



# Bullfrog 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 Pro. Using this software with 2022 Hillsborough County aerial, 2017 Land Use/ Land Cover (LULC) and Waterbody ID (WBID) layers courtesy of the Florida Department of Environmental Protection (FDEP). The Landscape Development Intensity Index (LDI) was calculated for the WBID containing the stream. From FDEP

(<https://floridadep.gov/dear/bioassessment/content/bioassessment-ldi-hdg-bcg>) “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 FDEP uses the LDI as a tool to estimate potential land use impacts on streams, lakes, and wetlands. LDI values less than two ( $\leq 2$ ) 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 FDEP 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 one sampling location 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 (LVS). 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 Table LVI 1000-1 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 in FDEP LVI 1000-1.

## STREAM CONDITION INDEX ASSESSMENT

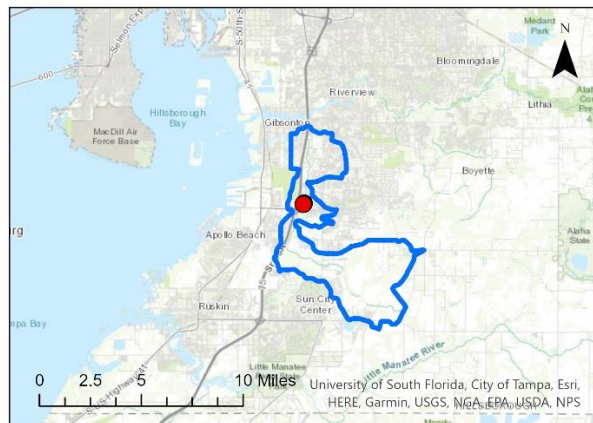
The Stream Condition Index (SCI) was sampled and calculated per DEP SOP SCI 1000. The SCI consists of collecting macroinvertebrates via 20 D-frame dipnet sweeps (0.5 m in length) in the most productive habitats in a 100 m reach of stream. The organisms are sub-sampled, and identified to the lowest practical 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 SCI 1000, the SCI scores greater than 35 are considered healthy. Proposed biological health assessment criteria state that a WBID is considered to meet designated uses if the average of the two most recent SCI scores is 40 or higher and neither of the most recent 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 Hillsborough County Public Utilities 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. Results will be discussed in the Florida Department of Environmental Protection's Numeric Nutrient Criteria framework and combined with the monthly sampling from the Hillsborough County Environmental Protection Commission Monthly sampling data.

## Study Area

Bullfrog Creek is located in south-central Hillsborough County in the Bullfrog Creek Watershed. Its headwaters are located west of Balm Wimauma Rd in Hillsborough County. The outfall of Bullfrog Creek is in Hillsborough Bay. The assessment of Bullfrog Creek was conducted on March 9<sup>th</sup>, 2023 and, at that time, the water levels were low but normal for the dry season. The Bullfrog Creek WBID covers 23.98 miles and is dominated by forest/natural (72.08%) and field/pasture (9.58%) land uses. The resulting calculated landscape development intensity index score was a 2.35.



### Bullfrog Creek WBID 1666

Mouth - Hillsborough Bay  
Area - 15,353.6 Acres (23.99 Sq Miles)  
Landscape Development  
Intensity - 2.35  
Stream Habitat Assessment - 99  
Rapid Peiphyton Survey -  
% ranked 4-6 - 0%  
Linear Vegetation Survey  
< 2 square meters of rooted vegetation  
Mean Coefficient of Conservatism - N/A  
% FLEPPC - N/A  
Stream Condition Index - 59

