Stream Assessment Report for
Delaney Creek
in Hillsborough County, Florida

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Reviewed by:

INTRODUCTION

This assessment was conducted to update existing physical and ecological data for Delaney Creek on the Hillsborough County & City of Tampa Water Atlas. The project is a collaborative effort between the University of South Florida's Center for Community Design and Research 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. View of Delaney Creek near Maydell Avenue

BACKGROUND

Delaney Creek is approximately 13 miles long with its mouth in Hillsborough Bay. The study area for this assessment is from the Selmon Expressway downstream to the S 36th Avenue Bridge. The study area includes an urban residential area to the north and mixed use agriculture and livestock along the south. Several north-south orientated ditches from the residential area connect to Delaney Creek.

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. **Due to the low water conditions at the time of the assessment, bathymetric mapping was not possible on Delaney Creek with many locations less than 0.5 ft deep and heavily vegetated.**

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 LCX 28C HD or 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 (**Error! Reference source not found.**). 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.

Due to the low water conditions at the time of the assessment, bathymetric mapping was not possible on Delaney Creek with many locations less than 0.5 ft deep and heavily vegetated.

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

Parameter	Feet	Meters	Acres	Acre-Ft	Gallons
Surface Area (sq)	540,144	50,181	12.40	0	0
Mean Depth	0	0	0	0	0
Maximum Depth	0	0	0	0	0
Volume (cubic)	0	0	0	0	0
Gauge (relative)	11.64	3.55	0	0	0

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 28c HD or HDS 5 combined GPS/fathometer described earlier. As depicted in Figure , 22 vegetation has 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 (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 2013 aquatic plant assessment for the stream. These data are determined from the 22 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	Stream	Watershed
Number of Vegetation Assessment Sites	22	82
Total Plant Diversity (# of Taxa)	81	134
% Non-Native Plants	27.16%	22.39%
Total Pest Plant Species	12	14

Figure 2. 2013 Vegetation Assessment Region Map for Delaney Creek

Table 3. List of Floating Leaf Zone Aquatic Plants Found

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
LEN	*Lemna spp.*	Duckweed	77%	N, E0
SPI	*Spirodela polyrhiza*	Giant Duckweed	77%	N, E0
ECS	*Eichhornia crassipes*	Water Hyacinth	63%	E1, P
SMA	*Salvinia minima*	Water Spangles, Water Fern	54%	E1
ACA	*Azolla filiculoides*	Carolina Mosquito Fern; American Waterfern	50%	N, E0

Figure 3. Water Hyacinth was a common non-native invasive species found on Delaney Creek during the assessment.

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**	**100%**	**N, E0**
BMA	***Urochloa mutica***	**Para Grass**	**100%**	**E1, P**
COM	***Commelina spp.***	**Dayflower**	**95%**	**N, E0, P**
LPA	***Ludwigia peruviana***	**Peruvian Primrosewillow**	**90%**	**E1, P**
LLA	***Ludwigia leptocarpa***	**Anglestem Primrosewillow**	**90%**	**N, E0**
PCA	***Pontederia cordata***	**Pickerel Weed**	**86%**	**N, E0**
ULA	***Urena lobata***	**Caesar's-weed**	**81%**	**E1, P**
QLA	***Quercus laurifolia***	**Laurel Oak; Diamond Oak**	**77%**	**N, E0**
CEA	***Colocasia esculenta***	**Wild Taro**	**72%**	**E1, P**
EUP	***Eupatorium capillifolium***	**Dog Fennel**	**72%**	**N, E0**
HYE	***Hydrocotyle umbellata***	**Manyflower Marshpennywort, Water Pennywort**	**68%**	**N, E0**
STS	***Schinus terebinthifolius***	**Brazilian Pepper**	**68%**	**E1, P**
SLT	***Sagittaria latifolia***	**Wapato, Common Arrowhead, Broadleaf Arrowhead, Duck Potato**	**59%**	**N, E0**
AGS	***Andropogon glomeratus***	**Bushy Bluestem; Bush Broom Grass**	**59%**	**N, E0**
APS	***Alternanthera philoxeroides***	**Alligator Weed**	**54%**	**E2, P**
MAM	***Myriophyllum aquaticum***	**Parrot Feather**	**54%**	**E0, P**
PRS	***Panicum repens***	**Torpedo Grass**	**50%**	**E1, P**
MSS	***Mikania scandens***	**Climbing Hempvine**	**50%**	**N, E0**
HAS	***Hymenachne amplexicaulis***	**Trompetilla**	**45%**	**E1**
SLA	***Sagittaria lancifolia***	**Duck Potato**	**45%**	**N, E0**
LEL	***Leucaena leucocephala***	**White Leadtree**	**40%**	**E2**
BHA	***Baccharis halimifolia***	**Groundsel Tree; Sea Myrtle**	**40%**	**N, E0**
CYO	***Cyperus odoratus***	**Fragrant Flatsedge**	**40%**	**N, E0**
DBA	***Dioscorea bulbifera***	**Air Potato**	**40%**	**E1**
ACE	***Acer rubrum***	**Southern Red Maple**	**36%**	**N, E0**
WTA	***Sphagneticola trilobata***	**Creeping Oxeye; Wedelia**	**36%**	**E2**
PAR	***Paspalum repens***	**Water Paspalum**	**36%**	**N, E0**
PMM	***Panicum maximum***	**Guineagrass**	**31%**	**E0**
BRP	***Broussonetia papyrifera***	**Paper Mulberry**	**31%**	**E2**
EAA	***Eclipta alba***	**Yerba De Tajo**	**31%**	**N, E0**
PDF	***Polygonum glabrum***	**Denseflower Knotweed**	**31%**	**N, E0**
SCA	***Salix caroliniana***	**Carolina Willow**	**22%**	**N, E0**

