



Dug Creek

STREAM HABITAT ASSESSMENT, STREAM CONDITIONS INDEX, LINEAR
VEGETATION SURVEY, RAPID PERIPHYTON SURVEY AND WATER QUALITY

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Methods

STUDY AREA ANALYSIS

The watershed containing the stream being assessed was analyzed using ESRI ArcGIS 10.2. Using this software with 2016 Hillsborough County aerial, 2014 Land Use/ Land Cover (LULC) and Watershed boundary (WBID) layers courtesy of the Florida Department of Environmental Protection. The Landscape Development Intensity Index (LDI) was calculated for the WBID containing the stream. From FDEP “The Landscape Development Intensity index (LDI) is an estimate of how much humans have altered an area of interest around a waterbody. Various land use types (low density residential, row crops, industrial and natural) are assigned coefficients of land use intensity based on estimates of the amount of human energy that is put into those land use types.

The LDI is calculated by multiplying each land use coefficient by the percentage of the area of interest occupied by that land use, and then summing the results. The Florida Department of Environmental Protection (DEP) uses the LDI as a tool to estimate potential land use impacts on streams, lakes, and wetlands. LDI values less than two (≤ 2) can be considered minimally disturbed.” In the Florida framework, the maximum LDI index score is approximately 42.

HABITAT AND VEGETATION ASSESSMENT

For small streams that are not easily navigated by Jonboat for bathymetric mapping and vegetation analysis, Hillsborough County requested the implementation of the Florida Department of Environmental Protection methods for Stream and River Habitat Assessment (FT 3100) (<http://www.dep.state.fl.us/water/sas/sop/sops.htm>) using forms FD 9000-3, FD 9000-4 and FD 9000-5, Rapid Periphyton Survey (FS 7230) using form FD 9000-25 and Linear Stream Vegetation Survey (FS 7320) using form FD 9000-32. These methods were utilized on two sampling locations on each stream, typically near access points along roadways.

Stream and River Habitat Assessment per FT3100 receives a score calculated in Form FD 9000-5. This score results from the ranking of the primary habitat components (substrate diversity, substrate availability, water velocity and habitat smothering) and secondary habitat components (Artificial channelization, bank stability, riparian buffer zone width and riparian zone vegetation quality). The maximum score possible in this method is a 160.

Two metrics are utilized in the Linear Vegetation Survey. The Mean Coefficient of Conservatism (CoC) applies a score of 0-10 to each species based on its ecological tolerances and fidelity to pre-settlement conditions. Species with higher scores show a high fidelity to native, undisturbed habitats and are typically sensitive to alterations. Available CoC scores can be obtained from LT 7000 from the Florida Department of Environmental Protection at: <http://www.dep.state.fl.us/water/sas/sop/sops.htm>. The Percent Florida Exotic Pest Plant Council (% FLEPPC) metric calculates the percent invasive exotics as the number of occurrences of FLEPPC Category I or II in the 100 m reach divided by the total number of taxa occurrences in the 100 m reach. The FLEPPC list can be found at: <http://www.fleppc.org/list/ulist.html>

STREAM CONDITION INDEX ASSESSMENT

The Stream Condition Index (SCI) was sampled per DEP SOP FS7420 and calculated per DEP SOP LT7200. The SCI consists of collecting macroinvertebrates via 20 D-frame dipnet sweeps (0.5 m in length) in the most productive habitats in a 100 m reach of stream. The organisms are sub-sampled, and identified to the lowest practical taxonomic level. The SCI is composed of ten metrics, eight of which decrease in response to human disturbance, with two metrics (% very tolerant and % dominant) increasing in response to human disturbance. According to DEP SOP LT 7000, the SCI score ranges and categories are: (68-100) Exceptional; (35-67) Healthy; and (0-34) Impaired. Proposed biological health assessment criteria state that a site is considered to meet designated uses if the average of the two most recent SCI scores is 40 or higher and neither of those scores is less than 35.

WATER QUALITY ASSESSMENT

Physical water quality samples were taken using a Eureka Manta Sub-2 multiprobe pre and post calibrated daily. Measurements taken with this device include: depth, conductivity, pH, Dissolved Oxygen (mg/l and % Saturation) and salinity. Chemical water parameters were collected and preserved on ice by USF Water Institute staff and analyzed at the Environmental Protection Commission of Hillsborough County Laboratory. Analysis include; Chlorophyll (a, b, c, t and corrected), Alkalinity, Color, E. Coli, Enterococci, Ammonia, Nitrates/Nitrites, Total Phosphorous, Kjeldahl Nitrogen and Total Nitrogen.

