA	<i>Salix caroliniana</i>	Carolina Willow	25%	N, E0
PQA	<i>Parthenocissus quinquefolia</i>	Virginia Creeper, Woodbine	24%	N, E0
CYD	<i>Cyperus distinctus</i>	Swamp Flatsedge	24%	N, E0
BAA	<i>Bidens alba</i>	White Beggar-ticks, Romerillo	22%	N, E0
OCA	<i>Osmunda cinnamomea</i>	Cinnamon Fern	20%	N, E0
PRS	<i>Panicum repens</i>	Torpedo Grass	20%	E1
RZM	<i>Rhizophora mangle</i>	Red Mangrove	18%	N, E0
ULA	<i>Urena lobata</i>	Caesar's-weed	18%	E1
QVA	<i>Quercus virginiana</i>	Virginia Live Oak	17%	N, E0
SAM	<i>Sambucus nigra subsp. Canadensis</i>	Elderberry	17%	N, E0
SMI	<i>Smilax spp.</i>	Catbriar, Greenbriar	17%	N, E0
EUP	<i>Eupatorium capillifolium</i>	Dog Fennel	15%	N, E0
CYO	<i>Cyperus odoratus</i>	Fragrant Flatsedge	15%	N, E0
PAN	<i>Panicum spp.</i>	Panic Grasses	14%	E0
PDF	<i>Polygonum glabrum</i>	Denseflower Knotweed	14%	N,

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
				E0
SAC	<i>Sacciolepis striata</i>	American Cupscale	14%	N, E0
TRS	<i>Toxicodendron radicans</i>	Poison Ivy	14%	N, E0
PMM	<i>Panicum maximum</i>	Guineagrass	11%	E0
RBA	<i>Ruellia simplex</i>	Britton's Wild Petunia	11%	E1
PCM	<i>Ptilimnium capillaceum</i>	Mock Bishopsweed; Herbwilliam	11%	N, E0
EWI	<i>Echinochloa walteri</i>	Coast Cockspur Grass (hairy)	11%	N, E0
HCI	<i>Hypoxis curtissii</i>	Swamp Stargrass, Common Yellow Stargrass	10%	N, E0
MVA	<i>Magnolia virginiana</i>	Sweetbay Magnolia	10%	N, E0
CAL	<i>Callicarpa americana</i>	Beautyberry	9%	N, E0
SOL	<i>Solidago spp.</i>	Goldenrod	9%	N, E0
TDM	<i>Taxodium distichum</i>	Bald Cypress	9%	N, E0
TAS	<i>Taxodium ascendens</i>	Pond Cypress	8%	N, E0
CRS	<i>Campsis radicans</i>	Trumpet Vine	8%	N, E0
PAS	<i>Phragmites australis</i>	Common Reed	8%	N, E0
ENC	<i>Encyclia tampensis</i>	Florida Butterfly Orchid	8%	N, E0
WTA	<i>Sphagneticola trilobata</i>	Creeping Oxeye; Wedelia	7%	E2
TRD	<i>Tripsacum dactyloides</i>	Eastern Gama Grass	7%	N, E0
DEM	<i>Dalbergia ecastaphyllum</i>	Coinvine	5%	N, E0
CAT	<i>Cyperus articulatus</i>	Jointed Flatsedge	4%	N, E0

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
BAM	<i>Bambusa spp.</i>	Bamboo	4%	E0
EAA	<i>Eclipta alba</i>	Yerba De Tajo	4%	N, E0
NEA	<i>Nephrolepis exaltata</i>	Sword Fern, Wild Boston Fern	4%	N, E0
SAU	<i>Saururus cernuus</i>	Lizard's Tail	4%	N, E0
PGA	<i>Psidium guajava</i>	Guava	4%	E1
LRS	<i>Ludwigia repens</i>	Creeping Primrosewillow, Red Ludwigia	3%	N, E0
ENT	<i>Enterolobium contortisiliquum</i>	Earpod Tree	3%	E2
ICA	<i>Imperata cylindrica</i>	Cogon Grass	3%	E1
HSP	<i>Hymenocallis henryae</i>	Henry's Spiderlily, Green Spiderlily	3%	N, E0
CLU	<i>Carex lupuliformis</i>	False Hop Sedge	3%	N, E0
DSA	<i>Distichlis spicata</i>	Saltgrass	3%	N, E0
CLW	<i>Coreopsis leavenworthii</i>	Leavenworth's Tickseed	2%	N, E0
BAF	<i>Baccharis angustifolia</i>	Saltwater Falsewillow	2%	N, E0
AAF	<i>Ambrosia artemisiifolia</i>	Common Ragweed	2%	N, E0
AVS	<i>Andropogon virginicus var. glaucus</i>	Broomsedge Bluestem, Chalky Bluestem	2%	N, E0
HTM	<i>Hypericum tetrapetalum</i>	Fourpetal St. John's-Wort	2%	N, E0
IPO	<i>Ipomoea spp.</i>	Morning Glory	2%	E0
IRI	<i>Iris spp.</i>	Flag	2%	E0
ITE	<i>Itea virginica</i>	Virginia Willow; Virginia Sweetspire	2%	N, E0
CIS	<i>Cyperus involucratus</i>	Umbrella Flat Sedge	2%	E2
HFM	<i>Hypericum fasciculatum</i>	Sandweed, Peelbark St. John's-wort	2%	N, E0
JUM	<i>Juncus marginatus</i>	Shore Rush, Grassleaf Rush	2%	N,