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
QNA	***Quercus nigra***	**Water Oak**	**22%**	**N, E0**
RBA	***Ruellia simplex***	**Britton's Wild Petunia**	**18%**	**E1**
LRS	***Ludwigia repens***	**Creeping Primrosewillow, Red Ludwigia**	**18%**	**N, E0**
VRA	***Vitis rotundifolia***	**Muscadine Grape**	**18%**	**N, E0**
WAX	***Myrica cerifera***	**Southern Bayberry; Wax Myrtle**	**18%**	**N, E0**
SPO	***Sabal palmetto***	**Sabal Palm, Cabbage Palm**	**13%**	**N, E0**
SCC	***Schoenoplectus californicus***	**Giant Bulrush**	**13%**	**N, E0**
PRA	***Pluchea baccharis***	**Rosy Camphorweed**	**13%**	**N, E0**
LOS	***Ludwigia octovalvis***	**Mexican Primrosewillow, Long-stalked Ludwigia**	**13%**	**N, E0**
ICA	***Imperata cylindrica***	**Cogon Grass**	**13%**	**E1**
CAA	***Centella asiatica***	**Asian Pennywort, Coinwort, Spadeleaf**	**13%**	**N, E0**
DVA	***Diodia virginiana***	**Buttonweed**	**13%**	**N, E0**
ACS	***Symphyotrichum carolinianum***	**Climbing Aster**	**13%**	**N, E0**
BLS	***Blechnum serrulatum***	**Swamp fern, Toothed Midsorus Fern**	**9%**	**N**
EUT	***Eustachys petraea***	**Pinewoods Fingergrass**	**9%**	**N, E0**
LJM	***Lygodium japonicum***	**Japanese Climbing Fern**	**9%**	**E1**
RVS	***Rumex verticillatus***	**Swamp Dock**	**9%**	**N, E0**
SAC	***Sacciolepis striata***	**American Cupscale**	**9%**	**N, E0**
OCA	***Osmunda cinnamomea***	**Cinnamon Fern**	**9%**	**N, E0**
PHS	***Polygonum hydropiperoides***	**Mild Waterpepper; Swamp Smartweed**	**9%**	**N, E0**
THA	***Thelypteris spp.***	**Shield ferns**	**9%**	**N, E0**
TYP	***Typha spp.***	**Cattails**	**4%**	**N, E0**
UAA	***Ulmus americana***	**American Elm; Florida Elm**	**4%**	**N, E0**
SSM	***Sapium sebiferum***	**Chinese Tallow Tree**	**4%**	**E1**
RCS	***Ricinus communis***	**Castorbean**	**4%**	**E2**
SAM	***Sambucus nigra subsp. Canadensis***	**Elderberry**	**4%**	**N, E0**
SHA	***Sesbania herbacea***	**Danglepod Sesban**	**4%**	**N, E0**
SPM	***Syngonium podophyllum***	**Nephthytis, Arrowhead Vine, American Evergreen**	**4%**	**E1**
IVA	***Iris virginica***	**Southern Blue Flag**	**4%**	**N, E0**
JRO	***Juncus roemerianus***	**Needle Rush, Black Rush**	**4%**	**N, E0**
NEP	***Nephrolepsis spp***	**Sword Fern**	**4%**	
PFO	***Paederia foetida***	**Skunkvine, Stinkvine**	**4%**	**E1**
PHN	***Panicum hemitomon***	**Maidencane**	**4%**	**N, E0**
CAM	***Crinum americanum***	**Swamp lily**	**4%**	**N, E0**

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
CLG	***Cyperus ligularis***	**Swamp Flatsedge**	**4%**	**N, E0**
CPT	***Cyperus polystachyos***	**Flat Sedge**	**4%**	**N, E0**
CSS	***Cyperus surinamensis***	**Tropical Flatsedge**	**4%**	**N, E0**
BOC	***Boehmeria cylindrica***	**Bog Hemp, False Nettle**	**4%**	**N, E0**
ADM	***Acrostichum danaeifolium***	**Giant Leather Fern**	**4%**	**N, E0**
AAS	***Amaranthus australis***	**Southern Water Hemp**	**4%**	**N, E0**

Figure 4. The typical emergent vegetation community of Delaney Creek in the assessment study area.

Table 5. List of Submerged Zone Aquatic Plants Found.

Plant Species Code	Scientific Name	Common Name	Percent Occurrence	Type
HVA	*Hydrilla verticillata*	Hydrilla, waterthyme	100%	E1, P
HPA	*Hygrophila polysperma*	East Indian Hygrophila, Indian Swampweed	95%	E1, P
CDM	*Ceratophyllum demersum*	Hornwort, Coontail	27%	N, E0
BMI	*Bacopa monnieri*	Common Bacopa	18%	N, E0