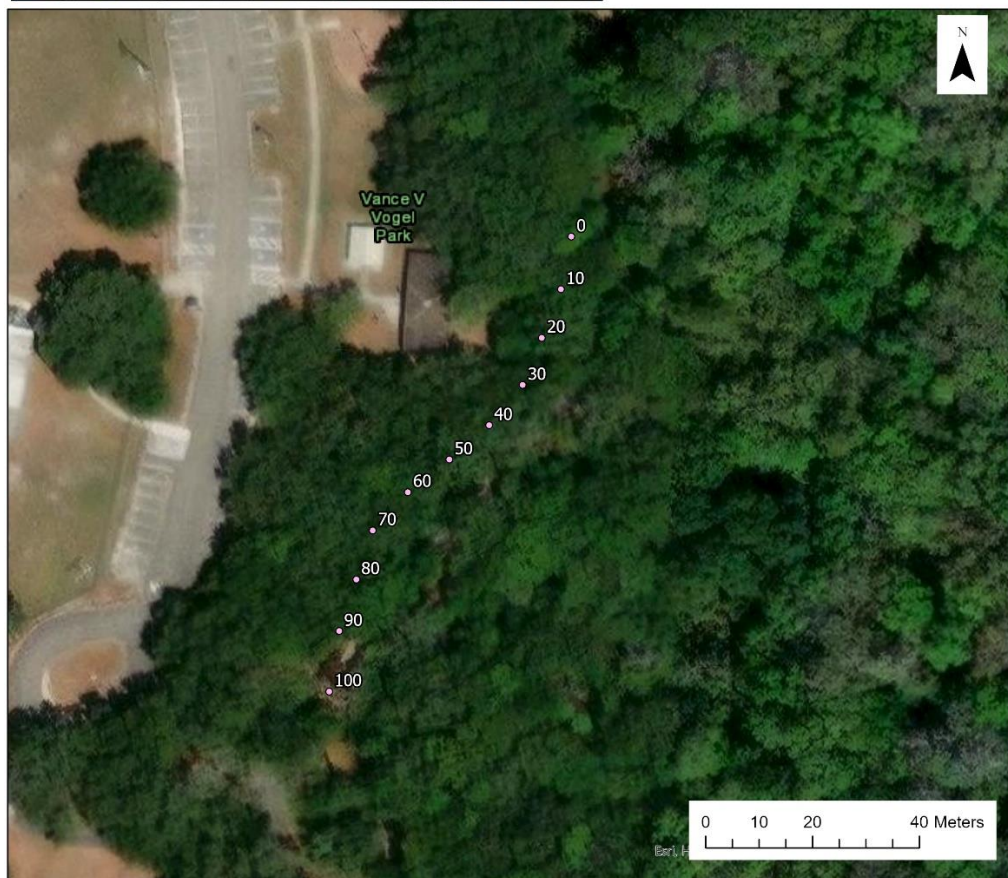


Figure 1 2023 Bullfrog Creek Study Area Map



*Figure 2 Photograph of the Bullfrog Creek Sample Site showing the typical sandy sediment of the streambed and low water conditions.*

## Habitat and Vegetation Assessment

The region of Bullfrog Creek where the assessment was conducted is in Vance V Vogel Park just off of Bullfrog Creek Road. The region was moderately shaded with a mean canopy cover measurement of 67.2%. Bullfrog Creek averaged 0.25 meters in depth and approximately 6.78 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 suboptimal category for Water Velocity (0.25 m/s) and Habitat Smothering (adequate number of stable pools with many productive habitats affected by sand smothering). Substrate Diversity was scored in the marginal category for having two major productive habitats (snag, roots) present in the stream. Substrate Availability was scored as poor for having major productive habitats in only 1.7% of the stream. Minor habitats included leaf packs/mats and sand 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. The secondary habitat components scored in the optimal category for Artificial Channelization (good sinuosity with no spoil banks or evidence of straightening) and Riparian Buffer Zone Width for the left bank (>18 meters). Bank Stability (slope is consistently too steep for both banks), Riparian Buffer Zone Width for the right bank (average of 16 meters), and Riparian Zone Vegetation Quality (visible disruption in plant community to both banks with the right being worse than the left) are scored in the suboptimal category. The secondary habitat components received a score of 63 out of 80. The resulting FDEP Habitat Assessment score was a 99.