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
				E0
PUI	<i>Paspalum urvillei</i>	Vaseygrass	2%	E0
SAB	<i>Sabatia spp.</i>	Rosegentians	2%	N, E0
THA	<i>Thelypteris spp.</i>	Shield ferns	2%	N, E0
SPM	<i>Syngonium podophyllum</i>	Nephthytis, Arrowhead Vine, American Evergreen	2%	E1
SCI	<i>Scirpus spp.</i>	Sedge	1%	E0
SCS	<i>Oxycaryum cubense</i>	Burhead Sedge, Cuban Scirpus, Cuban Bulrush	1%	E0
SLT	<i>Sagittaria latifolia</i>	Wapato, Common Arrowhead, Broadleaf Arrowhead, Duck Potato	1%	N, E0
RUB	<i>Rubus spp.</i>	Sawtooth Blackberry, Dewberry	1%	E0
RCA	<i>Rhynchospora corniculata</i>	Horned Beak Rush	1%	N, E0
PHN	<i>Panicum hemitomom</i>	Maidencane	1%	N, E0
LCA	<i>Lachnanthes caroliana</i>	Carolina Redroot	1%	N, E0
LJM	<i>Lygodium japonicum</i>	Japanese Climbing Fern	1%	E1
LLA	<i>Ludwigia leptocarpa</i>	Anglestem Primrosewillow	1%	N, E0
NSP	<i>Nasturium spp.</i>	Water-Cresses	1%	E0
JES	<i>Juncus effusus subsp. Solutus</i>	Soft Rush	1%	N, E0
AIA	<i>Aeschynomene indica</i>	Indian Jointvetch	1%	E0
AJN	<i>Albizia julibrissin</i>	Silk Tree, Mimosa	1%	E1
BFS	<i>Borrchia frutescens</i>	Bushy Seaside Oxeye	1%	N, E0
CFO	<i>Cornus foemina</i>	Swamp Dogwood, Stiff Dogwood	1%	N, E0
CAQ	<i>Carya aquatica</i>	Water Hickory	1%	N, E0
COE	<i>Conocarpus erectus</i>	Buttonwood	1%	N, E0
COM	<i>Commelina spp.</i>	Dayflower	1%	N, E0



Figure 15. Red Mangrove, *Rhizophora mangle*, and Swamp Lily, *Crinum americanum*, near Interstate 75.

Table 5. List of Submerged Zone Aquatic Plants Found.

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
HVA	<i>Hydrilla verticillata</i>	Hydrilla, waterthyme	8%	E1
MUM	<i>Micranthemum umbrosum</i>	Shade Mudflower, Baby's Tears	3%	N, E0
BMI	<i>Bacopa monnieri</i>	Common Bacopa	3%	N, E0
EBI	<i>Eleocharis baldwinii</i>	Baldwin's Spikerush, Roadgrass	3%	N, E0



Figure 16. Vegetation of the upper portions of the study area on the Little Manatee River

Table 6. List of All Plants and Sample Sites

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Alligator Weed	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,17,18,19,20,22,23,24,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,54,55,56,58,59,60,61,62,63,64,65,66,76,77,78,79,80,81,82,83,84,85	83	Emergent
Giant Leather Fern	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,65	75	Emergent
Swamp lily	1,2,3,4,5,6,7,8,9,10,12,15,18,19,20,22,23,24,25,27,28,29,30,31,32,35,36,38,40,41,45,46,47,48,49,52,55,56,57,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,84,85	75	Emergent
Southern Bayberry; Wax Myrtle	1,3,4,5,6,7,8,9,10,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,56,57,58,59,60,61,65,71	68	Emergent
Para Grass	1,2,4,8,11,12,14,16,18,20,24,27,28,29,30,33,34,35,41,42,43,44,45,46,47,48,49,50,51,52,53,54,56,57,58,59,60,63,64,65,67,68,69,70,71,72,74,75,76,77,79,80,81,82,83,84,85	67	Emergent
Groundsel Tree; Sea Myrtle	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,50,51,52,53,55,56,58,60	65	Emergent
Climbing Aster	2,4,8,11,13,17,18,19,23,24,25,26,27,28,32,33,34,35,36,38,39,40,42,43,44,45,46,47,48,52,53,54,55,56,57,58,59,60,61,62,65,66,67,68,69,70,71,72,73,74,75,76,77,78,80	64	Emergent
Air Potato	13,14,26,27,28,29,30,34,35,36,39,40,41,42,43,44,45,48,49,50,51,52,53,54,55,56,57,58,59,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84	62	Emergent
Cattails	1,2,3,4,5,6,7,8,9,10,11,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,40,42,43,44,45,46,47,48,49,50,51,52,54,59,62,66	61	Emergent
Jamaica Swamp Saw Grass	3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,47,48,49,50,51,52,56,60	60	Emergent
Manyflower Marshpenn wort, Water Pennywort	5,10,15,16,17,18,19,20,22,23,24,25,27,30,33,40,41,43,45,47,48,49,52,53,54,55,57,58,59,60,61,62,63,64,66,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85	60	Emergent
Sabal Palm, Cabbage	1,2,4,5,6,7,8,9,10,16,20,21,25,26,29,31,32,33,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,55,56,57,58,59,60,62,63,64,65,68,70,72	57	Terrestrial

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Palm			
Swamp Dock	8,21,24,25,26,27,28,32,37,39,40,45,46,47,48,49,50,52,53,54,56,57,58,59,60,61,62,63,64,65,66,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85	57	Emergent
Brazilian Pepper	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,50,51,53	56	Emergent
Muscadine Grape	1,5,8,12,13,14,15,16,17,20,24,25,26,27,41,42,43,44,45,46,47,48,51,53,55,56,58,59,60,61,62,63,64,65,66,68,69,70,71,72,73,74,75,76,77,78,79,80	56	Emergent
Needle Rush, Black Rush	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,48,50,52,53	55	Emergent
Southern Water Hemp	1,7,8,9,10,11,12,13,14,15,16,19,20,21,22,23,24,25,26,32,36,37,38,39,40,42,43,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,63,65,67	55	Emergent
Rosy Camphorweed	4,7,10,11,13,14,16,19,20,23,24,25,26,27,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,52,53,54,55,56,57,58,59,61,67,70	54	Emergent
Redbay	5,8,9,13,15,23,24,25,26,27,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,66	52	Emergent
Saw Palmetto	1,2,3,4,5,6,7,8,9,10,16,20,25,26,31,32,33,36,40,41,42,43,44,45,46,47,48,49,50,51,52,53,55,56,57,58,59,60,65,70,71,72,73,74,75	52	Terrestrial
Laurel Oak; Diamond Oak	41,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85	51	Emergent
Mild Waterpepper; Swamp Smartweed	11,13,32,33,34,35,38,39,41,42,43,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,80,82	51	Emergent
Red cedar	1,4,7,9,10,11,14,15,16,20,21,23,24,25,26,27,28,29,30,31,32,35,37,38,39,40,41,42,45,46,48,49,50,51,52,54,55,56,57,58,59,60,61,65	51	Terrestrial
Sand Live Oak	1,2,3,4,5,6,7,8,9,10,11,15,16,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50	51	Terrestrial
Spotted	1,23,27,32,33,34,35,37,38,39,41,42,43,44,45,46,47,48,49,50,51,52,54,55,56,57,58,59,60,61,62,63,64,65	49	Emergent