Figure 5. Hydrilla was a common non-native invasive species in Delaney Creek

Table 6. List of All Plants and Sample Sites

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Hydrilla, waterthyme	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22	100	Submersed
Para Grass	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22	100	Emergent
White Beggar-ticks, Romerillo	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22	100	Terrestrial
Dayflower	1,2,3,4,5,6,7,8,9,10,11,12,13,15,16,17,18,19,20,21,22	95	Emergent
East Indian Hygrophila, Indian Swampweed	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,17,18,19,20,21,22	95	Submersed
Anglestem Primrosewillow	3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22	90	Emergent
Peruvian Primrosewillow	2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22	90	Emergent
Pickerel Weed	3,4,5,6,7,8,9,10,11,12,13,14,15,17,18,19,20,21,22	86	Emergent
Caesar's-weed	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,21	81	Emergent
Duckweed	5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21	77	Floating
Giant Duckweed	5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21	77	Floating
Laurel Oak; Diamond Oak	1,2,3,4,5,6,7,8,11,15,16,17,18,19,20,21,22	77	Emergent
Dog Fennel	3,4,5,10,11,12,13,14,15,16,17,18,19,20,21,22	72	Emergent
Wild Taro	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,22	72	Emergent
Brazilian Pepper	1,2,3,10,12,13,14,15,16,17,18,19,20,21,22	68	Emergent
Manyflower Marshpennywort, Water Pennywort	1,2,10,11,12,13,14,15,16,17,18,19,20,21,22	68	Emergent
Water Hyacinth	2,3,4,5,6,7,8,9,10,11,12,13,14,15	63	Floating
Bushy Bluestem; Bush Broom Grass	3,4,5,6,7,8,9,10,11,12,13,14,15	59	Emergent
Wapato, Common Arrowhead, Broadleaf Arrowhead, Duck Potato	4,5,6,7,8,9,10,11,12,15,17,18,22	59	Emergent
Alligator Weed	2,10,11,12,13,14,15,16,17,18,19,20	54	Emergent
Parrot Feather	4,5,6,7,8,9,10,11,12,13,14,15	54	Emergent
Water Spangles, Water Fern	11,12,13,14,15,16,17,18,19,20,21,22	54	Floating
Carolina Mosquito Fern; American Waterfern	5,6,7,8,9,10,11,12,13,14,15	50	Floating
Climbing Hempvine	5,6,7,8,9,10,11,12,13,14,15	50	Emergent
Torpedo Grass	7,11,13,14,15,16,17,18,19,20,21	50	Emergent
Duck Potato	5,6,7,8,9,10,12,13,14,15	45	Emergent
Trompetilla	2,5,6,7,8,9,10,11,12,13	45	Emergent
Air Potato	2,4,5,6,7,8,14,15,16	40	Emergent
Fragrant Flatsedge	10,11,13,14,16,17,18,19,20	40	Emergent
Groundsel Tree; Sea Myrtle	3,4,5,6,7,8,9,12,15	40	Emergent
White Leadtree	10,14,15,16,17,18,20,21,22	40	Terrestrial

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Creeping Oxeye; Wedelia	**3,7,13,14,16,17,18,19**	**36**	**Emergent**
Southern Red Maple	**3,4,14,15,17,19,20,22**	**36**	**Emergent**
Water Paspalum	**4,5,6,7,8,9,12,22**	**36**	**Emergent**
Denseflower Knotweed	**10,11,12,13,14,15,16**	**31**	**Emergent**
Guineagrass	**12,13,16,17,18,19,20**	**31**	**Terrestrial**
Paper Mulberry	**7,16,17,18,19,20,21**	**31**	**Emergent**
Yerba De Tajo	**5,6,7,13,14,16,17**	**31**	**Emergent**
Hornwort, Coontail	**10,11,12,13,14,15**	**27**	**Submersed**
Carolina Willow	**7,13,14,15,17**	**22**	**Emergent**
Water Oak	**4,14,15,20,21**	**22**	**Emergent**
Britton's Wild Petunia	**12,13,14,15**	**18**	**Terrestrial**
Common Bacopa	**12,15,16,19**	**18**	**Submersed**
Creeping Primrosewillow, Red Ludwigia	**11,12,15,20**	**18**	**Emergent**
Muscadine Grape	**16,17,21,22**	**18**	**Emergent**
Southern Bayberry; Wax Myrtle	**4,10,16,21**	**18**	**Emergent**
Asian Pennywort, Coinwort, Spadeleaf	**2,14,15**	**13**	**Emergent**
Buttonweed	**12,13,14**	**13**	**Emergent**
Climbing Aster	**9,13,14**	**13**	**Emergent**
Cogon Grass	**3,10,14**	**13**	**Terrestrial**
Giant Bulrush	**13,14,15**	**13**	**Emergent**
Mexican Primrosewillow, Long-stalked Ludwigia	**11,12,13**	**13**	**Emergent**
Rosy Camphorweed	**14,15,16**	**13**	**Emergent**
Sabal Palm, Cabbage Palm	**12,14,15**	**13**	**Terrestrial**
American Cupscale	**3,4**	**9**	**Emergent**
Cinnamon Fern	**2,15**	**9**	**Emergent**
Japanese Climbing Fern	**2,7**	**9**	**Terrestrial**
Mild Waterpepper; Swamp Smartweed	**17,19**	**9**	**Emergent**
Pinewoods Fingergrass	**16,17**	**9**	**Terrestrial**
Shield ferns	**1,2**	**9**	**Emergent**
Swamp Dock	**2,15**	**9**	**Emergent**
Swamp fern, Toothed Midsorus Fern	**14,15**	**9**	**Emergent**
American Elm; Florida Elm	**14**	**4**	**Emergent**
Bog Hemp, False Nettle	**18**	**4**	**Emergent**

Plant Common Name	Found at Sample Sites	Percent Occurrence	Growth Type
Castorbean	**22**	**4**	**Terrestrial**
Cattails	**9**	**4**	**Emergent**
Chinese Tallow Tree	**17**	**4**	**Emergent**
Danglepod Sesban	**11**	**4**	**Emergent**
Elderberry	**14**	**4**	**Emergent**
Flat Sedge	**13**	**4**	**Emergent**
Giant Leather Fern	**15**	**4**	**Emergent**
Maidencane	**9**	**4**	**Emergent**
Needle Rush, Black Rush	**12**	**4**	**Emergent**
Nephthytis, Arrowhead Vine, American Evergreen	**22**	**4**	**Terrestrial**
Skunkvine, Stinkvine	**2**	**4**	**Terrestrial**
Southern Blue Flag	**15**	**4**	**Emergent**
Southern Water Hemp	**17**	**4**	**Emergent**
Swamp Flatsedge	**17**	**4**	**Terrestrial**
Swamp lily	**15**	**4**	**Emergent**
Sword Fern	**15**	**4**	**Terrestrial**
Tropical Flatsedge	**15**	**4**	**Emergent**

Discussion of Vegetation Assessment Results

The study area of Delaney Creek has been heavily modified and channelized from its natural condition. It is typified by steep banks and opportunistic vegetation commonly found in disturbed habitats. Many of the non-native invasive species have been spread by fragmentation such as *hydrilla* and *hygrophila*. Of the 81 species identified on Delaney Creek, 27% were non-native invasive species.