Study Area

Dug Creek is located in central Hillsborough County. Its headwaters are located west of Westlake and Glengarry Rd and the outfall of Dug Creek is in the Little Manatee River. The assessment of Dug Creek was conducted on March 27, 2019. At the time of the assessment, the water levels were normal for the dry season. The Dug Creek WBID covers 7.58 square miles and is dominated by natural (56.3%), residential (23.2%), agricultural (10.9%) and commercial (1.5%) land uses. The resulting calculated landscape development intensity index score was 3.57.

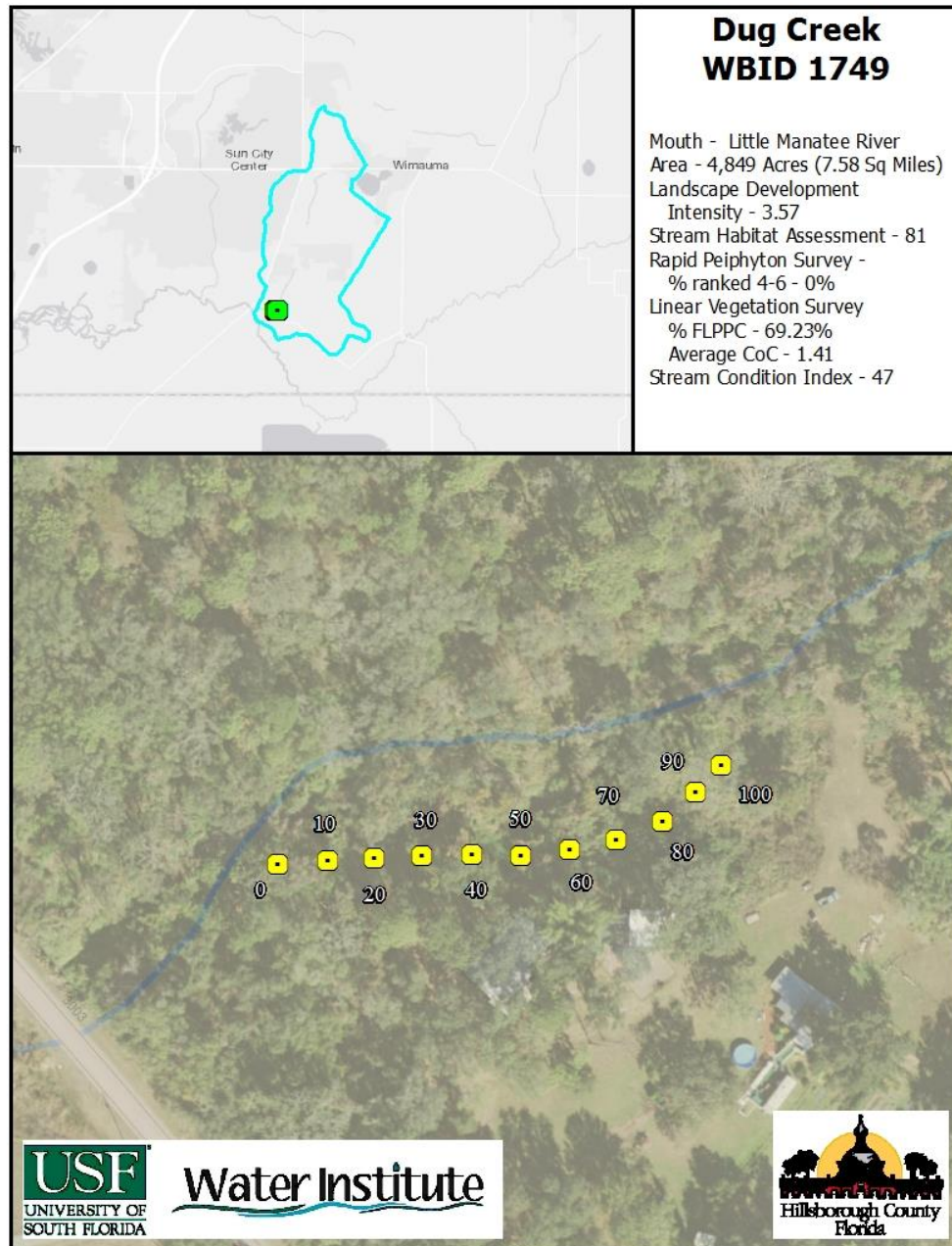


Figure 1 2019 Dug Creek Study Area Map



Figure 2 Overview photograph of Dug Creek at the Saffold Rd Sample Site

Habitat and Vegetation Assessment

The region of Dug Creek where the assessment was conducted is in a mixture of Natural and residential land use near an agricultural area. The region was moderately shaded with a mean canopy cover measurement of 59.5%. Dug Creek averaged 0.3 meters in depth, approximately 4.0 meters wide with a flow of 0.25 m/s.