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Water Hemlock	,66,67,68,70,72,74,75,79		
Pine Tree	3,4,5,6,7,8,9,10,11,15,20,25,26,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,54,65,69,71,72,73,74	47	Emergent
Peruvian Primrosewillow	28,40,42,43,45,48,49,50,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,79,81,83,84,85	45	Emergent
Soft-stem Bulrush	1,2,3,5,6,7,8,9,14,16,20,23,24,25,27,28,31,33,36,37,39,40,41,43,46,47,48,49,50,51,52,53,54,56,57,58,59	43	Emergent
Southern Red Maple	12,15,24,27,28,32,33,34,35,38,39,40,45,48,49,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,85	41	Emergent
Buttonbush	31,47,48,49,52,53,55,56,57,59,60,61,62,63,64,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85	40	Emergent
Sweetgum	24,40,41,43,50,51,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,82,83	37	Emergent
Swamp fern, Toothed Midsorus Fern	5,22,24,25,26,27,28,31,32,37,39,41,43,44,45,46,47,48,49,50,51,52,55,56,57,58,60,61,63,64,65	36	Emergent
Royal Fern	5,23,24,33,34,35,36,37,39,40,43,45,46,48,49,50,51,52,55,56,57,58,60,61,62,63,64,66,70	34	Emergent
Spatterdock, Yellow Pondlily	27,44,46,47,48,49,53,54,55,56,57,58,59,60,61,62,63,64,65,66,68,69,70,71,72,73,74,81,82	34	Floating
Dahoon Holly	31,32,36,38,39,41,42,43,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,77	32	Emergent
Duck Potato	5,27,32,33,34,35,36,37,39,41,45,46,47,48,49,50,51,52,54,55,56,57,58,59,60,61,62,63	32	Emergent
Bog Hemp, False Nettle	34,35,36,41,42,43,44,45,51,52,53,54,55,58,59,60,63,64,65,66,68,69,74,77,78,79,80	31	Emergent
Eastern False Dragonhea	19,51,57,59,61,62,63,64,65,66,67,69,70,71,72,73,74,75,76,77,78,80,81,82,83,84,85	31	Emergent

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
d			
Pickereel Weed	7,26,32,33,38,43,45,46,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66	31	Emergent
Carolina Ash, Water Ash, Pop Ash	55,57,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85	30	Emergent
Sand Cordgrass	1,4,6,7,8,11,13,17,18,19,21,22,24,27,29,31,32,33,34,35,36,37,38,39,41,55	30	Terrestrial
Water Oak	5,32,55,60,61,62,63,64,65,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84	30	Emergent
Wild Taro	33,41,45,52,53,54,55,57,59,61,62,63,64,65,66,67,68,70,71,74,75,76,78,79,83,84	30	Emergent
Carolina Willow	1,3,52,59,65,68,69,70,71,72,73,75,76,77,78,79,80,81,82,83,84,85	25	Emergent
Climbing Hempvine	14,19,24,25,35,36,40,44,46,47,48,49,50,52,53,56,57,60,69,71,72,81	25	Emergent
Peppervine	13,23,24,27,28,38,39,40,41,42,43,45,48,49,50,51,54,56,57,60,61,68	25	Emergent
Duckweed	2,3,11,18,19,23,24,25,27,31,32,40,51,52,53,54,81,82,83,84,85	24	Floating
Swamp Flatsedge	16,26,27,28,31,32,37,44,45,46,47,48,49,50,51,52,55,56,57,60,62	24	Emergent
Virginia Creeper, Woodbine	5,21,24,25,26,27,32,35,36,37,39,41,42,43,46,50,53,56,57,60,68	24	Emergent
White Beggar- ticks, Romerillo	1,33,34,35,36,41,42,43,64,70,71,72,73,74,76,79,80,82,85	22	Terrestrial
Cinnamon Fern	35,39,46,49,56,60,61,62,63,64,66,67,71,72,73,75,82	20	Emergent
Torpedo Grass	1,16,22,29,34,36,39,41,51,57,66,72,74,75,78,79,80	20	Emergent
Caesar's- weed	1,51,60,61,63,65,66,70,71,73,74,75,76,79,80,85	18	Emergent

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Red Mangrove	1,2,3,4,5,6,7,8,10,16,20,21,23,24,35,37	18	Terrestrial
Catbriar, Greenbriar	39,43,50,51,66,67,71,72,73,74,75,76,78,79,80	17	Emergent
Elderberry	11,13,19,27,31,32,34,35,36,40,45,46,52,54,63	17	Emergent
Virginia Live Oak	21,51,53,54,55,56,57,58,59,60,61,62,63,64,66	17	Terrestrial
Dog Fennel	10,25,26,27,38,41,42,43,51,64,65,66,71	15	Emergent
Fragrant Flatsedge	24,27,31,34,35,36,37,39,48,49,51,76,83	15	Emergent
Water Spangles, Water Fern	11,18,19,27,39,43,51,52,58,61,62,63,64	15	Floating
American Cupscale	74,75,76,77,78,79,80,81,82,83,84,85	14	Emergent
Denseflower Knotweed	70,73,74,75,76,77,78,79,80,81,82,83	14	Emergent
Panic Grasses	73,74,75,76,77,78,79,80,81,83,84,85	14	Emergent
Poison Ivy	31,35,46,47,48,50,60,67,70,71,75,78	14	Emergent
Britton's Wild Petunia	61,62,76,77,78,79,80,83,84,85	11	Terrestrial
Coast Cockspur Grass (hairy)	28,51,61,66,67,68,69,71,78,81	11	Emergent
Guineagrass	72,74,75,78,79,80,81,83,84,85	11	Terrestrial
Mock Bishopsweed;	25,42,51,52,61,63,66,67,68,70	11	Emergent

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Herbwilliam			
Swamp Stargrass, Common Yellow Stargrass	72,74,76,77,78,79,83,84,85	10	Emergent
Sweetbay Magnolia	34,46,48,49,50,51,55,56,60	10	Emergent
Bald Cypress	9,32,33,49,51,65,66,68	9	Emergent
Beautyberry	31,32,33,34,35,36,60,72	9	Emergent
Goldenrod	11,22,23,32,37,40,41,51	9	Emergent
Common Reed	3,6,7,9,10,13,31	8	Emergent
Florida Butterfly Orchid	24,28,55,58,60,73,80	8	Emergent
Hydrilla, waterthyme	79,80,81,82,83,84,85	8	Submersed
Pond Cypress	9,37,51,56,57,61,66	8	Emergent
Trumpet Vine	66,68,69,73,75,77,81	8	Emergent
Creeping Oxeye; Wedelia	32,51,56,76,79,85	7	Emergent
Eastern Gama Grass	51,54,58,60,65,73	7	Emergent
Coinvine	1,3,5,7,8	5	Terrestrial
Bamboo	32,33,51,61	4	Emergent