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 Delaney Creek Water Quality Page can be viewed at http://www.hillsborough.wateratlas.usf.edu/river/waterquality.asp?wbodyid=27&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 Figure , Figure , and Figure for Delaney Creek. 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, Delaney Creek has a color value determined as a platinum cobalt unit (pcu) value of 36.8 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. Delaney Creek has a WQI of 38 as of January-March of 2013 and does not meet the FDEP Impaired Waters Rule (IWR) criteria and could be classified as not impaired. See also **Error! Reference source not found.**.

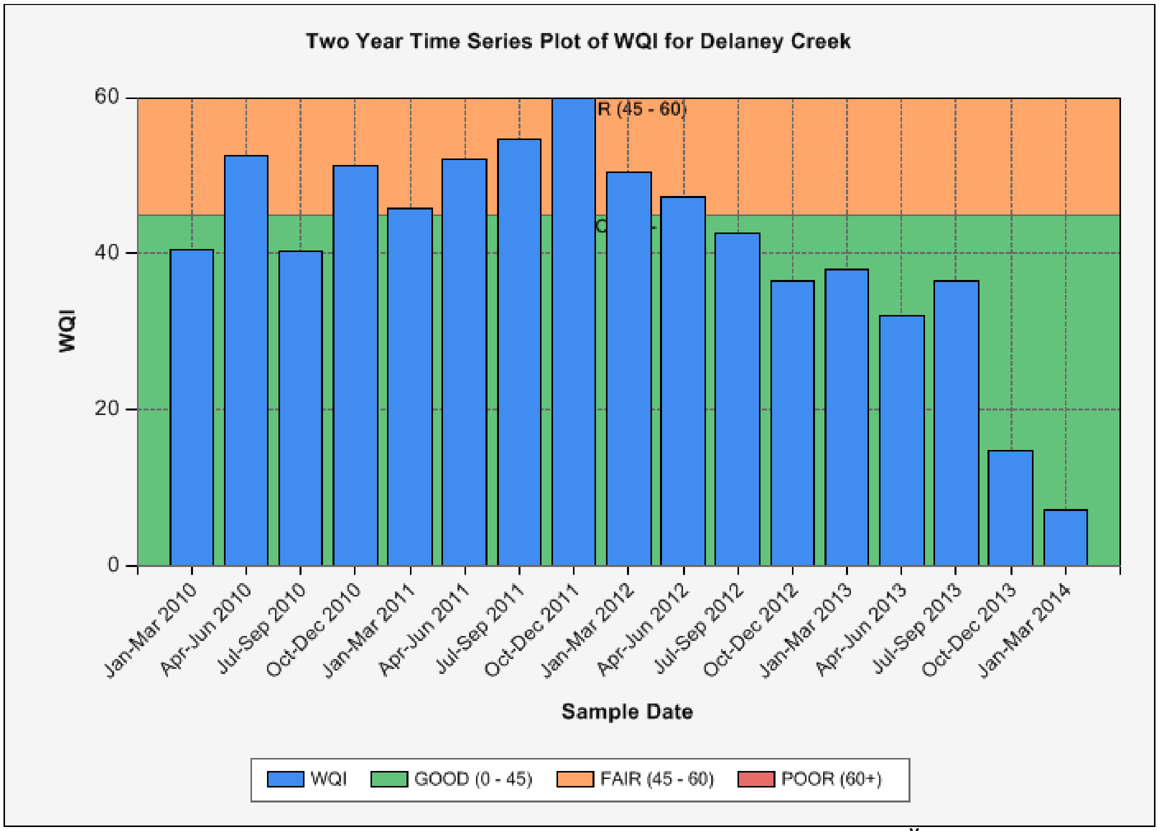


Figure 6. Recent Water Quality Index (WQI) graph for Delaney Creek[v]

[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=27&data=WQI&datatype=WQ&waterbodyatlas=river&ny=10&bench=1