The primary habitat components of the FDEP Habitat Assessment focus on in-water habitat. The primary habitat components score in the optimal category for Water Velocity. Marginal scores were achieved for Substrate Diversity (Presence of two major productive habitats (snags, roots)) and Habitat Smothering (Many of the productive habitats were affected by sand smothering and the pools were unstable). Substrate Availability scored in the poor category due to low overall percentage of productive habitats (2.6% of total stream area) and sand smothering. Minor habitats included sand and silt deposits. The total score for the primary habitat components was a 36 out of 80.

The secondary habitat components of the FDEP Habitat Assessment focus on the surrounding features of the stream. At the water level at the time of assessment, Dug Creek was low on its banks revealing the eroded sand banks from the wet season. The secondary habitat components scored in the optimal category for Riparian Buffer Zone Width for the left bank. Artificial Channelization and Vegetation Quality for the left bank scored in the suboptimal category. Bank Stability, Riparian Buffer Width for the right bank when facing upstream and Riparian Zone Vegetation Quality for the right bank when facing upstream were all marginal. There were several areas of raw eroded banks where the sand bank had collapsed on the right bank. The riparian buffer zone surrounding the stream was greater than 18 meters on the left bank and consisted of native trees. The right bank had a buffer averaging 10 meters and contained a mixture of invasive species and species indicative of disturbance (*Urena lobata*). The vegetation in the stream itself was dominated by mostly native species with 2 non-native invasive species likely from an upstream source. The secondary habitat components received a score of 45 out of 80. The resulting FDEP Habitat Assessment score was an 81.

Periphyton was not encountered during the 99 samples taken during the Rapid Periphyton Survey. The tree canopy in the assessment area averaged 59.5% limiting available sunlight for macrophytes and algae.

The FDEP Linear Vegetation Survey encountered 11 herbaceous species in Dug Creek, six of which are native. *Colocasia esculenta*, *Ruellia simplex*, *Urochloa mutica*, *Hydrilla verticillata* and *Sphagneticola trilobata* are non-native invasive species. None of the species encountered were abundant. *Colocasia esculenta* most the most commonly occurring species.

Table 1 Linear Vegetation Survey Results – Dug Creek

Taxa Name	C of C Score	Sample Site										Total Occurrences
		0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	
<i>Colocasia esculenta</i>	0	1	1		1	1	1	1	1	1	1	9
<i>Ruellia simplex</i>	0			1	1		1	1	1	1	1	7
<i>Commelina virginica</i>	4.67				1	1		1		1	1	6
<i>Commelina diffusa</i>	2.02		1	1		1				1		4
<i>Urochloa mutica</i>	0	1		1		1					1	4
<i>Ipomoea alba</i>	2.45		1	1							1	3
<i>Hydrilla verticillata</i>	0								1		1	2
<i>Cephalanthus occidentalis</i>	5										1	1
<i>Cicuta maculata</i>	4.54							1				1
<i>Hydrocotyle umbellata</i>	1.92									1		1
<i>Sphagneticola trilobata</i>	0	1										1
Mean Coefficient of Conservatism	1.41											
% FLEPPC	31.25%											



Figure 3 Example of the typical habitats observed in Dug Creek

Stream Condition Index

The analysis of the SCI sample involves splitting the sample into 2 aliquots for analysis. The SCI metrics are then calculated on each separately. The final SCI score is an average of the two scores. The SCI score for Dug Creek was 47 out of a possible 100 points, corresponding with a “Healthy” designation, with the expected community of a healthy stream.

High scores were achieved for the Total Clingers in sample A and % Very tolerant individuals metrics in sample B. Both subsamples contained a single sensitive taxa as well as a Long-lived taxa. The presence of both long-lived taxa and a sensitive taxa indicates that the water has not had any acute pollution events or desiccation events in the past year. The full results of the SCI sampling are shown in Table 3 (Sample A) and Table 4 (Sample B) for Dug Creek.