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Guava	47,49,51,54	4	Emergent
Jointed Flatsedge	32,45,52,62	4	Emergent
Lizard's Tail	81,82,83,84	4	Emergent
Sword Fern, Wild Boston Fern	10,34,35,36	4	Terrestrial
Yerba De Tajo	61,66,67,83	4	Emergent
Baldwin's Spikerush, Roadgrass	2,50,51	3	Submerse d
Cogon Grass	34,61,71	3	Terrestrial
Common Bacopa	4,7,83	3	Submerse d
Creeping Primrosewil low, Red Ludwigia	78,84,85	3	Emergent
Earpod Tree	48,49,63	3	Emergent
False Hop Sedge	54,56,62	3	Emergent
Henry's Spiderlily, Green Spiderlily	61,67,70	3	Emergent
Saltgrass	7,19,22	3	Emergent
Shade Mudflower,	69,83,84	3	Submerse d

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Baby's Tears			
Broomsedg e Bluestem, Chalky Bluestem	1,16	2	Emergent
Common Ragweed	71,72	2	Emergent
Flag	52,55	2	Emergent
Fourpetal St. John's- Wort	31,32	2	Emergent
Leavenwort h's Tickseed	51,59	2	Emergent
Morning Glory	33,34	2	Emergent
Nephthytis, Arrowhead Vine, American Evergreen	34,63	2	Terrestrial
Rosegentia ns	51,56	2	Emergent
Saltwater Falsewillow	4,13	2	Emergent
Sandweed, Peelbark St. John's-wort	1,42	2	Emergent
Shield ferns	8,26	2	Emergent
Shore Rush,	54,57	2	Emergent

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Grassleaf Rush			
Umbrella Flat Sedge	32,62	2	Emergent
Vaseygrass	27,40	2	Emergent
Virginia Willow; Virginia Sweetspire	57,60	2	Emergent
Anglestem Primrosewil low	80	1	Emergent
Burhead Sedge, Cuban Scirpus, Cuban Bulrush	48	1	Emergent
Bushy Seaside Oxeye	4	1	Emergent
Buttonwoo d	28	1	Terrestrial
Carolina Redroot	45	1	Emergent
Dayflower	75	1	Emergent
Horned Beak Rush	1	1	Emergent
Indian Jointvetch	8	1	Emergent
Japanese Climbing	39	1	Terrestrial

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Fern			
Maidencane	57	1	Emergent
Sawtooth Blackberry, Dewberry	32	1	Emergent
Sedge	47	1	Emergent
Silk Tree, Mimosa	22	1	Emergent
Soft Rush	66	1	Emergent
Swamp Dogwood, Stiff Dogwood	83	1	Emergent
Wapato, Common Arrowhead, Broadleaf Arrowhead, Duck Potato	53	1	Emergent
Water Hickory	83	1	Emergent
Water- Cresses	81	1	Emergent

Discussion of Vegetation Assessment Results

The number of species found in each region varied for 10 (regions 17 and 18) to 51 (region 51). The highest diversity was found in regions 48 through 63. These regions contained both freshwater species and species that are moderately adapted to salinity fluctuations. Leather Fern (*Acrostichum danaeifolium*) was the most commonly dominant species particularly in the downstream regions.

Section 3: Long-term Ambient Water Chemistry

A critical element in any stream assessment is the long-term water chemistry data set. These data are obtained from several data sources that are available to the Water Atlas and are managed in the Water Atlas Data Download and graphically presented on the water quality page for streams in Hillsborough County. The Little Manatee River Water Quality Page can be viewed at

<http://www.hillsborough.wateratlas.usf.edu/river/waterquality.asp?wbodyid=54&wbodyatlas=river>.

A primary source of stream water chemistry in Hillsborough County is the Routine Monitoring Sampling by the Hillsborough County Environmental Protection Commission. Other source data are used as available; however these data can only indicate conditions at time of sampling.

These data are displayed and analyzed on the Water Atlas as shown in Figure 17, Figure 18, and Figure 19 for Little Manatee River. The figures are graphs of: (1) the overall water quality index (WQI), which is a method commonly used to characterize the productivity of a stream, and may be thought of as a stream's ability to support plant growth and a healthy food source for aquatic life; (2) the chlorophyll *a* concentration, which indicates the stream's algal concentration, and (3) the stream's Secchi Disk depth which is a measure of water visibility and depth of light penetration. These data are used to evaluate a stream's ecological health and to provide a method of ranking streams and are indicators used by the US Environmental Protection Agency (USEPA) and the Florida Department of Environmental Protection (FDEP) to determine a stream's level of impairment. The chlorophyll *a* and Secchi Disk depth graphs include benchmarks which indicate the median values for the various parameters for a large number of Streams in Florida expressed as percentiles.

Based on best available data, Little Manatee River has a color value determined as a platinum cobalt unit (pcu) value of 38.5 and is considered a Clear stream (has a mean color in pcu equal to or below 40). The FDEP and USEPA may classify a stream as impaired if the stream is a dark stream (has a mean color in pcu greater than 40) and has a WQI greater than 60, or is a clear stream and has a WQI greater than 40. Little Manatee River has a WQI of 8 and does not meet the FDEP Impaired Waters Rule (IWR) criteria for impaired streams. See also Table .