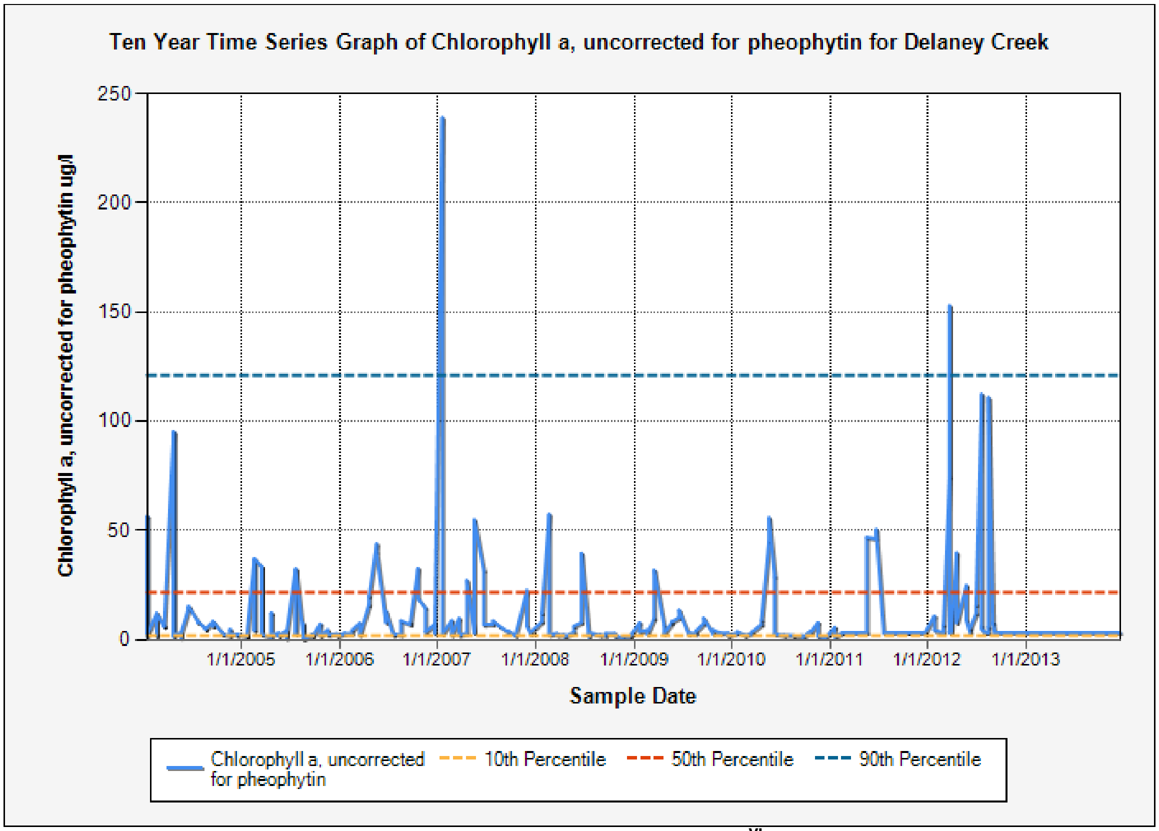


Figure 7. Recent Chlorophyll a graph for Delaney Creek[vi]

[vi] Graph Source: Hillsborough County Water Atlas. For the latest data go to http://www.hillsborough.wateratlas.usf.edu/graphs20/graph_it.aspx?wbodyid=27&data=Chla_ugl&datatype=WQ&waterbodyatlas=river&ny=10&bench=1

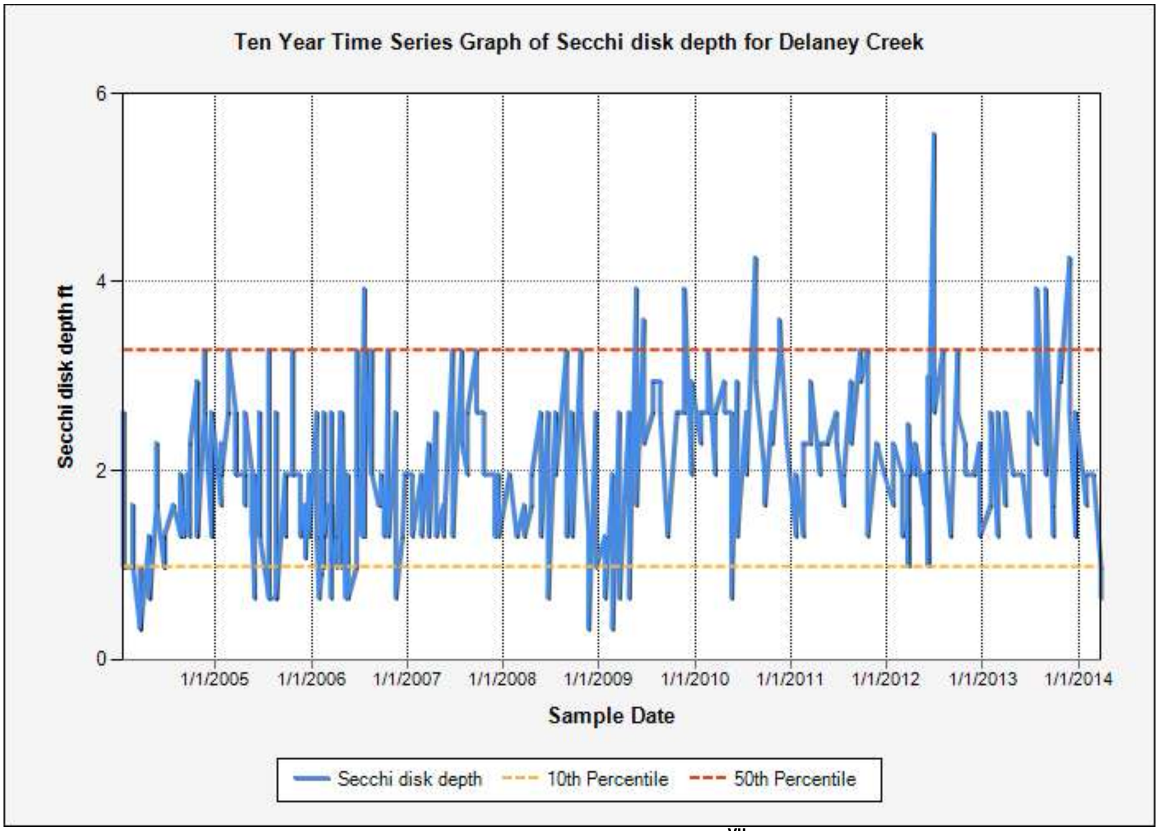


Figure 8. Recent Secchi Disk graph for Delaney Creek[vii]

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 Table 6 and 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 and chlorophyll a must be at or below 20 µg/L not be considered impaired.

[vii] Graph Source: Hillsborough County Water Atlas. For the latest data go to http://www.hillsborough.wateratlas.usf.edu/graphs20/graph_it.aspx?wbodyid=27&data=secchi_ft&datatype=WQ&waterbodyatlas=stream&ny=10&bench=1

Table 6 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.

Delaney Creek, a freshwater creek that flows into Hillsborough Bay, has one long-term data stations in the study area whose three-year geometric mean for Total Nitrogen, Total Phosphorus and Chlorophyll are as shown below in Table 7.