Table 2 SCI metric summaries for Dug Creek

SCI Metric		Raw Totals	SCI scores	Adjusted SCI scores
Total Taxa		23.00	3.33	3.33
Total Ephemeroptera		2.00	4.00	4.00
Total Trichoptera		2.00	2.86	2.86
% Filter Feeders		24.69	5.58	5.58
Total Clingers		5.00	7.14	7.14
Total Long-lived Taxa		1.00	3.33	3.33
% Dominance		43.13	4.18	4.18
% Tanytarsini		6.25	5.83	5.83
Total Sensitive Taxa		1.00	1.43	1.43
% Very Tolerant Individuals		10.63	5.62	5.62
SCI Sum	43.29			
Final SCI score	48.10			

SCI Metric		Raw Totals	SCI scores	Adjusted SCI scores
Total Taxa		22.00	2.92	2.92
Total Ephemeroptera		2.00	4.00	4.00
Total Trichoptera		1.00	1.43	1.43
% Filter Feeders		25.16	5.69	5.69
Total Clingers		4.00	5.71	5.71
Total Long-lived Taxa		1.00	3.33	3.33
% Dominance		48.37	3.13	3.13
% Tanytarsini		5.23	5.38	5.38
Total Sensitive Taxa		1.00	1.43	1.43
% Very Tolerant Individuals		2.61	8.54	8.54
SCI Sum	41.56			
Final SCI score	46.17			

Table 3 SCI full results for Sample A

Stream Condition Index Results for Dug Creek SCIA																				
Phylum	Subphylum	Class	Subclass	Order	Family	Taxa	Abundance	Collapsed Abundance	Taxa Presence	Ephemeroptera	Trichoptera	50% Filterer	100% Filterer	Clinger Taxa	Long-lived Taxa	Dominant Taxa	Tanytarsini	Sensitive Taxa	Very Tolerant	Specimen Notes
Annelida		Citellata	Oligochaeta	Tubificida	Naididae	Tubificinae spp.	1	1	1	0	0	0	0	0	0	0	0	0	0	0 Damaged and/or immature
Annelida		Citellata	Oligochaeta	Opisthopora	Sparganophilidae	Sparganophilus spp.	1	1	1	0	0	0	0	0	0	0	0	0	0	0 Immature
Mollusca		Gastropoda	Caenogastropoda	Littorinimorph	Hydrobiidae	Hydrobiidae spp.	3	3	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca		Gastropoda	Caenogastropoda	Littorinimorph	Hydrobiidae	Pyrgophorinae platyrachis	5	5	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Crustacea	Malacostraca	Decapodstraca	Amphipoda	Dogielinellidae	Hyalina aestica sp. complex	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	Baetidae spp.	4	1	0	0	0	0	0	0	0	0	0	0	0	0 Damaged and/or immature, not L. propinquus
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	Labobaetis propinquus	3	3	1	1	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	Baetis intercalaris	1	5	1	1	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Coenagrionidae	Coenagrionidae spp.	4	4	1	0	0	0	0	0	0	0	0	0	0	0 Immature
Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Aeshnidae	Boyeria vinosa	1	1	1	0	0	0	0	0	1	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Hydropsychidae	Cheumatopsyche spp.	20	20	1	0	1	0	20	1	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Hydroptilidae	Neotrichia spp.	1	1	1	0	1	0	0	1	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	Dubiraphia spp.	1	1	1	0	0	0	0	0	0	0	0	0	0	0 1 adult
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	Sirenia spp.	2	2	1	0	0	0	0	0	1	0	0	0	0	0 2 larvae
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	Microcyllopus spp.	5	5	1	0	0	0	0	0	0	0	0	0	0	0 5 larvae
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Chironomidae spp.	5	1	0	0	0	0	0	0	0	0	0	0	0	0 pupae
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Tanytarsus spp.	1	1	1	0	0	0.5	0	0	0	0	0	1	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Polypedium flavum	65	69	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Polypedium illinoense group	8	9	1	0	0	0	0	0	0	0	0	0	0	0 9
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Polypedium fallax group	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Rheotanytarsus exiguus group	5	5	1	0	0	0	5	1	0	0	5	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Ablabesmyia mallochi	2	2	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Peratanytarsus dissimilis	4	4	1	0	0	0	0	0	0	0	4	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	Labrundinia spp.	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Ceratopogonidae	Atrichopogon spp.	1	1	1	0	0	0	0	0	0	0	0	0	0	0 1 larva
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Simuliidae	Simulium spp.	14	14	1	0	0	0	0	14	1	0	0	1	0	0 15 larvae, 1 pupa

Table 4 SCI full results for Sample B

[illegible]

Water Quality Assessment

Long-term water quality data is available for Dug Creek. The data that is available was collected by the Hillsborough County Environmental Protection Commission. Values for the physical water parameters begin in 2005 and continue through present. Values for the laboratory water parameters begin in 2005 through present including the sample taken along with this assessment. The 2019 USF Water Institute Assessment fall within the range of the previous data collections. Table 5 provides a summary of the Physical/Chemical conditions recorded at the site.