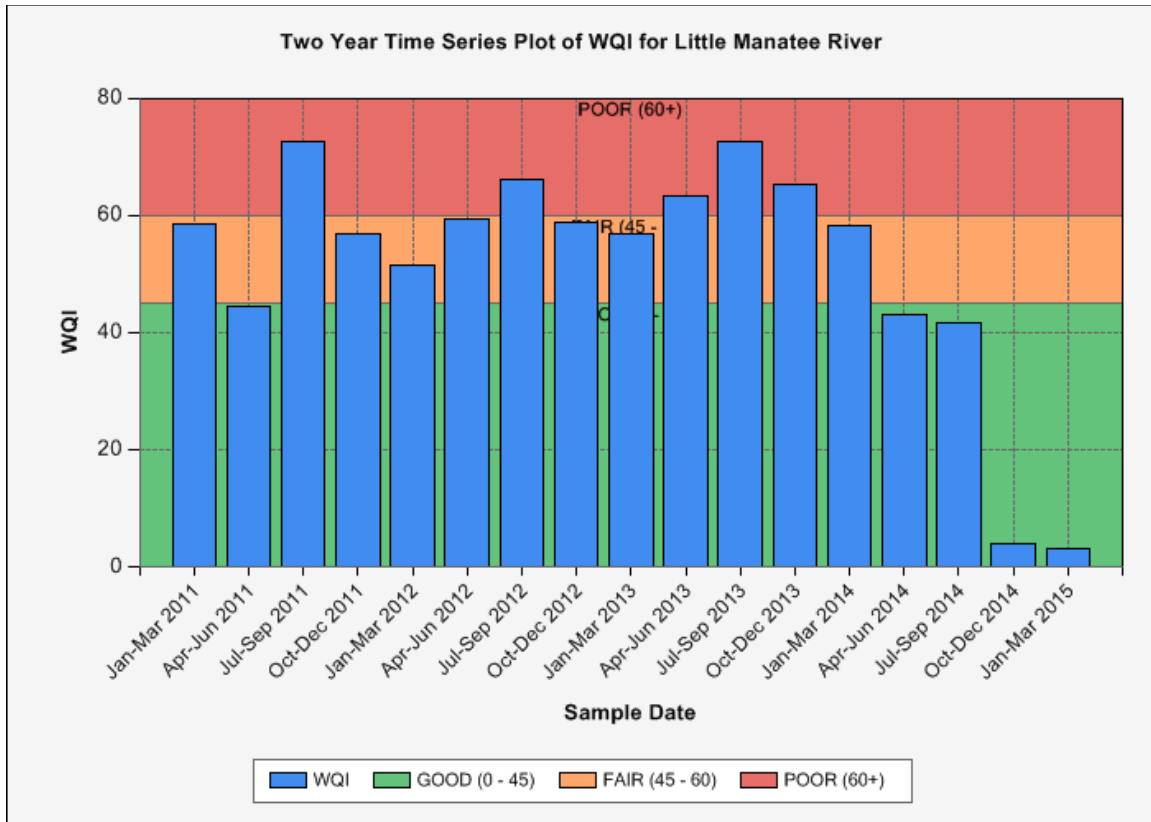


Figure 17. Recent Water Quality Index (WQI) graph for Little Manatee River^v

^v Graph source: Hillsborough County Water Atlas. For an explanation of the Good, Fair and Poor benchmarks, please see the notes at the end of this report. For the latest data go to: http://www.hillsborough.wateratlas.usf.edu/graphs20/graph_it.aspx?wbodyid=54&data=WQI&data_type=WQ&waterbodyatlas=river&ny=10&bench=1

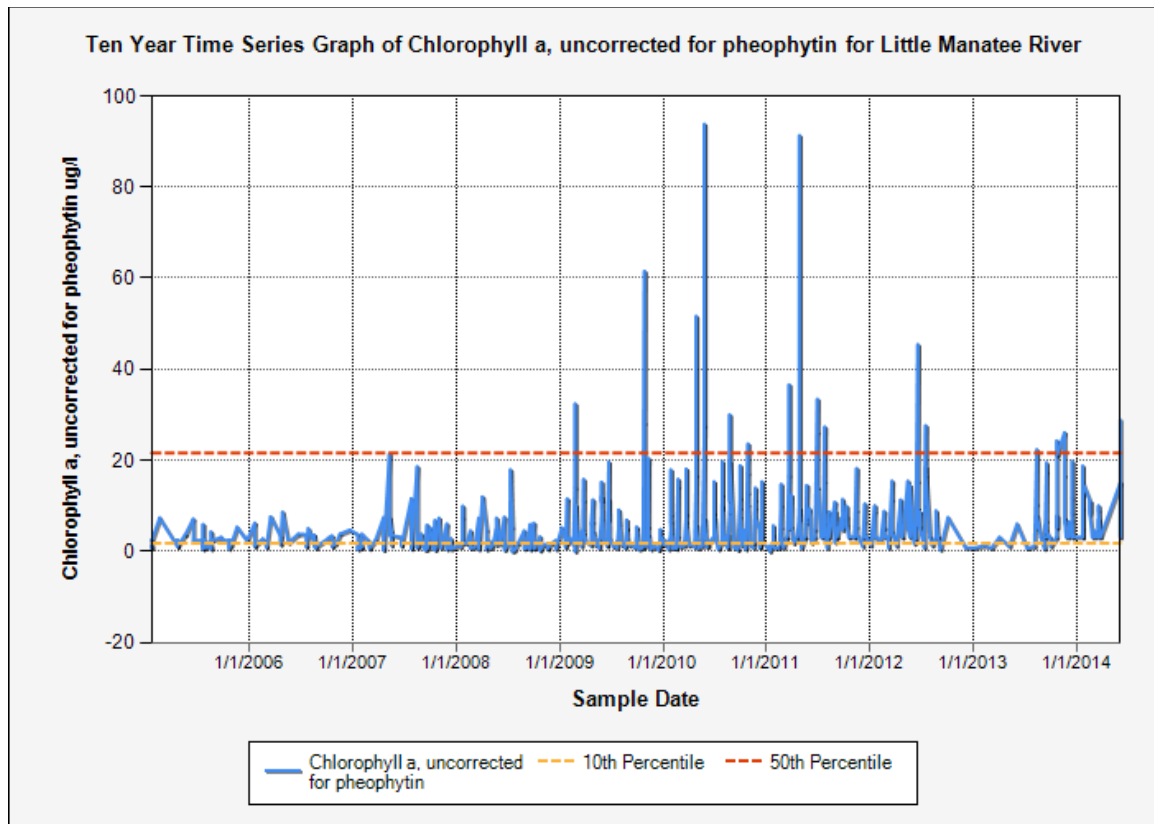


Figure 18. Recent Chlorophyll a graph for Little Manatee River^{vi}

^{vi} Graph Source: Hillsborough County Water Atlas. For the latest data go to http://www.hillsborough.wateratlas.usf.edu/graphs20/graph_it.aspx?wbodyid=54&data=Chla_ugl&datatype=WQ&waterbodyatlas=river&ny=10&bench=1

