Stream Assessment Report for Tampa Bypass Canal in Hillsborough County, Florida

Date Assessed: June 9, 2014
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INTRODUCTION

This assessment was conducted to update existing physical and ecological data for Tampa Bypass Canal 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. General photograph of the Tampa Bypass Canal at the time of the assessment.

BACKGROUND

The Tampa Bypass Canal is a manmade system to prevent flooding along the Hillsborough River in Tampa. The system draws water from the Hillsborough River near Harney Road north of Sligh Avenue, as well as Cow House Creek southeast of Morris Bridge Road and Interstate 75. Water levels are controlled through a series of control structures allowing water in along the northern extent as well as control structures along the southern extent allowing water to exit the system Six Mile Creek and Palm River. The shoreline of the system is typically steep banks reinforced by concrete rubble. The emergent vegetation zone along the system is frequently mowed.

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 Map[ii]. 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). 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.

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[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 form 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)	9,730,398	903,984	223.38	0	0
Mean Depth	10.93	3.33	0	0	0
Maximum Depth	21.91	6.68	0	0	0
Volume (cubic)	100,541,746	2,847,025	0	2,308.14	752,109,699
Gauge (relative)	14.34	4.37	0	0	0

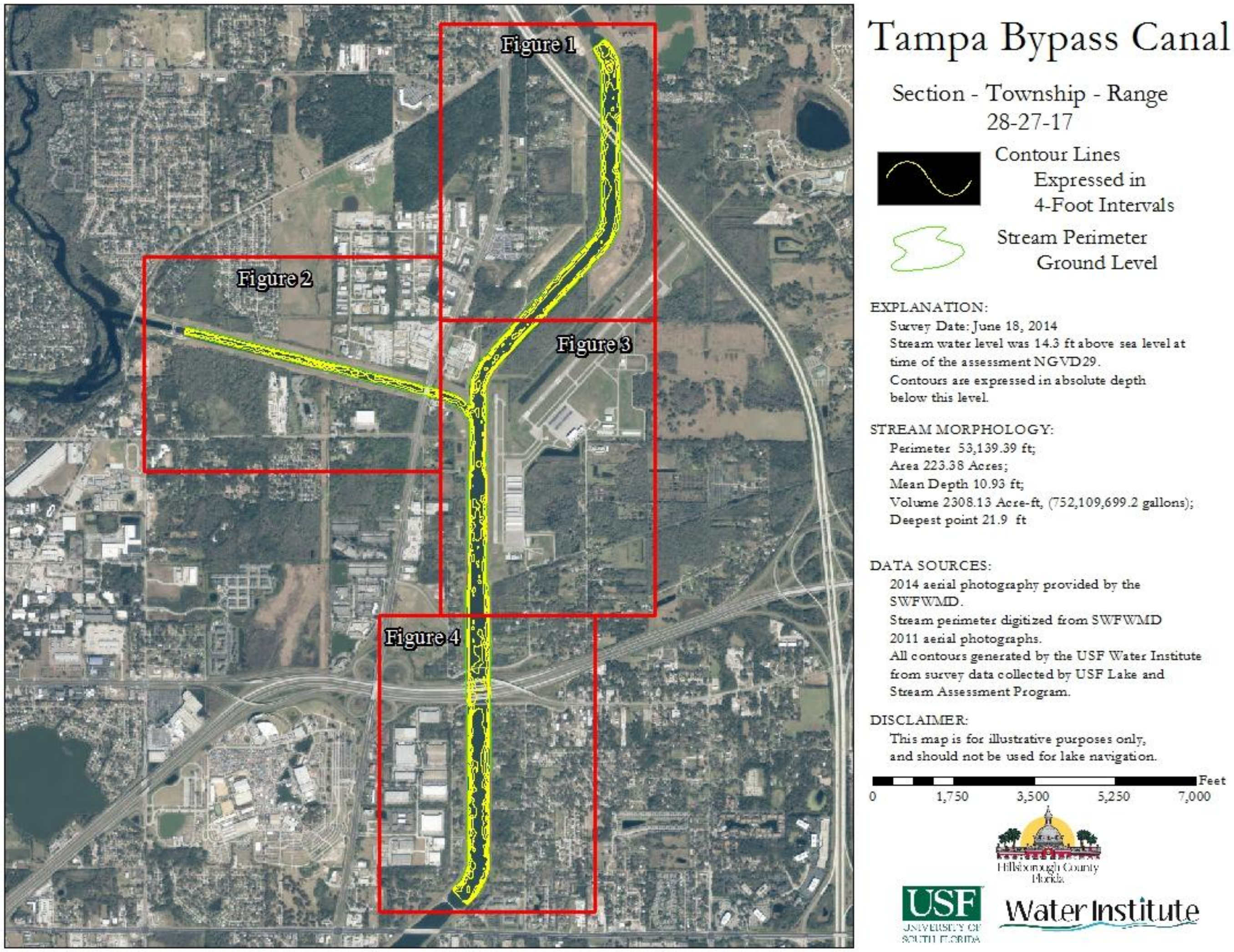

Figure 2. 2014 4-Foot Bathymetric Contour Map for Tampa Bypass Canal

Tampa Bypass Canal Figure 1

Figure 3 2014 4-Foot Bathymetric Contour Map for Tampa Bypass Canal Figure 1

Tampa Bypass Canal Figure 2

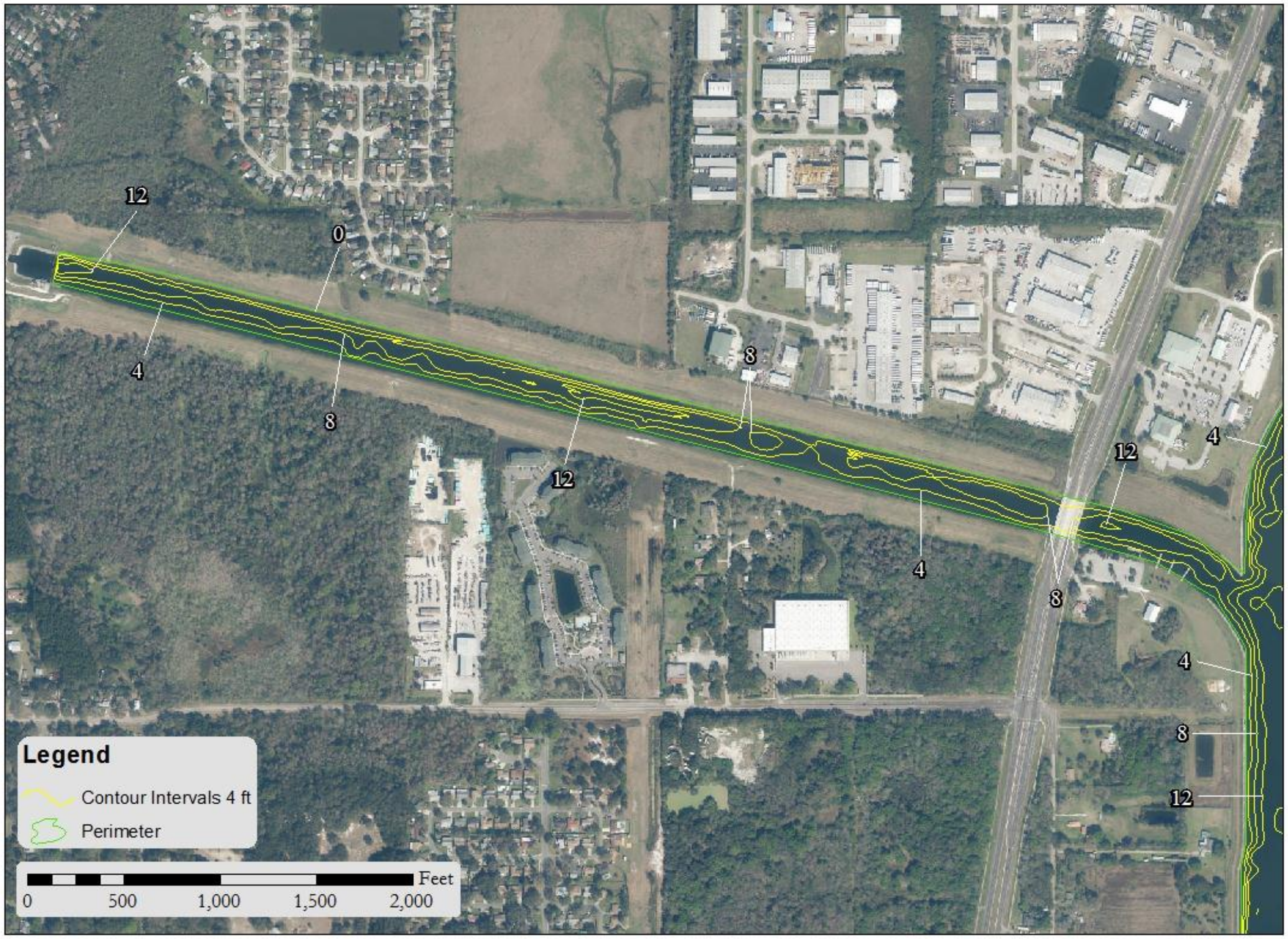

Figure 4 2014 4-Foot Bathymetric Contour Map for Tampa Bypass Canal Figure 2

Tampa Bypass Canal Figure 3

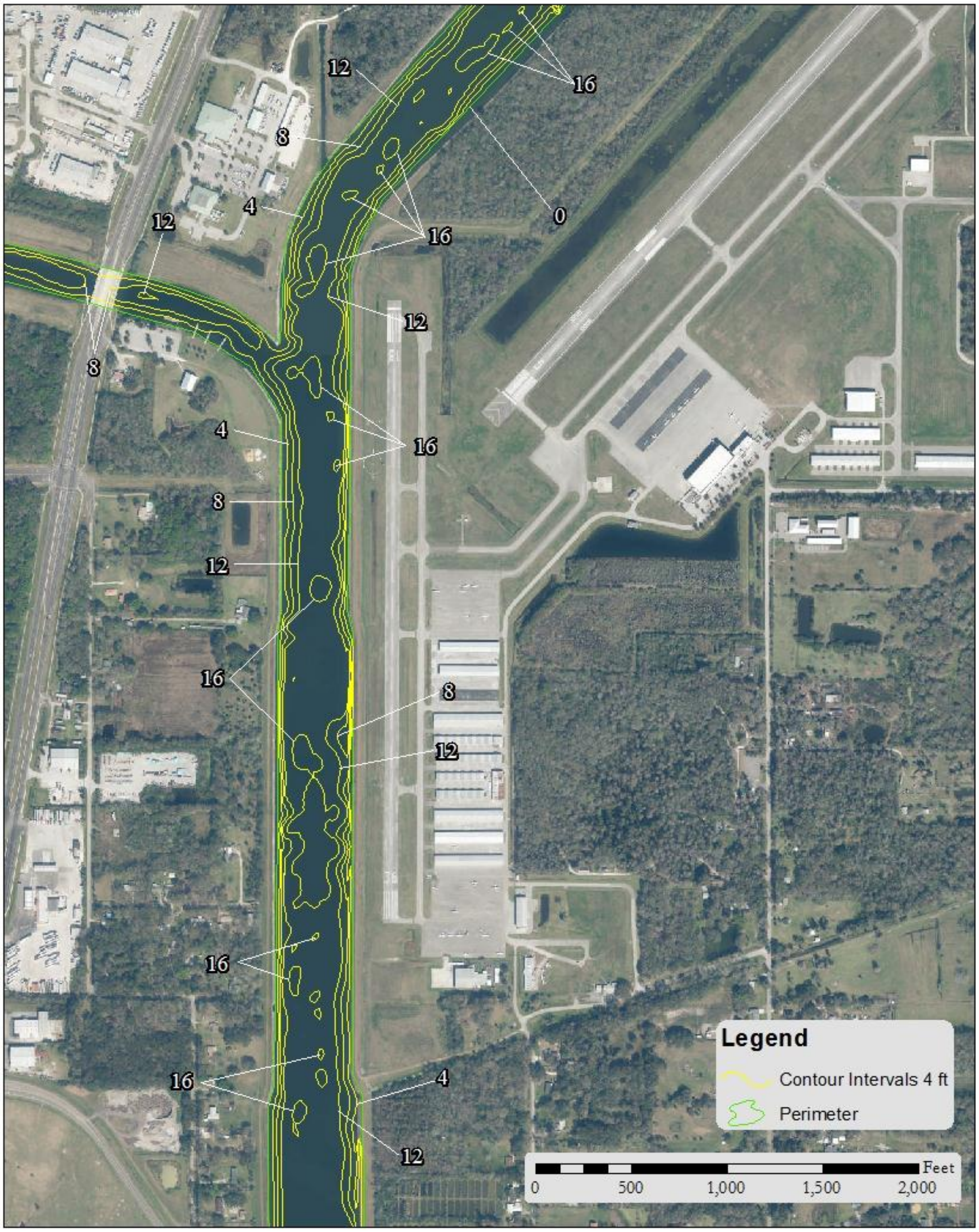

Figure 5 2014 4-Foot Bathymetric Contour Map for Tampa Bypass Canal Figure 3

Tampa Bypass Canal Figure 4

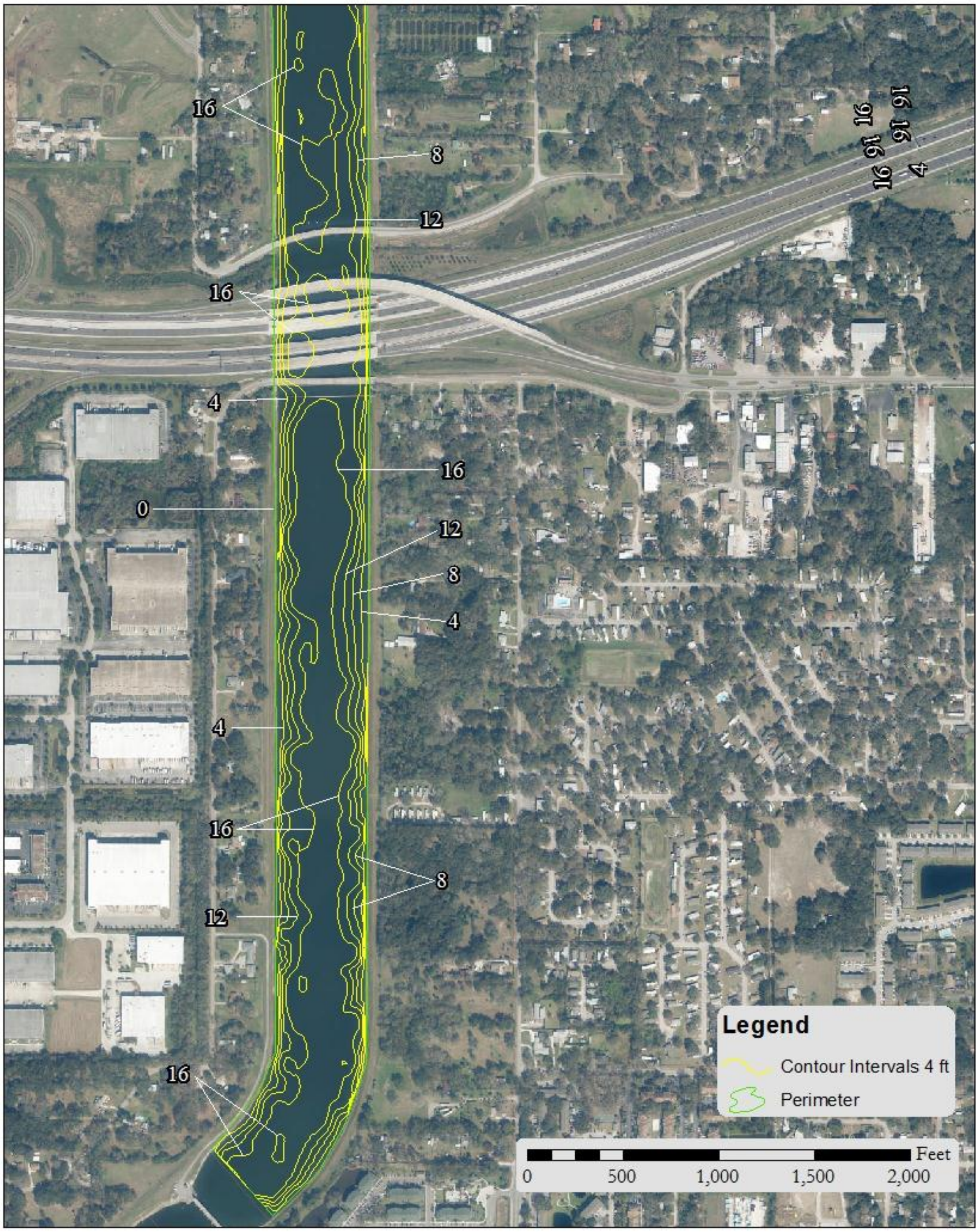

Figure 6 2014 4-Foot Bathymetric Contour Map for Tampa Bypass Canal Figure 4

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 77 through 10, 38 vegetation regions have been assessed for in ~250 meter regions measured from the center of the stream. 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 (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 detail the results from the 2014 aquatic plant assessment for the stream. These data are determined from the 38 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.

[iv] See end note 3.

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

Parameter	Lake	Watershed
Number of Vegetation Assessment Sites	38	158
Total Plant Diversity (# of Taxa)	86	160
% Non-Native Plants	35	27
Total Pest Plant Species	1	13