Table 5 Dug Creek Physical Water Quality (Field)

Dug Creek								
Date	Depth (m)	Temp (°C)	pH	DO (mg/L)	DO (% Sat)	Cond (UMHO/cm)	Salinity (PPT)	Secchi Depth (m)
3/27/2019	0.13	19.73	7.95	8.51	91.3	334.8	0.16	0.3 VOB
Mean POR		22.63	7.35	7.68	88.35	423.4	0.20	0.32

The chemical water quality analysis for Dug Creek is shown in Table 6 along with mean values for the period of record for available parameters. Period of record mean and the sample for this assessment for Total Phosphorous values were below the nutrient region threshold developed by FDEP of 0.49 mg/L with a mean value of 0.194 mg/L (2005-2019). The three year geometric mean of Total Phosphorous was 0.224 mg/L. Total Phosphorous values for the sample from this assessment were 0.314 mg/L. Total Nitrogen values were below the nutrient region threshold developed by FDEP of 1.65 mg/L with a mean value of 1.054 mg/L (2005-2019). The three year geometric mean of Total Nitrogen was 1.187 mg/L. The Total Nitrogen value from the assessment was below the threshold with a concentration of 1.097 mg/L. During the past 3 years there was a single sample exceeding the Total Nitrogen standard with a value of 3.288 mg/L. Chlorophyll-a corrected values fall within the site specific evaluation range of 3.2 µg/l to 20 µg/l for the period of record (4.69 µg/l 2005-2019), and in the site specific evaluation range for the most recent three year geomean (3.20 µg/l). For sites with Chlorophyll-a values in this range, the assessment is inconclusive of conditions reflecting an imbalance in flora. Elevated biomass of the bacterial parameters was observed in the long term dataset with E. Coli having a geomean of 1,621 colonies/100 ml, 2,967/100 ml for Enterococci.

Table 6 Dug Creek Water Quality (Laboratory)

Parameter	Dug Creek	POR Mean	Units
Alkalinity	32.0		mg/LCaCO ₃
Nitrates/Nitrites	0.554	0.336	mg/L
E. Coli	1,700	1,621	#/100 ml
Enterococci	4,800	2,643	#/100 ml
Chlorophyll a	2.0	3.24	ug/L
Chlorophyll b	0.5	1.39	ug/L
Chlorophyll c	0.4	0.86	ug/L
Chlorophyll t	2.0	4.52	ug/L
Chlorophylla Corr	4.1	3.20	ug/L
Chlorophyll-pheo	5.4	2.90	ug/L
Ammonia	0.024	0.047	mg/L
Kjeldahl Nitrogen	0.543	0.047	mg/L
Total Nitrogen	1.097	1.054	mg/L
Total Phosphorus	0.314	0.194	mg/L
Color(345)F.45	13.8	26.57	Pt/Co

Conclusion

Dug Creek at Saffold Rd is located in a residential area near an agricultural area. The stream itself showed signs of past alteration in the region assessed. At the time of the habitat assessment, the water levels were low, corresponding to the middle of the dry season, however sufficient habitat for macroinvertebrates was observed. Due to these factors, the Habit Assessment resulted in a marginal score of 81. Slight disruption to the vegetation community was observed in the results of the Linear Vegetation Survey with Dug Creek not meeting the metric for Average Coefficient of Conservatism or the Percent FLEPPC. Dug Creek did meet standards for the rapid periphyton survey with 0% of samples being ranked between 4 and 6. The historical water quality record for Dug Creek showed acceptable concentrations of Total Phosphorous and Total Nitrogen. The results of the SCI sampling indicate that the stream is “healthy” based on the macroinvertebrate community. The long term data indicates high levels of bacterial contamination. Table 7 summarizes the results of the nutrient sampling, floristic sampling, habitat assessment and SCI.

Table 7 Summary of Water Quality, Floristic Surveys and Habitat Assessments

Measure		Dug Creek	Mean POR	Threshold
Total Phosphorous (mg/l)		0.314	0.194	< 0.49
Total Nitrogen (mg/l)		1.097	1.054	< 1.65
RPS (% Rank 4-6)		0.00%		< 25%
LVS	Avg C of C	1.41		≥ 2.5
	FLEPPC %	69.23%		< 25%
Chlorophyll (µg/l)		4.1	3.2	< 20 µg/l
Habitat Assessment		81		> 34
SCI		47		> 34