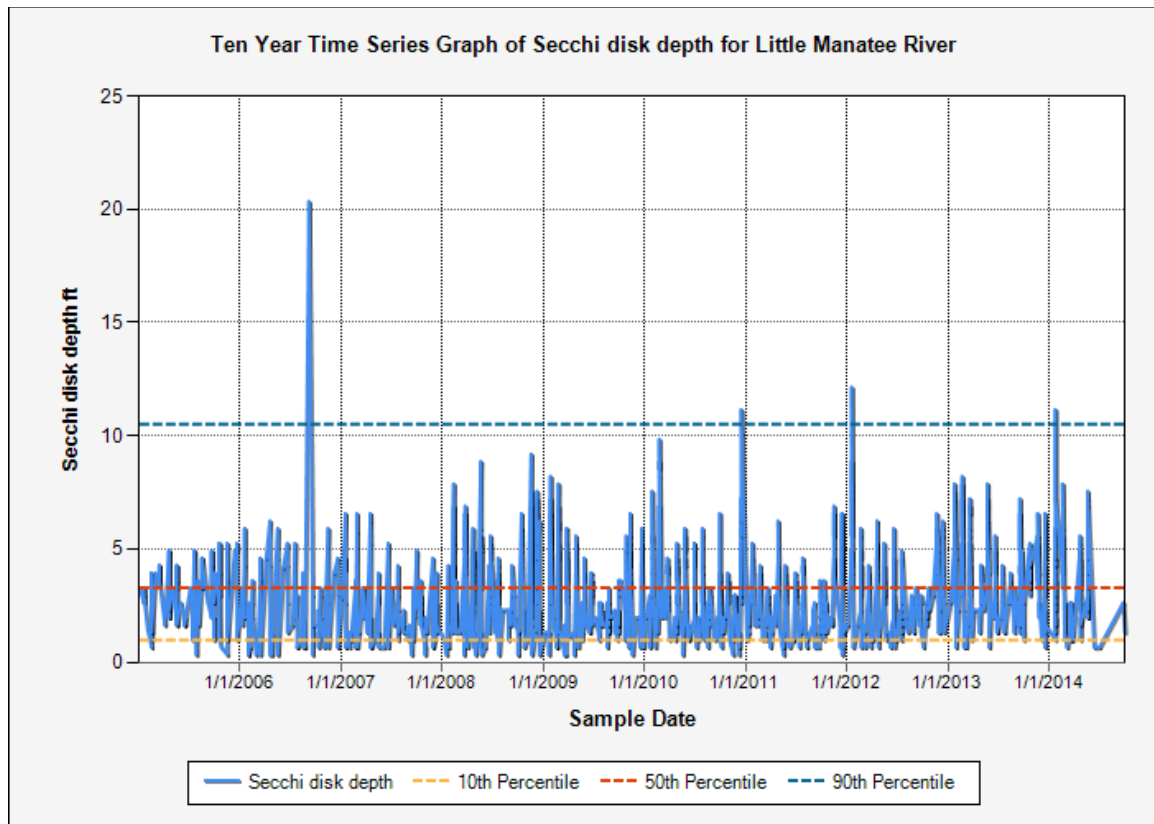


Figure 19. Recent Secchi Disk graph for Little Manatee River^{vii}

^{vii} Graph Source: Hillsborough County Water Atlas. For the latest data go to http://www.hillsborough.wateratlas.usf.edu/graphs20/graph_it.aspx?wbodyid=54&data=secchi_ft&datatype=WQ&waterbodyatlas=stream&ny=10&bench=1

Stream Numeric Nutrient Criteria. November 30, 2012 the USEPA accepted the majority of the FDEP proposed NNCs which included an NNC for streams. The NNC for freshwater streams is provided in the Stream Assessment Notes at the end of this report, and for the Tampa Bay area (considered West Central) total phosphorous must be less than or equal to 0.49 mg/L and total nitrogen must be less than or equal to 1.65 mg/L to meet the criteria (Table 7) and chlorophyll a must be at or below 20 µg/L not be considered impaired.

Table 7 Stream Numeric Nutrient Criteria

<u>Nutrient Watershed Region</u>	<u>Total Phosphorus Nutrient Threshold¹</u>	<u>Total Nitrogen Nutrient Threshold¹</u>
<u>Panhandle West</u>	<u>0.06 mg/L</u>	<u>0.67 mg/L</u>
<u>Panhandle East</u>	<u>0.18 mg/L</u>	<u>1.03 mg/L</u>
<u>North Central</u>	<u>0.30 mg/L</u>	<u>1.87 mg/L</u>
<u>Peninsular</u>	<u>0.12 mg/L</u>	<u>1.54 mg/L</u>
<u>West Central</u>	<u>0.49 mg/L</u>	<u>1.65 mg/L</u>
<u>South Florida</u>	<u>No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.</u>	<u>No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.</u>

¹These values are annual geometric mean concentrations not to be exceeded more than once in any three calendar year period.

The Little Manatee River, a predominately freshwater river in the study area has three long-term data stations in the study area (Hillsborough County EPC 113 and 182 and Streamwater Watch 251) whose three-year geometric mean for Total Nitrogen, Total Phosphorus and Chlorophyll are as shown below in Table 8. According to the Numeric Nutrient Criteria, Flint Creek would not be considered impaired for the exceedance of Nitrogen and Phosphorous concentrations in each of the past three years. Flint Creek does exceed the numeric nutrient criteria for chlorophyll concentrations.

Table 8 Little Manatee River NNC data summary

Flint Creek at US Highway 301	Total Phosphorous mg/l	Total Nitrogen mg/l	Chlorophyll-a Corrected µg/l
Period of Record Geomean	0.345	1.117	3.29
2012 Geomean	0.277	1.022	5.52
2013 Geomean	0.270	1.119	5.74
2014 Geomean	0.245	1.099	6.05

As part of the stream assessment the physical water quality and chemical water chemistry of a stream are measured. These data only indicate a snapshot of the stream's water quality; however they are useful when compared to the trend data available from Hillsborough County Environmental Protection Commission or other sources. Table 9 contains the summary water quality data and index values and adjusted values calculated from these data. The total phosphorus (TP), total nitrogen (TN) and chlorophyll a water chemistry sample data are the results of chemical analysis of samples taken during the assessment and analyzed by the Hillsborough County Environmental Protection Commission laboratory.