Table 7. Delaney Creek at 36th Avenue S Numeric Nutrient Criteria

Delaney Creek at 36th Avenue S	Total Phosphorous mg/l	Total Nitrogen mg/l	Chlorophyll-a Corrected µg/l
Period of Record Geomean	0.354	1.348	3.441
2011 Geomean	0.168	0.844	3.824
2012 Geomean	0.206	0.794	4.166
2013 Geomean	0.161	0.957	3.825

Using the Numeric Nutrient Criteria, Delaney Creek at 36th Avenue S would not be considered impaired for annual geomean exceedance of Total Phosphorous, Total Nitrogen or Chlorophyll-a Corrected.

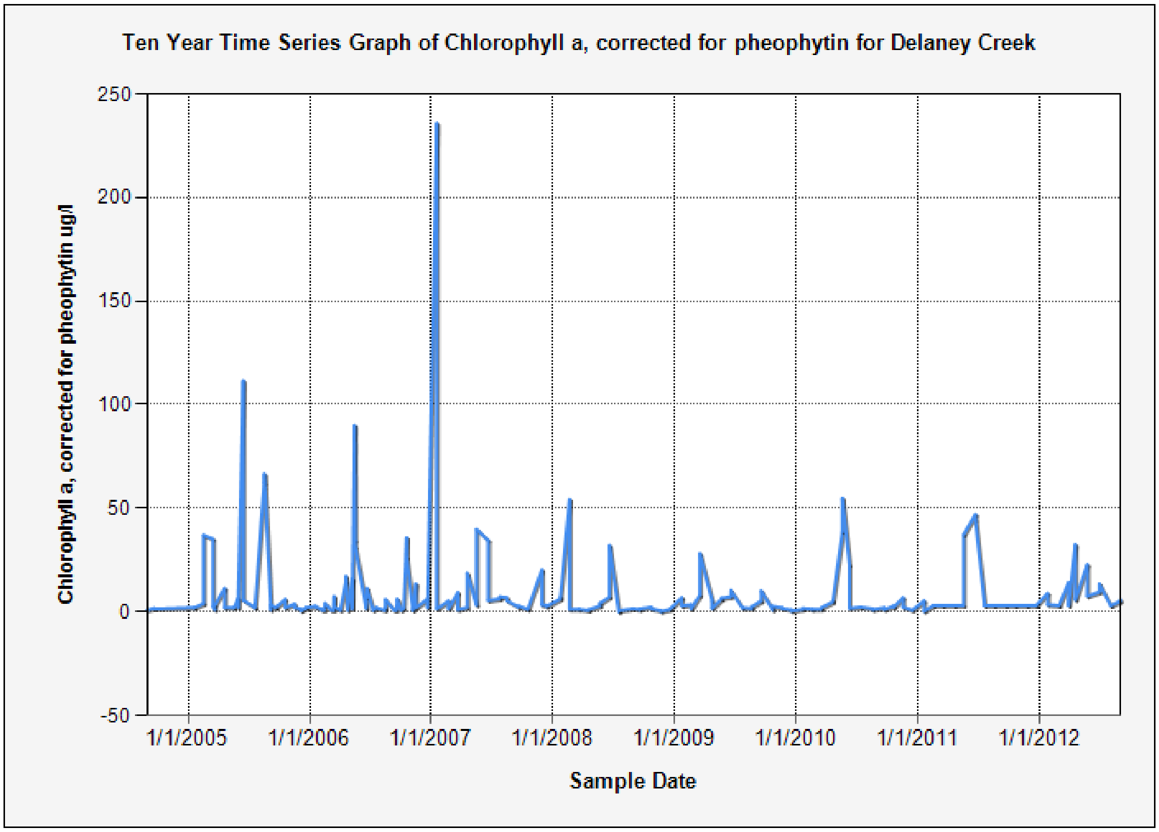


Figure 92. Graph of Chlorophyll-a corrected for pheophytin for Delaney Creek

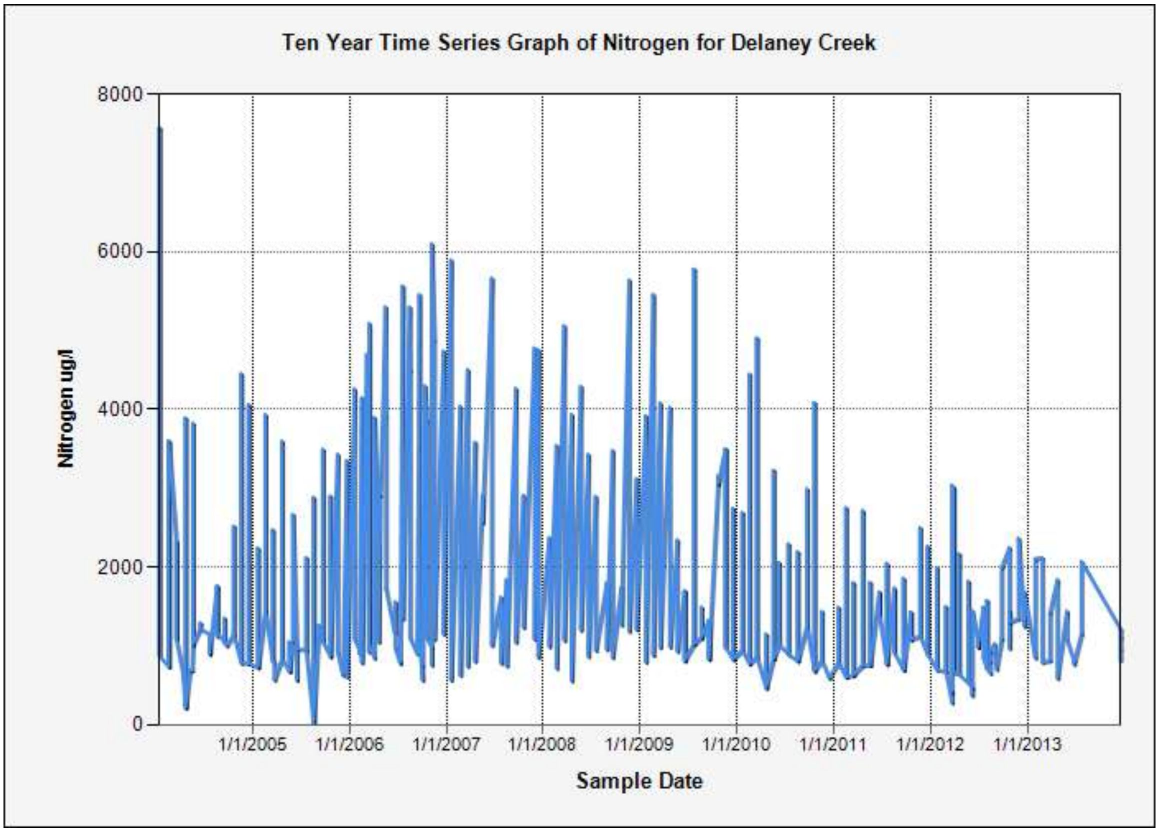


Figure 3 Graph of Total Nitrogen for Delaney Creek

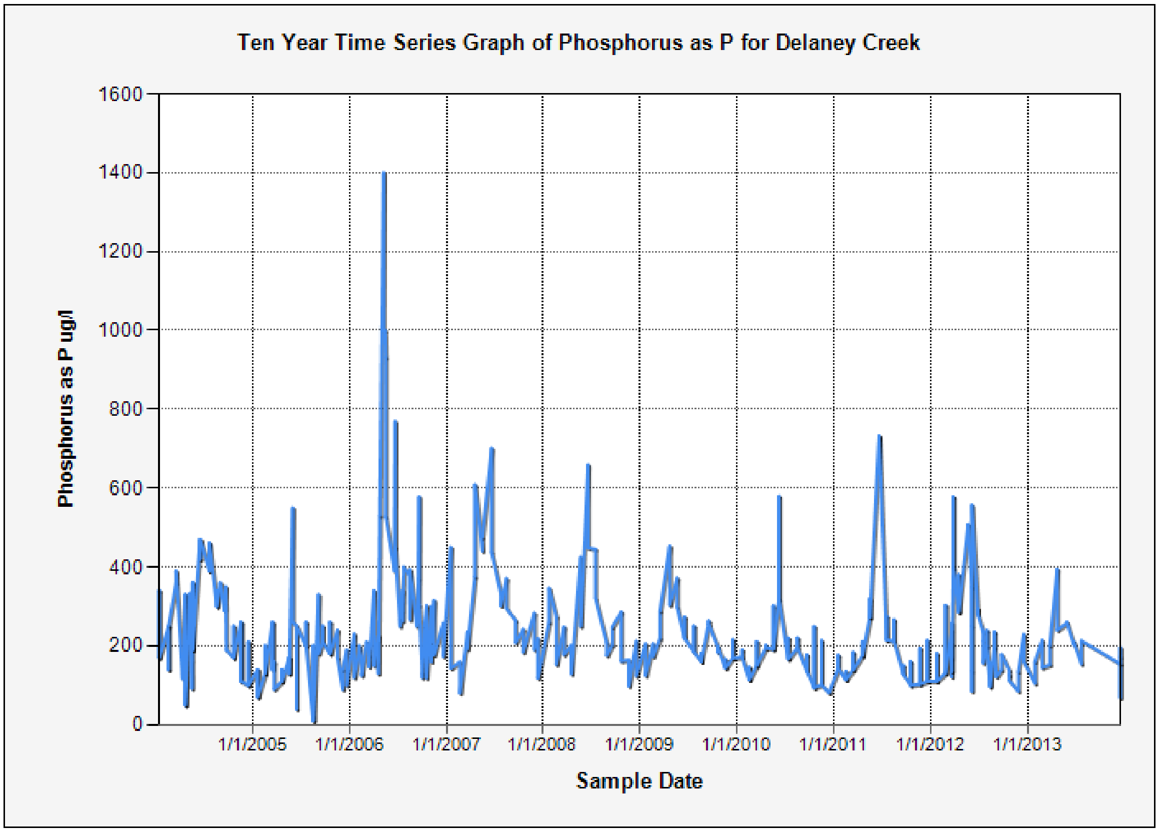


Figure 4 Graph of Total Phosphorous for Delaney Creek

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! Reference source not found.**8 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. Delaney Creek is a nitrogen limited system meaning that an additional input of nitrogen would potentially increase the biomass of aquatic vegetation and algae.

Table 8. Water Quality Parameters (Laboratory) for Baker Creek

Parameter	86th Street S	78th Street S	Robindale Road N/S Canal	Maydell Drive	36th Avenue S	Geometric Mean Value