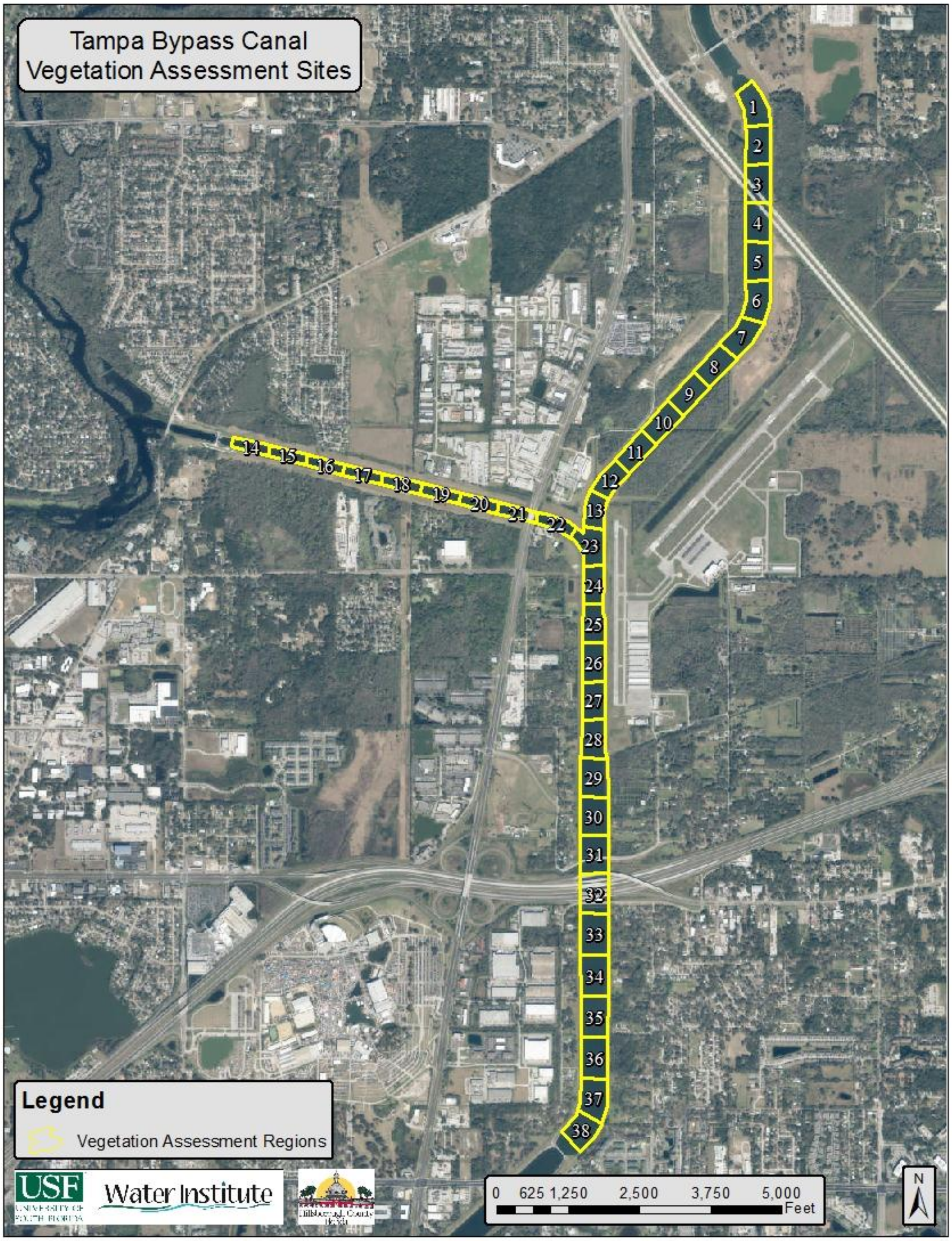

Figure 7. 2014 Vegetation Assessment Region Map for Tampa Bypass Canal

Table 3. List of Floating Leaf Zone Aquatic Plants Found

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
ECS	*Eichhornia crassipes*	Water Hyacinth	44%	E1
PSS	*Pistia stratiotes*	Water Lettuce	42%	E1
LEN	*Lemna spp.*	Duckweed	28%	N, E0
SPI	*Spirodela polyrhiza*	Giant Duckweed	28%	N, E0
NLM	*Nuphar advena*	Spatterdock, Yellow Pondlily	13%	N, E0
SMA	*Salvinia minima*	Water Spangles, Water Fern	13%	E1

Figure 8. Water Lettuce, *pistia stratiotes*, was a common non-native invasive species observed on the Tampa Bypass Canal

Table 4. List of Emergent Zone Aquatic Plants Found

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
BAA	*Bidens alba*	White Beggar-ticks, Romerillo	94%	N, E0
APS	*Alternanthera philoxeroides*	Alligator Weed	76%	E2
BOC	*Boehmeria cylindrica*	Bog Hemp, False Nettle	76%	N, E0
PRS	*Panicum repens*	Torpedo Grass	73%	E1
AAF	*Ambrosia artemisiifolia*	Common Ragweed	60%	N, E0
HYE	*Hydrocotyle umbellata*	Manyflower Marshpennywort, Water Pennywort	44%	N, E0
CYO	*Cyperus odoratus*	Fragrant Flatsedge	42%	N, E0
BMA	*Urochloa mutica*	Para Grass	42%	E1
PHN	*Panicum hemitomon*	Maidencane	42%	N, E0
ACE	*Acer rubrum*	Southern Red Maple	39%	N, E0
ECG	*Echinochloa crus-galli*	Barnyardgrass	36%	E0
LPA	*Ludwigia peruviana*	Peruvian Primrosewillow	36%	E1
MSS	*Mikania scandens*	Climbing Hempvine	28%	N, E0
UAA	*Ulmus americana*	American Elm; Florida Elm	28%	N, E0
SAM	*Sambucus nigra subsp. Canadensis*	Elderberry	26%	N, E0
EUP	*Eupatorium capillifolium*	Dog Fennel	26%	N, E0
PCM	*Ptilimnium capillaceum*	Mock Bishopsweed; Herbwilliam	23%	N, E0
SCV	*Schoenoplectus tabernaemontani*	Soft-stem Bulrush	21%	N, E0
SLA	*Sagittaria lancifolia*	Duck Potato	21%	N, E0
STS	*Schinus terebinthifolius*	Brazilian Pepper	21%	E1
SPO	*Sabal palmetto*	Sabal Palm, Cabbage Palm	18%	N, E0
SCA	*Salix caroliniana*	Carolina Willow	18%	N, E0
CFO	*Cornus foemina*	Swamp Dogwood, Stiff Dogwood	18%	N, E0
CAM	*Crinum americanum*	Swamp lily	15%	N, E0
ACS	*Symphyotrichum carolinianum*	Climbing Aster	15%	N, E0
BHA	*Baccharis halimifolia*	Groundsel Tree; Sea Myrtle	15%	N, E0
TYP	*Typha spp.*	Cattails	15%	N, E0
PPX	*Paspalum praecox*	Early Paspalum	15%	N, E0
PUI	*Paspalum urvillei*	Vaseygrass	15%	E0
PQA	*Parthenocissus quinquefolia*	Virginia Creeper, Woodbine	13%	N, E0
LOS	*Ludwigia octovalvis*	Mexican Primrosewillow, Long-stalked Ludwigia	13%	N, E0
PCA	*Pontederia cordata*	Pickerel Weed	13%	N, E0
SOL	*Solidago spp.*	Goldenrod	10%	N, E0
RVS	*Rumex verticillatus*	Swamp Dock	10%	N, E0