The growth of plants (planktonic algae, macrophytic algae and rooted plants) is directly dependent on the available nutrients within the water column of a stream and to some extent the nutrients which are held in the sediment and the vegetation biomass of a stream. Additionally, algae and other plant growth are [limited](#) by the nutrient in lowest concentration relative to that needed by a plant. Plant biomass contains less phosphorus by weight than nitrogen so phosphorus is many times the limiting nutrient. When both nutrients are present at a concentration in the stream so that either or both may restrict plant growth, the limiting factor is called "balanced". The ratio of total nitrogen to total phosphorous, the "N to P" ratio (N/P), is used to determine the limiting factor. If N/P is greater than or equal to 30, the stream is considered phosphorus limited, when this ratio is less than or equal to 10, the stream is considered nitrogen limited and if between 10 and 30 it is considered balanced.

Table 9. Water Quality Parameters (Laboratory) for Flint Creek

Parameter	I-75	24 th St	US HWY 301
Total Phosphorus (ug/L)	305	234	251
Total Nitrogen (ug/L)	724	1,053	1,268
Chlorophyll a Corrected(ug/L)	23.8	12.6	3.0
TN/TP	2.37	4.5	5.05
Limiting Nutrient	Nitrogen	Nitrogen	Nitrogen
Color (PCU)	37.0	40.3	38.1
Secchi disk depth (ft)	2.7	3.2	4.3

The color of a stream is also important to the growth of algae. Dark, tannic streams tend to suppress algal growth and can tolerate a higher amount of nutrient in their water column; while clear streams tend to support higher algal growth with the same amount of nutrients. The color of a stream, which is measured in a unit called the "cobalt platinum unit (PCU)" because of the standard used to determine color, is important because it is used by the State of Florida to determine stream impairment as explained earlier. Rivers, streams or other "flow through" systems tend to support lower algal growth for the same amount of nutrient concentration. All these factors are important to the understanding of your stream's overall condition. Table 9 includes many of the factors that are typically used to determine the actual state of plant growth in your stream. These data should be understood and reviewed when establishing a management plan for a stream; however, as stated above other factors must be considered when developing such a plan. Please contact the [Water Atlas Program](#) if you have questions about this part or any other part of this report.

Table 1010 provides data derived from the vegetation assessment which is used to determine an adjusted WQI. This is accomplished by calculating the amount of phosphorus and nitrogen that could be released by existing submerged vegetation (Adjusted Nutrient) if this vegetation were treated with an herbicide or managed by the addition of Triploid Grass Carp (*Ctenopharyngodon idella*). The table also shows the result of a model that calculates the potential algae, as chlorophyll a (Adjusted Chlorophyll), which could develop due to the additional nutrients held within the plant biomass. While it would not be expected that all the vegetation would be turned into available phosphorus by these management methods, the data is useful when planning various management activities. Approximately 12.00 % of the stream has submerged vegetation present (PAC) and this vegetation represents about 1.30 % of the available stream volume (PVI). Please see additional parameters for adjusted values where appropriate in Table 1010. The

vegetation holds enough nutrients to add about 0 µg/L of phosphorus and 0 µg/L of nitrogen to the water column and increase the algal growth potential within the stream.

Little Manatee River is nitrogen-limited; i.e., an increase in nitrogen could change the WQI and increase the potential for algal growth.

Table 10. Field parameters and calculations used to determine nutrients held in Submerged Aquatic Vegetation (SAV) biomass.

Parameter	Value	Mean Value
% Area Covered (PAC)	12.0 %	
PVI	1.3 %	
Total Phosphorus - Adjusted (ug/L)	0.7	
Total Phosphorus - Combined (ug/L)	297.7	
Total Nitrogen - Adjusted (ug/L)	0.943	
Total Nitrogen - Combined (ug/L)	1.958	
Chlorophyll - Adjusted from Total Nutrients (ug/L)	2.01	
Chlorophyll - Combined (ug/L)	5.98	

Table 11 contains the field data taken in the upstream and downstream extents of the stream using a multi-probe (we use either a Eureka Manta) which has the ability to directly measure the temperature, pH, dissolved oxygen (DO), percent DO (calculated from DO, temperature and conductivity). These data are listed for three levels in the stream.

Table 11. Water Chemistry Data Based on Manta Water Chemistry Probe for Little Manatee River

Sample Location	Sample Depth (m)	Time	Temp (deg C)	Conductivity (mS/cm3)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH
Surface - 75	0.48	6/4/2014 11:25:00 AM	27.98	12.990	74.50	5.88	7.53
Middle - 75	1.15	6/4/2014 11:30:00 AM	27.82	16.030	65.50	5.13	7.42
Mean Value - 75	1.13	6/4/2014 11:30:00 AM	27.93	15.790	63.80	4.99	7.42
Bottom - 75	1.76	6/4/2014 11:35:00 AM	27.99	18.350	51.40	3.98	7.32
Middle - 301	0.77	6/4/2014 12:25:00 PM	24.10	0.363	73.20	6.45	7.44
Middle - 24th street	0.76	6/4/2014 1:55:00 PM	26.67	0.375	76.70	6.45	7.20

To better understand many of the terms used in this report, we recommend that the reader visit the [Hillsborough County & City of Tampa Water Atlas](#) and explore the “Learn More” areas which are found on the resource pages. Additional information can also be found using the [Digital Library](#) on the Water Atlas website.

Section 4: Conclusion

Little Manatee River is a large area (1,138.72-acre) stream that would be considered in the healthy category of streams based on water chemistry. It has a plant diversity of 129 species relative to the total watershed plant diversity of 159 species with about 12.00 % percent of the open water areas containing submerged aquatic vegetation. Vegetation helps to maintain the nutrient balance in the stream as well as provide good fish habitat. The stream has many open water areas to support various types of recreation and has a good diversity of plant species. The primary pest plants in the stream include *Dioscorea bulbifera*.

This assessment was accomplished to assist stream property owners to better understand and manage their streams. Hillsborough County supports this effort as part of their [Stream Waterwatch Program \(SWW\)](#) and has developed guidelines for stream property owner groups to join the SWW and receive specific assistance from the County in the management of their stream. For additional information and recent updates please visit the [Hillsborough County & City of Tampa Water Atlas](#) website.