Total Phosphorus (ug/L)	**154**	**196**	**68**	**172**	**155**	**140.5**
Total Nitrogen (ug/L)	**965**	**1,212**	**817**	**1,103**	**1,119**	**1,033.6**
Chlorophyll-a Corrected (ug/L)	**3.1**	**3.1**	**3.1**	**3.1**	**3.1**	**3.1**
TN/TP	**6.27**	**6.18**	**12.01**	**6.41**	**7.22**	**7.36**
Limiting Nutrient	**Nitrogen**	**Nitrogen**	**Balanced**	**Nitrogen**	**Nitrogen**	**Nitrogen**
Color (PCU)	**37.8**	**40.1**	**31.5**	**38.3**	**36.3**	**36.7**
Fecal Coliform	**520**	**1,620**	**840**	**520**	**340**	**659.9**
Enterococci	**820**	**1,640**	**1,220**	**1,000**	**700**	**1,028.1**
Secchi disk depth (ft)	**2.4 Visible on Bottom**	**2.1 Visible on Bottom**	**2.6 Visible on Bottom**	**2.2 Visible on Bottom**	**2.1 Visible on Bottom**	**2.3 Visible on Bottom**
Numeric Nutrient Criteria Status	**No Data**	**No Data**	**No Data**	**No Data**	**Not Impaired**	**Not Impaired**
Phosphorous NNC Criteria (ug/L)	**490**	**490**	**490**	**490**	**490**	**490**
Nitrogen NNC Criteria (ug/L)	**1650**	**1650**	**1650**	**1650**	**1650**	**1650**
2013 Geomean Phosphorous	**No Data**	**No Data**	**No Data**	**No Data**	**161.1**	**354.3 (Period of Record)**
2013 Geomean Nitrogen	**No Data**	**No Data**	**No Data**	**No Data**	**956.8**	**1,348.2 (Period of Record)**