CEA	*Colocasia esculenta*	Wild Taro	10%	E1

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
VRA	***Vitis rotundifolia***	**Muscadine Grape**	**10%**	**N, E0**
EAA	***Eclipta alba***	**Yerba De Tajo**	**7%**	**N, E0**
JUM	***Juncus marginatus***	**Shore Rush, Grassleaf Rush**	**7%**	**N, E0**
BRP	***Broussonetia papyrifera***	**Paper Mulberry**	**7%**	**E2**
SHA	***Sesbania herbacea***	**Danglepod Sesban**	**7%**	**N, E0**
PFO	***Paederia foetida***	**Skunkvine, Stinkvine**	**7%**	**E1**
NEA	***Nephrolepis exaltata***	**Sword Fern, Wild Boston Fern**	**5%**	**N, E0**
PRA	***Pluchea baccharis***	**Rosy Camphorweed**	**5%**	**N, E0**
PHS	***Polygonum hydropiperoides***	**Mild Waterpepper; Swamp Smartweed**	**5%**	**N, E0**
QLA	***Quercus laurifolia***	**Laurel Oak; Diamond Oak**	**5%**	**N, E0**
RBA	***Ruellia simplex***	**Britton's Wild Petunia**	**5%**	**E1**
SRS	***Serenoa repens***	**Saw Palmetto**	**5%**	**N, E0**
AAA	***Ampelopsis arborea***	**Peppervine**	**5%**	**N, E0**
KVA	***Kosteletzkya virginica***	**Virginia Saltmarsh Mallow**	**5%**	**N, E0**
COS	***Cephalanthus occidentalis***	**Buttonbush**	**5%**	**N, E0**
CSS	***Cyperus surinamensis***	**Tropical Flatsedge**	**2%**	**N, E0**
DBA	***Dioscorea bulbifera***	**Air Potato**	**2%**	**E1**
DIC	***Rhynchospora colorata***	**White-top Sedge, Starrush Whitetop**	**2%**	**N, E0**
DIM	***Desmodium incanum***	**Creeping Beggarweed, Zarzabacoa Comun**	**2%**	**E0**
LEL	***Leucaena leucocephala***	**White Leadtree**	**2%**	**E2**
LGA	***Lindernia grandiflora***	**Savannah False Pimpernel**	**2%**	**N, E0**
ICE	***Ilex cassine***	**Dahoon Holly**	**2%**	**N, E0**
IVA	***Iris virginica***	**Southern Blue Flag**	**2%**	**N, E0**
CCA	***Cinnamomum camphora***	**Camphor-tree**	**2%**	**E1**
CMA	***Cicuta maculata var. mexicana***	**Spotted Water Hemlock**	**2%**	**N, E0**
COM	***Commelina spp.***	**Dayflower**	**2%**	**N, E0**
ASM	***Acer saccharinum***	**Silver Maple**	**2%**	**N, E0**
AVS	***Andropogon virginicus var. glaucus***	**Broomsedge Bluestem, Chalky Bluestem**	**2%**	**N, E0**
AGS	***Andropogon glomeratus***	**Bushy Bluestem; Bush Broom Grass**	**2%**	**N, E0**
AAS	***Amaranthus australis***	**Southern Water Hemp**	**2%**	**N, E0**
TRS	***Toxicodendron radicans***	**Poison Ivy**	**2%**	**N, E0**
SPS	***Schoenoplectus pungens***	**Threesquare Bulrush**	**2%**	**N, E0**
RHE	***Rhexia spp.***	**Meadow Beauties**	**2%**	**N, E0**
SCI	***Scirpus spp.***	**Sedge**	**2%**	**E0**
SET	***Setaria spp.***	**Bristlegrass, Foxtail**	**2%**	
QNA	***Quercus nigra***	**Water Oak**	**2%**	**N, E0**