Stream Assessment Notes

1. The Water Quality Index (WQI)¹ is similar to the Trophic State Index (TSI) in that both are used for the statewide assessment of surface waters: the 305(b) Report. WQI is used for streams, black waters (natural tea and coffee-colored waters), and springs, while TSI is used for lakes and estuaries. The WQI is calculated by averaging the values of most or all of the parameters within five water quality parameter categories: 1) water clarity (measured as turbidity and-or Secchi disk depth), 2) dissolved oxygen, 3) oxygen demanding substances (measured as biochemical oxygen, chemical oxygen demand and-or total organic carbon), 4) nutrients (measured as total nitrogen, nitrite plus nitrate, and-or total phosphorus), and 5) bacteria (total coliform and-or fecal coliform).

Water Atlas presents WQIs over the last four seasons (three month intervals). The WQI "value" for a waterbody is determined by averaging the values (data) of the aforementioned parameters for each "season" (Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec). These seasonal averages are then averaged to provide an overall "rating" or WQI. The term "confidence" expresses the degree of completeness of the index; in other words, "confidence" states how many parameter categories were used to calculate the Overall Water Quality Index.

Ranges of WQI values have been established to provide a general ranking of the waterbody (Figure 1.) WQI values may also include the 'Confidence' (Figure 2) , which provides you with some relative idea as to how much information was used to calculate the WQI for that waterbody.

WQI	Rating
0-45	Good
45-60	Fair
>60	Poor

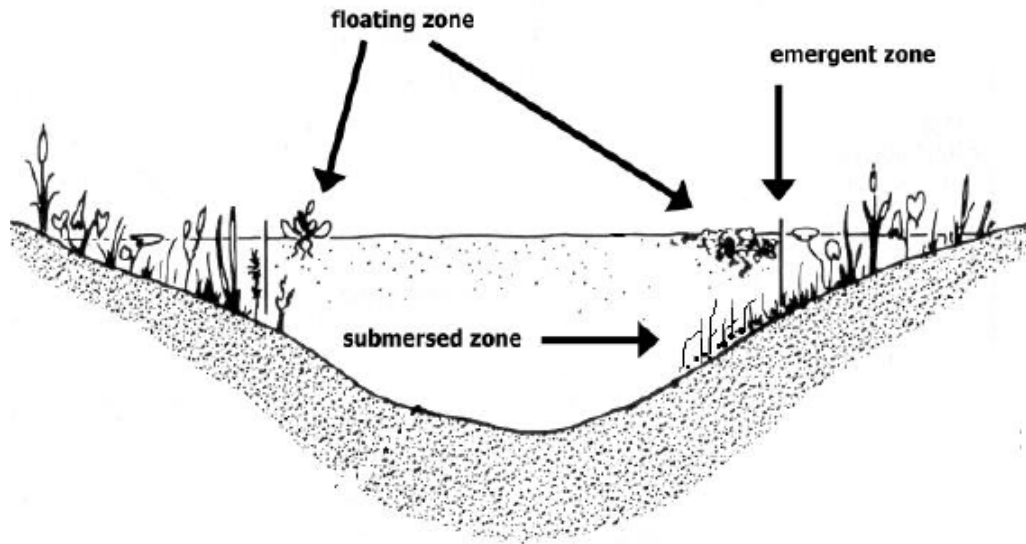
Figure 1. Water Quality Index (WQI) ranges and their designations.

WQI	Rating	Confidence	Season
30	Good	5/5	Winter (2000)
40	Good	3/5	Fall (2000)
30	Good	2/5	Summer (2000)
50	Fair	3/5	Summer (2000)

Figure 2. WQI rankings are provided with examples of Confidence values.

¹The acronym WQI also stands for "Water Quality Inspection" in much of the DEP literature.

2. **Wide Area Augmentation System (WAAS)** is a form of differential GPS (DGPS) where data from 25 ground reference stations located in the United States receive GPS signals from GPS satellites in view and retransmit these data to a master control site and then to geostationary satellites. The geostationary satellites broadcast the information to all WAAS-capable GPS receivers. The receiver decodes the signal to provide real time correction of raw GPS satellite signals also received by the unit. WAAS-enabled GPS is not as accurate as standard DGPS which employs close by ground stations for correction, however; it was shown to be a good substitute when used for this type of mapping application. Data comparisons were conducted with both types of DGPS employed simultaneously and the positional difference was determined to be well within the tolerance established for the project.
3. The three primary aquatic vegetation zones are shown below:



4. A stream is **impaired** if: "A stream or stream segment shall be included on the planning list for nutrients if the following imbalances are observed:
 - a. Algal mats are present in sufficient quantities to pose a nuisance or hinder reproduction of a threatened or endangered species, or
 - b. Annual mean chlorophyll a concentrations are greater than 20 $\mu\text{g/l}$ or if data indicate annual mean chlorophyll a values have increased by more than 50% over historical values for at least two consecutive years.

Specific Authority 403.061, 403.067 FS. Law Implemented 403.062, 403.067 FS. History – New 6-10-02, Repromulgated 1/2/07."

Please see page 12 of the [Impaired Waters Rule](#). Updated activity regarding impaired waters may be tracked at: <http://www.dep.state.fl.us/water/tmdl/>

5. An **adjusted chlorophyll a value** ($\mu\text{g/L}$) was calculated by modifying the methods of Canfield et al (1983). The total wet weight of plants in the stream (kg) was calculated by multiplying stream surface area (m^2) by PAC (percent area coverage of macrophytes) and multiplying the product by the biomass of submersed plants (kg wet weight m^2) and then by 0.25, the conversion for the 1/4 meter sample cube. The dry weight (kg) of plant material was calculated by multiplying the wet weight of plant material (kg) by 0.08, a factor that represents the average percent dry weight of submersed plants (Canfield and Hoyer, 1992) and then converting to grams. The potential phosphorus concentration (mg/m^3) was calculated by multiplying dry weight (g) by 1.41 mg TP g^{-1} dry weight, a number that represents the mean phosphorus (mg) content of dried plant material measured in 750 samples from 60 Florida lakes (University of Florida, unpublished data), and then dividing by lake volume (m^3) and then converting to $\mu\text{g/L}$ (1000/1000). From the potential phosphorus concentration, a predicted chlorophyll a concentration was determined from the total phosphorus and chlorophyll a relationship reported by Brown (1997) for 209 Florida lakes. Adjusted chlorophyll a concentrations were then calculated by adding each lake's measured chlorophyll a concentration to the predicted chlorophyll a concentration.