*Table 1 Scoring Summary for the Stream Habitat Assessment*

Metric		Score
Primary Habitat Components		
	Substrate Diversity	8
	Substrate Availability	2
	Water Velocity	15
	Habitat Smothering	11
	<b>Primary Score</b>	<b>36</b>
Secondary Habitat Components		
	Artificial Channelization	16
	Bank Stability - Right Bank	8
	Bank Stability - Left Bank	7
	Riparian Buffer Zone Width - Right Bank	8
	Riparian Buffer Zone Width - Left Bank	10
	Riparian Zone Vegetation Quality - Right Bank	6
	Riparian Zone Vegetation Quality - Left Bank	8
	<b>Secondary Score</b>	<b>63</b>
<b>Habitat Assessment Score</b>		<b>99</b>

Periphyton was encountered during 1 of the 99 samples taken during the Rapid Periphyton Survey. This sample was ranked 3 for being between >1 mm and 6 mm in length. The tree canopy in the assessment area averaged 67.2% reducing available light for periphyton to flourish.

The FDEP Linear Vegetation Survey encountered less than two square meters of rooted herbaceous vegetation in Bullfrog Creek at the time of the assessment. As a result neither metric for mean coefficient of conservatism or Percent FLEPPC were calculated.

*Table 2 Linear Vegetation Survey Results – Bullfrog Creek*

[illegible]



*Figure 3 A photograph of snag (major productive habitat) with leaf packs (minor habitat) in Bullfrog Creek.*



*Figure 4 Roots were a major productive habitat in Bullfrog 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 Bullfrog Creek was 59 out of a possible 100 points, corresponding with a “Category 2 Healthy” designation, with noticeable loss of taxonomic diversity from the expected community of a healthy stream. Both 2023 subsamples contained low total taxa with 21 in subsample A and 20 in subsample B. High scores (above 7.0) were achieved for the % Filter Feeders, Total Clingers, and % Very Tolerant Individuals in both samples. Low scores (less than 3.0) were achieved for the Total Taxa (both samples), % Tanytarsini (Sample A), and Total Sensitive Taxa (both samples). The full results of the SCI sampling are shown in Table 4 (Sample A) and Table 5 (Sample B) for Bullfrog Creek.

*Table 3 SCI metric summaries for Bullfrog Creek Sample A (top) and Sample B (bottom)*

SCI Metric	Raw Totals	SCI scores	Adjusted SCI scores
Total Taxa	21.00	2.50	2.50
Total Ephemeroptera	3.00	6.00	6.00
Total Trichoptera	3.00	4.29	4.29
% Filter Feeders	41.83	9.57	9.57
Total Clingers	7.00	10.00	10.00
Total Long-lived Taxa	1.00	3.33	3.33
% Dominance	37.25	5.35	5.35
% Tanytarsini	0.65	1.48	1.48
Total Sensitive Taxa	2.00	2.86	2.86
% Very Tolerant Individuals	2.61	8.54	8.54

SCI Sum	53.91
Final SCI score	59.90

SCI Metric	Raw Totals	SCI scores	Adjusted SCI scores
Total Taxa	20.00	2.08	2.08
Total Ephemeroptera	3.00	6.00	6.00
Total Trichoptera	3.00	4.29	4.29
% Filter Feeders	45.33	10.38	10.00
Total Clingers	5.00	7.14	7.14
Total Long-lived Taxa	1.00	3.33	3.33
% Dominance	41.33	4.53	4.53
% Tanytarsini	2.00	3.23	3.23
Total Sensitive Taxa	2.00	2.86	2.86
% Very Tolerant Individuals	1.33	9.63	9.63