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
PLU	***Pluchea spp.***	**Marsh Fleabane, Camphorweed**	**2%**	**N, E0**
OCA	***Osmunda cinnamomea***	**Cinnamon Fern**	**2%**	**N, E0**
MCA	***Momordica charantia***	**Wild Balsam Apple**	**2%**	**E0**
WAX	***Myrica cerifera***	**Southern Bayberry; Wax Myrtle**	**2%**	**N, E0**
WTA	***Sphagneticola trilobata***	**Creeping Oxeye; Wedelia**	**2%**	**E2**

Figure 9. Tampa Bypass Canal emergent vegetation zone in one of the non-mowed areas

Table 5. List of Submerged Zone Aquatic Plants Found.

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
HVA	*Hydrilla verticillata*	Hydrilla, waterthyme	89%	E1,P
CDM	*Ceratophyllum demersum*	Hornwort, Coontail	21%	N, E0
BMI	*Bacopa monnieri*	Common Bacopa	5%	N, E0
NGS	*Najas guadalupensis*	Southern Naiad	2%	N, E0

Figure 10. Typical shoreline of Tampa Bypass Canal

Table 6. List of All Plants and Sample Sites

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
White Beggar-ticks, Romerillo	**1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,22,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38**	**94**	**Terrestrial**
Hydrilla, waterthyme	**1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,38**	**89**	**Submersed**
Alligator Weed	**1,3,7,8,11,14,15,16,17,18,19,20,21,22,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38**	**76**	**Emergent**
Bog Hemp, False Nettle	**3,4,5,6,7,8,11,12,13,14,15,16,21,22,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38**	**76**	**Emergent**
Torpedo Grass	**4,5,6,7,14,15,16,17,18,19,20,21,22,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38**	**73**	**Emergent**
Common Ragweed	**1,2,3,4,5,6,7,8,9,10,11,12,13,21,22,23,24,25,26,27,28,29,30**	**60**	**Emergent**
Manyflower Marshpennywort, Water Pennywort	**11,12,13,14,15,16,17,18,19,20,21,22,26,27,28,29,31**	**44**	**Emergent**
Water Hyacinth	**1,13,14,22,24,25,26,27,28,29,30,31,32,33,34,35,38**	**44**	**Floating**
Fragrant Flatsedge	**1,3,4,5,7,8,11,12,13,14,15,16,17,18,19,20**	**42**	**Emergent**
Maidencane	**14,15,16,17,18,19,20,21,22,24,25,28,29,30,31,32**	**42**	**Emergent**
Para Grass	**1,2,3,6,7,8,9,10,11,15,16,17,18,19,20,21**	**42**	**Emergent**
Water Lettuce	**1,2,3,4,13,14,19,20,21,24,25,26,27,28,29,30**	**42**	**Floating**
Southern Red Maple	**1,3,4,5,6,7,8,9,10,11,14,16,21,22,31**	**39**	**Emergent**
Barnyardgrass	**1,4,5,6,7,8,9,10,11,12,13,14,19,20**	**36**	**Terrestrial**
Peruvian Primrosewillow	**1,3,8,10,11,14,15,16,17,18,19,20,21,22**	**36**	**Emergent**
American Elm; Florida Elm	**1,3,4,5,6,7,8,9,10,11,12**	**28**	**Emergent**
Climbing Hempvine	**1,2,3,4,5,6,7,9,14,15,22**	**28**	**Emergent**
Duckweed	**15,16,17,18,19,20,21,22,26,27,29**	**28**	**Floating**
Giant Duckweed	**4,5,6,7,8,9,10,11,12,15,16**	**28**	**Floating**
Dog Fennel	**1,3,7,9,13,26,28,29,30,31**	**26**	**Emergent**
Elderberry	**1,3,4,5,7,8,9,11,13,20**	**26**	**Emergent**
Mock	**3,4,5,6,7,9,11,12,13**	**23**	**Emergent**

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Bishopsweed; Herbwilliam			
Brazilian Pepper	**3,4,5,6,12,21,22,32**	**21**	**Emergent**
Duck Potato	**8,15,17,18,19,20,21,22**	**21**	**Emergent**
Hornwort, Coontail	**13,14,17,18,19,20,21,22**	**21**	**Submersed**
Soft-stem Bulrush	**14,16,17,18,19,20,21,22**	**21**	**Emergent**
Carolina Willow	**2,9,16,21,22,31,32**	**18**	**Emergent**
Sabal Palm, Cabbage Palm	**1,3,4,5,6,7,29**	**18**	**Terrestrial**
Swamp Dogwood, Stiff Dogwood	**1,3,4,5,6,7,11**	**18**	**Emergent**
Cattails	**14,16,17,19,20,22**	**15**	**Emergent**
Climbing Aster	**1,3,8,11,21,22**	**15**	**Emergent**
Early Paspalum	**14,15,16,17,19,20**	**15**	**Emergent**
Groundsel Tree; Sea Myrtle	**1,3,4,7,21,22**	**15**	**Emergent**
Swamp lily	**17,20,22,28,35,36**	**15**	**Emergent**
Vaseygrass	**14,15,16,17,19,20**	**15**	**Emergent**
Mexican Primrosewillow, Long-stalked Ludwigia	**11,14,15,21,22**	**13**	**Emergent**
Pickerel Weed	**16,17,18,19,20**	**13**	**Emergent**
Spatterdock, Yellow Pondlily	**11,14,15,16,17**	**13**	**Floating**
Virginia Creeper, Woodbine	**4,10,12,31,32**	**13**	**Emergent**
Water Spangles, Water Fern	**9,10,11,12,17**	**13**	**Floating**
Goldenrod	**13,14,18,22**	**10**	**Emergent**
Muscadine	**2,3,4,5**	**10**	**Emergent**