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! Reference source not found.**8 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. Delaney Creek is nitrogen-limited; i.e., an increase in nitrogen could change the WQI and increase the potential for algal growth.

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 8 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.

Based on the water quality samples taken during the assessment and the available long term data, Delaney Creek would not be considered impaired for nutrients or chlorophyll-a concentrations. Delaney Creek does show some bacterial contamination from livestock and household pets. During the assessment Livestock was observed in the stream at the upstream extent of the study area. In addition, in the study area downstream from Causeway Blvd piles of "livestock waste products" were observed along the banks of the creek.

Figure 5 Livestock waste products should not be stored or disposed of along waterbodies

Table 9 contains the field data taken in the upstream and downstream extents of the stream using a multi-probe (we use either a YSI 6000 or 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 and twice for the surface measurement. The duplicate surface measurement is taken as a quality assurance check on measured data. Due to the depth of water present at the time of the assessment, only surface readings were able to be taken.

Table 9. Water Chemistry Data Based on Manta Water Chemistry Probe for Delaney Creek

Sample Location	Sample Depth (m)	Time	Temp (deg C)	Conductivity (mS/cm3)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH
Mean Value	1.48	10/25/2013 12:00:00 AM	23.99	0.426	94.16	8.31	8.01
Surface - 78th Street	0.91	10/25/2013 12:00:00 AM	23.83	0.383	86.60	7.68	8.08
Surface - 86th Street	1.27	10/25/2013 12:00:00 AM	23.68	0.360	118.60	10.54	8.15
Surface - Maydell Drive	2.47	10/25/2013 12:00:00 AM	24.89	0.403	110.30	9.58	8.35
Surface - NS canal Robindale Road	0.93	10/25/2013 12:00:00 AM	23.68	0.483	66.90	5.94	7.60
Surface - S 36th Avenue	1.82	10/25/2013 12:00:00 AM	23.91	0.500	88.40	7.82	7.89

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

Delaney Creek is a medium area (12.4-acre) stream that would be considered in the Eutrophic category of streams based on water chemistry. It has a plant diversity of 81 species relative to the total watershed plant diversity of 134 species with about 22.00% 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 few open water areas to support various types of recreation and has a fair diversity of plant species. The primary pest plants in the stream include Eichhornia crassipes, Urochloa mutica, Commelina spp., Ludwigia peruviana, Urena lobata, Colocasia esculenta, Schinus terebinthifolius, Alternanthera philoxeroides, Myriophyllum aquaticum, Panicum repens, Hydrilla verticillata, and Hygrophila polysperma. Bacterial contamination is a concern for Delaney Creek in the study area.

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).

2. 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.

3. 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.

4.

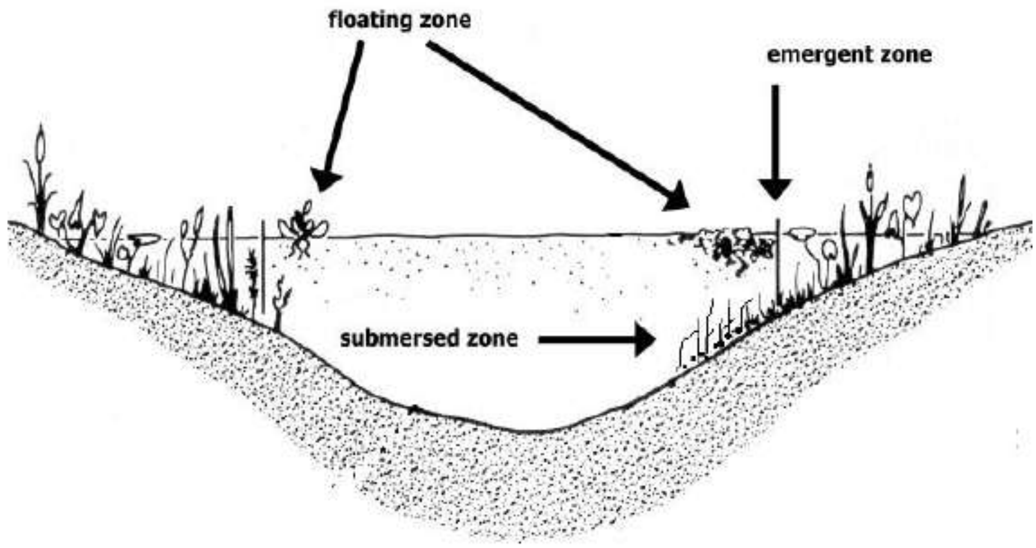
WQI	Rating	Confidence	Season
30	Good	5/5	Winter (2000)
40	Good	3/5	Fall (2000)
30	Good	2/5	Summer (2000)
50	Fair	3/5	Summer (2000)

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.

5. **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.

6. The three primary aquatic vegetation zones are shown below:



7. 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.

8. 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/

9. 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.