SCI Sum	53.10
Final SCI score	59.00

Table 4 SCI full results for Sample A

Stream Condition Index Results for Bullfrog Creek SCIA																				
Phylum	Subphylum	Class	Subclass	Order	Family	Taxa	Abundance	Collapsed Abundance	Taxa Presence	Ephemeroptera Taxa	Trichoptera Taxa	50% Filterer	100% Filterer	Clinger Taxa	Long-lived Taxa	Dominant Taxa	Tanytarsini	Sensitive Taxa	Very Tolerant Individuals	Specimen Notes
Mollusca		Gastropoda	Caenogastropoda	Littorinimorpha	Hydrobiidae	<i>Pyrgophorus platyrachis</i>	1	1	1	0	0	0	0	0	0	0	0	0	1	
Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda		<i>Senticaudata</i> spp.	1	1	1	0	0	0	0	0	0	0	0	0	0	Damaged; ANT1 like Hyallella
Arthropoda	Crustacea	Malacostraca	Eumalacostraca		Atyidae	<i>Atyidae</i> spp.	1	1	1	0	0	0	0	0	0	0	0	0	0	Dumped
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	<i>Baetidae</i> spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	Head only; missing mouthparts
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	<i>Labia baetis propinquus</i>	3	3	1	1	0	0	0	0	0	0	0	0	0	Damaged; ID by mouthparts
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Baetidae	<i>Baetis intercalaris</i>	4	5	1	0	0	0	0	0	0	0	0	0	0	Damaged; ID by mouthparts
Arthropoda	Hexapoda	Insecta	Pterygota	Ephemeroptera	Heptageniidae	<i>Heptageniidae</i> spp.	3	3	1	1	0	0	0	0	1	0	0	1	0	Damaged; No Gill 7
Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Coenagrionidae	<i>Coenagrionidae</i> spp.	2	0	0	0	0	0	0	0	0	0	0	0	0	Damaged; Early instars
Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Coenagrionidae	<i>Agrus</i> spp.	1	0	0	0	0	0	0	0	0	0	0	0	0	Early instar
Arthropoda	Hexapoda	Insecta	Pterygota	Odonata	Libellulidae	<i>Libellula litorea</i>	1	1	0	0	0	0	0	0	0	0	0	0	0	
Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> spp.	57	57	1	0	1	0	57	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Hydropsychidae	<i>Hydropsychidae</i> spp.	1	1	1	0	1	0	0	0	1	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Trichoptera	Hydropsychidae	<i>Neotrichia</i> spp.	1	1	1	0	0	0	0	0	1	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	<i>Stenelmis</i> spp.	10	10	1	0	0	0	0	0	0	0	0	0	0	Larvae=9; Adult=1
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Elmidae	<i>Microcyclus</i> spp.	19	19	1	0	0	0	0	0	0	0	0	0	0	Larvae=8; Adult=11
Arthropoda	Hexapoda	Insecta	Pterygota	Coleoptera	Gyrinidae	<i>Gyrinidae</i> spp.	2	2	0	0	0	0	0	0	0	0	0	0	0	Larvae=2
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	<i>Chironomidae</i> spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	Pupae=4
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	<i>Tanytarsini</i> spp.	1	0	0	0	0	0	0	0	0	0	0	0	0	Damaged; not ablabesmyia
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	<i>Polypedilum scalabum</i> group	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	<i>Polypedilum flavum</i>	27	30	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	<i>Polypedilum illinoense</i> group	2	3	1	0	0	0	0	0	0	0	0	0	0	3
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	<i>Pentaneurys tarsus</i> spp.	1	1	1	0	0	0	1	0	1	0	1	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	<i>Pentaneura incognita</i> sp.	1	2	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Chironomidae	<i>Stenochironomus</i> spp.	2	2	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Hexapoda	Insecta	Pterygota	Diptera	Simuliidae	<i>Simulium</i> spp.	6	6	1	0	0	0	0	0	6	1	0	1	0	Larvae=4; Adult=2

Table 5 SCI full results for Sample B

[illegible]

## Water Quality Assessment

Long-term water quality data is available for Bullfrog Creek. The data that is available was collected by the Hillsborough County Environmental Protection Commission on a monthly cycle. The available dataset at station 167 (Bullfrog Creek at Big Bend Road) begins in 2005 and continues through the end of 2022. The 2023 USF Water Institute Assessment values fall within the range of the previous data collections. Table 6 provides a summary of the Physical/Chemical conditions recorded at the site.