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Grape			
Swamp Dock	**11,12,13,27**	**10**	**Emergent**
Wild Taro	**14,15,16,19**	**10**	**Emergent**
Danglepod Sesban	**1,9,10**	**7**	**Emergent**
Paper Mulberry	**6,9,32**	**7**	**Emergent**
Shore Rush, Grassleaf Rush	**16,18,19**	**7**	**Emergent**
Skunkvine, Stinkvine	**3,5,7**	**7**	**Terrestrial**
Yerba De Tajo	**3,11,20**	**7**	**Emergent**
Britton's Wild Petunia	**3,4**	**5**	**Terrestrial**
Buttonbush	**16,19**	**5**	**Emergent**
Common Bacopa	**13,19**	**5**	**Submersed**
Laurel Oak; Diamond Oak	**1,11**	**5**	**Emergent**
Mild Waterpepper; Swamp Smartweed	**7,14**	**5**	**Emergent**
Peppervine	**1,4**	**5**	**Emergent**
Rosy Camphorweed	**5,14**	**5**	**Emergent**
Saw Palmetto	**29,31**	**5**	**Terrestrial**
Sword Fern, Wild Boston Fern	**1,32**	**5**	**Terrestrial**
Virginia Saltmarsh Mallow	**11,22**	**5**	**Emergent**
Air Potato	**17**	**2**	**Emergent**
Bristlegrass, Foxtail	**32**	**2**	**Emergent**
Broomsedge	**22**	**2**	**Emergent**

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Bluestem, Chalky Bluestem			
Bushy Bluestem; Bush Broom Grass	**1**	**2**	**Emergent**
Camphor-tree	**12**	**2**	**Emergent**
Cinnamon Fern	**3**	**2**	**Emergent**
Creeping Beggarweed, Zarzabacoa Comun	**17**	**2**	**Emergent**
Creeping Oxeye; Wedelia	**11**	**2**	**Emergent**
Dahoon Holly	**1**	**2**	**Emergent**
Dayflower	**11**	**2**	**Emergent**
Marsh Fleabane, Camphorweed	**12**	**2**	**Emergent**
Meadow Beauties	**19**	**2**	**Terrestrial**
Poison Ivy	**1**	**2**	**Emergent**
Savannah False Pimpernel	**14**	**2**	**Emergent**
Sedge	**22**	**2**	**Emergent**
Silver Maple	**32**	**2**	**Emergent**
Southern Bayberry; Wax Myrtle	**3**	**2**	**Emergent**
Southern Blue Flag	**16**	**2**	**Emergent**
Southern Naiad	**14**	**2**	**Submersed**
Southern Water Hemp	**3**	**2**	**Emergent**
Spotted Water Hemlock	**21**	**2**	**Emergent**

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Threesquare Bulrush	**22**	**2**	**Emergent**
Tropical Flatsedge	**16**	**2**	**Emergent**
Water Oak	**6**	**2**	**Emergent**
White Leadtree	**22**	**2**	**Terrestrial**
White-top Sedge, Starrush Whitetop	**17**	**2**	**Emergent**
Wild Balsam Apple	**32**	**2**	**Terrestrial**

Discussion of Vegetation Assessment Results

The vegetation communities of the Tampa Bypass Canal were largely dominated by non-native invasive species and native pioneering species due to the large amount of disturbance from construction and frequent mowing. The highest diversity of plant species was observed in the northern regions where there was some remaining buffer vegetation in regions 2 through 7.

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 Tampa Bypass Canal Water Quality Page can be viewed at http://www.hillsborough.wateratlas.usf.edu/river/waterquality.asp?wbodyid=70&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 11Figure 1111, Figure 1212, and Figure 1313 for Tampa Bypass Canal. The figures are graphs of: (1) the overall water quality index (WQI)i, 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, Tampa Bypass Canal has a color value determined as a platinum cobalt unit (pcu) value of 19.3 near the Hillsborough River, 9.1 at Interstate 75 and 11.3 at Interstate 4 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. Tampa Bypass Canal has a WQI of 13 and does not meet the FDEP Impaired Waters Rule (IWR) criteria for impaired streams. See also 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

Nutrient Watershed Region	Total Phosphorus Nutrient Threshold[1]	Total Nitrogen Nutrient Threshold[1]
Panhandle West	0.06 mg/L	0.67 mg/L
Panhandle East	0.18 mg/L	1.03 mg/L
North Central	0.30 mg/L	1.87 mg/L
Peninsular	0.12 mg/L	1.54 mg/L
West Central	0.49 mg/L	1.65 mg/L
South Florida	No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.	No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.

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

Tampa Bypass Canal does not have a long-term data station for Total Nitrogen, Total Phosphorus and Chlorophyll. The results from the assessment sampling are as shown below in Table 8. According to the Numeric Nutrient Criteria, Tampa Bypass Canal would not be considered impaired for the exceedance of Chlorophyll, Nitrogen and Phosphorous concentrations based on the single sampling event data.

Table 8 Flint Creek NNC data summary

Tampa Bypass Canal	Total Phosphorous mg/l	Total Nitrogen mg/l	Chlorophyll-a Corrected µg/l
@ **Hillsborough River**	**0.072**	**0.717**	**39.0**
@ **I-75**	**0.061**	**0.612**	**39.7**
@ **I-4**	**0.072**	**0.637**	**36.8**
Mean Values	**0.068**	**0.655**	**38.5**

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. **Error! Not a valid bookmark self-reference.**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.