*Table 6 Bullfrog Creek Physical Water Quality (Field)*

<b>WATER QUALITY</b>	Depth (m)	Temp (°C)	pH (SU)	D.O. (MG/L)	D.O. Sat (%)	Cond. (µmhos/cm)	Salinity (PPT)	SECCHI (m)
Top:								1.3
Mid:	0.28	17.3	6.54	10.95	111.2	543	0.26	VOB
Bottom:								Total Depth 0.4
Meter ID:	50							

The chemical water quality analysis for Bullfrog Creek is shown in Table 7 with geometric mean values for the previous 3 years for available parameters. The previous 3-year geometric mean values for Total Phosphorous values were below the nutrient region threshold developed by FDEP of 0.49 mg/L with a geometric mean value of 0.197 mg/L (2020), 0.15 mg/L (2021) and 0.087 mg/L (2022). Total Nitrogen values were below the nutrient region threshold developed by FDEP of 1.65 mg/L for the previous three year period with a mean value of 0.577 mg/L (2020), 0.600 mg/L (2021) and 0.528 mg/L (2022). Chlorophyll-a corrected values fall below the site specific evaluation range of 3.2 µg/l to 20 µg/l for the most recent 3-years of samples (2.57 µg/l in 2020, 2.0 µg/l in 2021, 2.31 µg/l in 2022). For sites with Chlorophyll-a values in this range, the assessment is indicating conditions reflecting a balance in flora.

An elevated biomass of the bacterial parameters was observed in the 3-year dataset with E. Coli having a geometric mean of 301.4 colonies/100 ml, 427.8/100 ml for Enterococci.

*Table 7 Bullfrog Creek Water Quality (Laboratory)*

<b>Parameter</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>Period of Record</b>	<b>Units</b>
<b>E. Coli</b>	223.1	355.4	325.7	No data	371.4	#/100 ml
<b>Enterococci</b>	363.3	598.4	321.8	No data	796.2	#/100 ml
<b>Chlorophyll-a</b>	4.36	2.92	3.36	No data	3.36	µg/L
<b>Chlorophyll-b</b>	0.496	0.337	0.399	No data	1.21	µg/L
<b>Chlorophyll-c</b>	0.900	0.623	0.616	No data	0.938	µg/L
<b>Chlorophyll-t</b>	5.63	3.47	4.08	No data	5.04	µg/L
<b>Chlorophyll-a Corrected</b>	2.57	2.00	2.31	No data	2.94	µg/L
<b>Ammonia</b>	0.015	0.040	0.043	No data	0.033	mg/L
<b>Kjeldahl Nitrogen</b>	0.525	0.531	0.421	No data	0.616	mg/L
<b>Total Nitrogen</b>	0.577	0.600	0.528	No data	0.712	mg/L
<b>Nitrates/Nitrites</b>	0.044	0.064	0.047	No data	0.072	mg/L
<b>Total Phosphorous</b>	0.197	0.150	0.087	No data	0.195	mg/L

## Conclusion

Bullfrog Creek at Vance Vogel Park is located in a predominantly natural easement along a developing area. At the time of the habitat assessment, the water levels were normal for the dry season. The 100 meter region where the assessment was conducted was characterized by a natural sinuous channel with attached forested floodplains. Snag and fine root was the most common productive habitats present. The Habit Assessment resulted in a suboptimal score of 99. Disruption to the vegetation community was not observed in the results of the Linear Vegetation Survey with less than two square meters of herbaceous vegetation rooted in the wetted portion of the stream. Bullfrog Creek met the metrics for the rapid periphyton survey with 0% of samples being ranked between 4 and 6 due in part to the moderate canopy coverage in the region. The recent water quality record for Bullfrog Creek showed concentrations of Chlorophyll-a corrected, Total Phosphorous and Total Nitrogen below the FDEP thresholds. The results of the SCI sampling indicate that the stream is “healthy” based on the macroinvertebrate community. Table 8 summarizes the results of the nutrient sampling, floristic sampling, habitat assessment and SCI.

*Table 8 Summary of Water Quality, Floristic Surveys and Habitat Assessments*

Measure		Bullfrog Creek	2020	2021	2022	Threshold			
Total Phosphorous (mg/l)		0%	0.197	0.15	0.087	< 0.49			
Total Nitrogen (mg/l)						0.577	0.6	0.528	< 1.65
RPS (% Rank 4-6)									< 25%
LVS	Avg C of C					< 2 m			≥ 2.5
	FLEPPC %					< 2 m			< 25%
Chlorophyll-a Corrected (µg/l)			2.57	2.00	2.31	< 20 µg/l			
Habitat Assessment		99				> 34			
SCI		59				> 34			