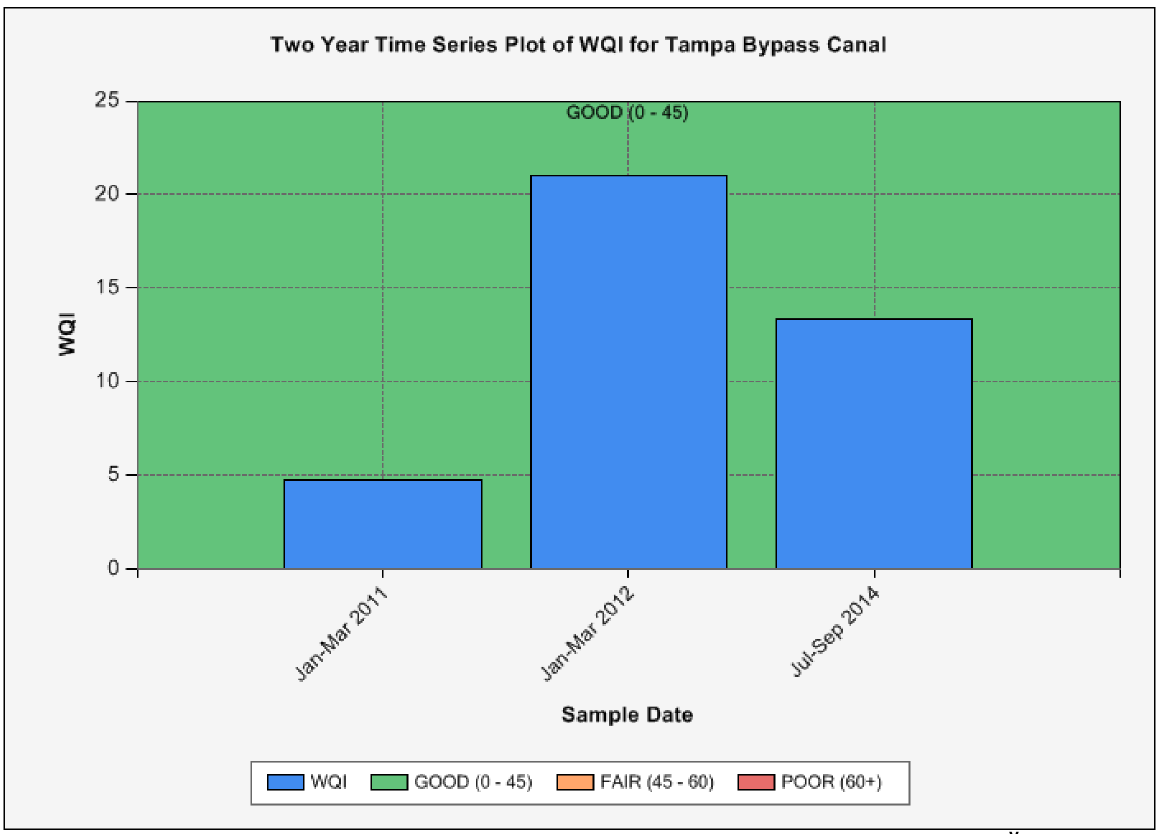

Figure 11. Recent Water Quality Index (WQI) graph for Tampa Bypass Canal[v]

[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=70&data=WQI&datatype=WQ&waterbodyatlas=river&ny=10&bench=1

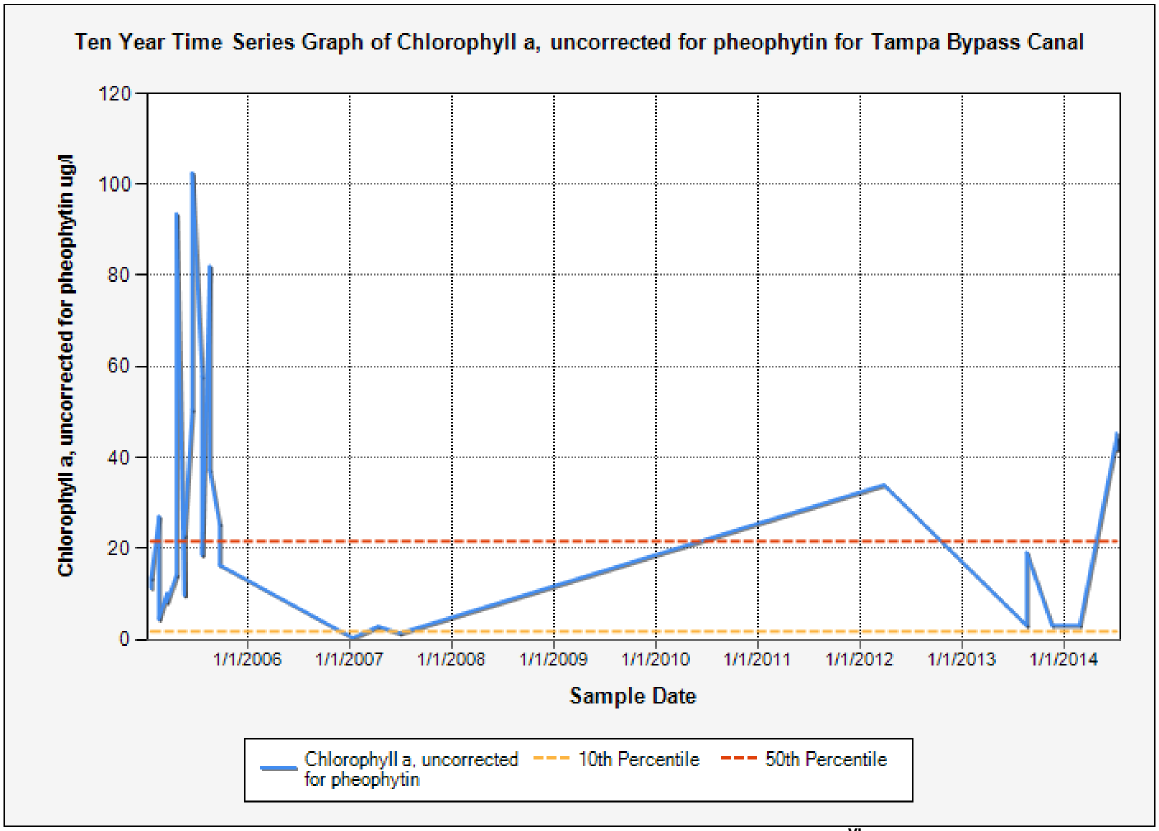

Figure 12. Recent Chlorophyll a graph for Tampa Bypass Canal[vi]

[vi] Graph Source: Hillsborough County Water Atlas. For the latest data go to http://www.hillsborough.wateratlas.usf.edu/graphs20/graph_it.aspx?wbodyid=70&data=Chla_ugl&datatype=WQ&waterbodyatlas=river&ny=10&bench=1

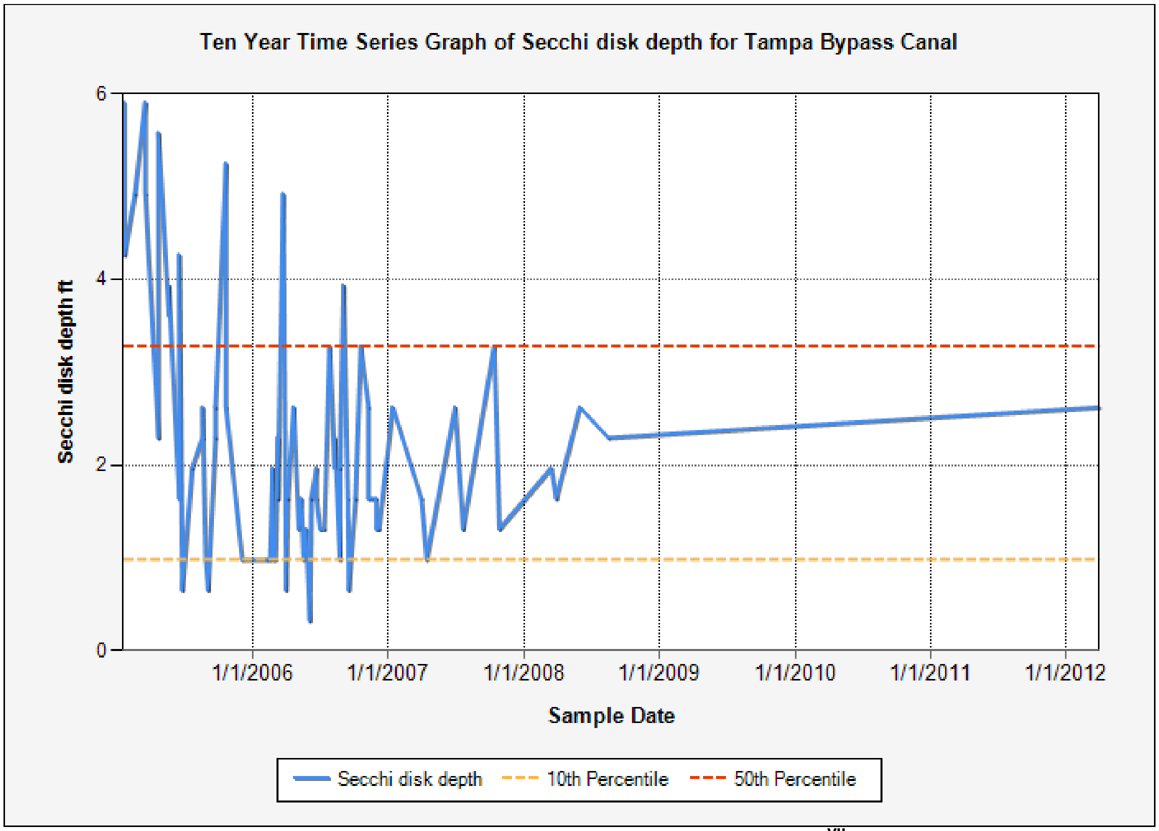

Figure 13. Recent Secchi Disk graph for Tampa Bypass Canal[vii]

[vii] Graph Source: Hillsborough County Water Atlas. For the latest data go to http://www.hillsborough.wateratlas.usf.edu/graphs20/graph_it.aspx?wbodyid=70&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.

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Table 9. Water Quality Parameters (Laboratory) for Tampa Bypass Canal

Parameter	@ Hillsborough River	@ I-75	@ I-4	Mean Value
Total Phosphorus (mg/L)	**0.072**	**0.061**	**0.072**	**0.069**
Total Nitrogen (mg/L)	**0.717**	**0.612**	**0.637**	**0.655**
Chlorophyll a Corrected (mg/L)	**39.0**	**39.7**	**36.8**	**38.5**
TN/TP	**9.96**	**10.03**	**8.85**	**9.49**
Limiting Nutrient	**NItrogen**	**Balanced**	**Nitrogen**	**Nitrogen**
Color (PCU)	**19.3**	**9.1**	**11.3**	**13.23**
Secchi disk depth (ft)	**2.8**	**3.0**	**3.2**	**3.0**

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.

The Tampa Bypass Canal showed elevated concentrations above the Numeric Nutrient Criteria standards set for west-central Florida for Total Phosphorous and Chlorophyll values based on the single sampling event for this assessment.

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 27.00 % of the stream has submerged vegetation present (PAC) and this vegetation represents about 13.16 % 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 72 μg/L of phosphorus and 456 μg/L of nitrogen to the water column and increase the algal growth potential within the stream.

Tampa Bypass Canal 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
% Area Covered (PAC)	**27.0 %**
PVI	**13.2 %**
Total Phosphorus - Adjusted (mg/L)	**0.072**
Total Phosphorus - Combined (mg/L)	**0.141**
Total Nitrogen - Adjusted (mg/L)	**0.456**
Total Nitrogen - Combined (mg/L)	**1.111**
Chlorophyll - Adjusted from Total Nutrients (mg/L)	**36.97**
Chlorophyll - Combined (mg/L)	**73.27**

Table 11 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 Tampa Bypass Canal

Sample Location	Sample Depth (m)	Time	Temp (deg C)	Conductivity (mS/cm3)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH
Mean Value	0.56	7/22/2014 12:00:00 AM	28.28	0.369	78.02	6.01	7.69
Surface - I-75	0.62	7/22/2014 11:53:00 AM	28.42	0.279	103.13	8.04	7.83
Bottom - I-75	3.89	7/22/2014 11:53:35 AM	26.78	0.379	5.20	0.42	7.15
Middle - I-75	1.99	7/22/2014 11:55:00 AM	27.49	0.256	75.95	6.02	7.40
Surface - I-4	0.46	7/22/2014 12:37:00 PM	30.32	0.342	149.80	11.31	8.73
Bottom - I-4	5.26	7/22/2014 12:39:46 PM	24.93	0.619	5.20	0.43	7.15
Bottom - Hillsborough River	3.87	7/22/2014 1:13:33 PM	24.80	0.563	5.80	0.48	7.23
Middle - Hillsborough River	1.86	7/22/2014 1:15:00 PM	29.05	0.411	62.00	4.78	7.50
Middle - I-4	2.31	7/22/2014 1:15:00 PM	28.29	0.342	44.65	3.49	7.22
Surface - Hillsborough River	0.58	7/22/2014 1:16:00 PM	30.24	0.404	128.95	9.75	8.21

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

Tampa Bypass Canal is a large area (236.17-acre) stream that would be considered in the impaired category of streams based on water chemistry. It has a plant diversity of 86 species relative to the total watershed plant diversity of 160 species with about 27.00 % 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 manyopen water areas to support various types of recreation and has a poor diversity of plant species. The primary pest plants in the stream include *hydrilla verticillata*.

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.

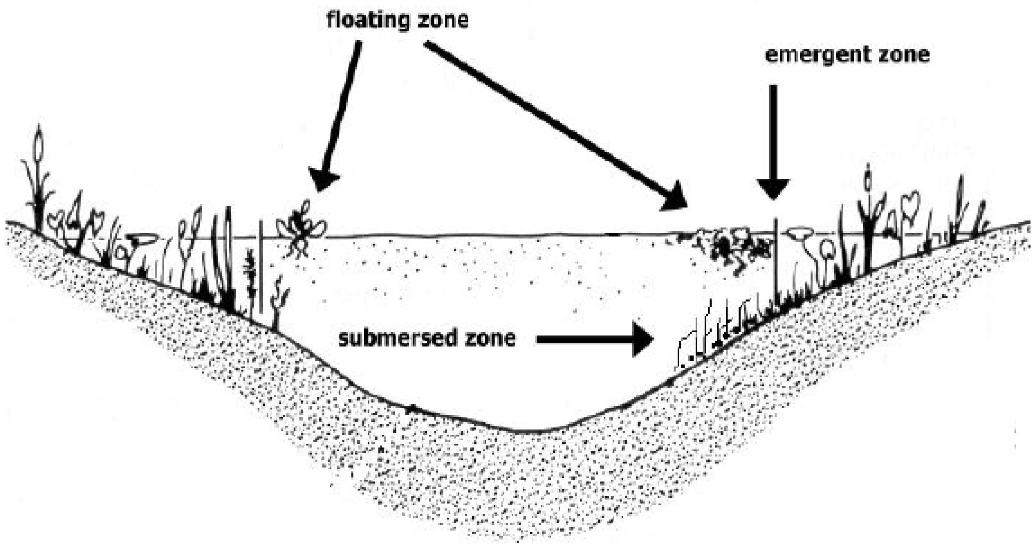
WQI	Rating	Confidence	Season
30	Good	5/5	Winter (2000)
40	Good	3/5	Fall (2000)
30	Good	2/5	Summer (2000)
50	Fair	3/5	Summer (2000)

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

[1]The 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 form 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 µg/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** (µg/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 µg/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.