STREAM ECOSUMMARY

Lloyd Creek, WBID 791A

Jefferson County

December 18, 2019 and April 29, 2021

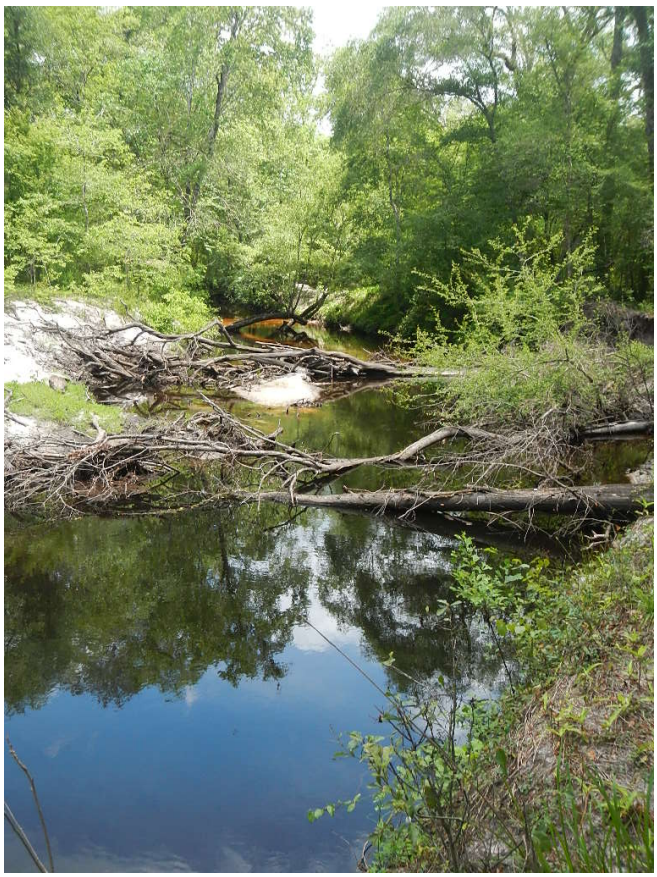


Figure 1. Sampling reach along Lloyd Creek in Jefferson County.

Physical, chemical, and biological sampling was conducted at Lloyd Creek (STORET/WIN 22030061, SBIO Lloyd*Ref) in Jefferson County on December 18, 2019 and April 29, 2021 by the DEP, Division of Environmental Assessment and Restoration (DEAR), Aquatic Ecology and Quality Assurance Section (AEQAS). This stream was sampled as part of the DEP Ecoregional Reference Stream Survey, which was designed to provide baseline information about the state's highest quality streams and monitor the water quality and biological community health of these streams through time. Overall, the water quality and macroinvertebrate community data indicated that the stream met expectations for a healthy, well-balanced stream.

Background

Healthy, well-balanced stream and river communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of nuisance (generally exotic) plants and animals. DEP evaluates if human activities have resulted in the condition where a waterbody has exceeded water quality criteria (Chapter 62-302, Florida Administrative Code), including whether adverse impacts to biological communities have occurred. DEP water quality standards are designed to protect designated uses of the waters of the state (*e.g.,* recreation, aquatic life use support), and exceedances of these standards is associated with interference with the designated use. Additionally, DEP evaluates the health of floral (plants and algae) and faunal (animal) communities and conducts habitat assessments to diagnose potential physical impacts.

Site Description

The Lloyd Creek sampling location (Figure 1) is located near the western boundary of Jefferson County in the Lloyd Creek Watershed (WBID 791A, Figure 2) within

the Ochlockonee-St.Marks Basin. The Lloyd Creek sampling location is a third order stream draining the Tifton Upland/Tallahassee Hills subecoregion, a subecoregion of the Southern Coastal Plain ecoregion. Lloyd Creek forms when Lang Branch and Cuba Branch combine. Approximately 8 miles from that confluence, Lloyd Creek flows into Lake Miccosukee. Lloyd Creek has a Landscape Development Intensity (LDI) Index score of 1.4. The LDI quantifies the intensity of human activity in the surrounding area based on land use and land cover, and is normalized on a scale from 1 to 10, where a natural land use has a coefficient of 1.0 and a central business district has a coefficient of 10.0. This site's score of 1.4 suggests minimal human activity in the 100m buffer surrounding the stream. The WBID is not currently listed for any paramaters on the Impaired Waters Verified List. Additional information about this WBID is available in the Water Quality Assessments, TMDLs, and BMAPs map application (https://fdep.maps.arcgis.com/home/webmap/viewer.html?webmap=1b4f1bf4c9c3481fb2864a415fbeca77hy



Figure 2. Location of Lloyd Creek in Jefferson County.

Methods

Water Quality

Surface water samples were collected for analysis of alkalinity, turbidity, chloride, color, fluoride, sulfate, total dissolved solids, total suspended solids, nutrients, chlorophyll, *Escherichia coli* (*E. coli*), pesticides, herbicides, sucralose, and metals following DEP Standard Operating Procedures (SOPs, see https://floridadep.gov/dear/quality-assurance/content/dep-sops for details) and met the requirements of the FDEP Quality Assurance Rule, Chapter 62-160, F.A.C. (https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-160). Results were compared with applicable Class III water quality criteria contained in 62-302, F.A.C., including nutrients, dissolved oxygen, and other indicators.

Chapter 62-302.531, F.A.C., provides that Numeric Nutrient Criteria are achieved in streams if: Information on chlorophyll *a* levels, algal mats or blooms, nuisance macrophyte growth, and changes in algal species composition do not indicate an imbalance in flora or fauna; AND EITHER

The average score of at least two temporally independent Stream Condition Indices (SCIs) is 40 or higher, with neither of the two most recent SCI scores less than 35, OR

The Nutrient Thresholds (expressed as annual geometric means) are not exceeded more than once in a three year period. The nutrient thresholds are region-specific. This sampling site is in the Panhandle East nutrient region. The floral and faunal measures are described below.

Dissolved Oxygen

Rule 62-302.533 (1), F.A.C., states that no more than 10 percent of the daily average percent dissolved oxygen (DO) saturation values shall be below 67 percent in the Panhandle West bioregion, 38 percent in the Peninsula and Everglades bioregions, or 34 percent in the Northeast and Big Bend bioregions. This site is in the Big Bend region for DO criteria assessment. Percent saturation takes into account

factors such as temperature, atmospheric pressure, and salinity.

The daily average freshwater DO criteria is preferentially assessed using daily average values calculated from full days of diel (collected over a 24 hour period) monitoring data. If diel monitoring data are not available (as was the case for this report), instantaneous samples are used to assess the DO criterion by comparing the instantaeous value with a time-of-day-specific translation of the daily average criterion (62-303.420(9), F.A.C.).

Habitat Assessment

The Stream and River Habitat Assessment was conducted per DEP SOP FT 3100. The Habitat Assessment is a rapid field method in which a sampler scores eight in-stream and riparian components to estimate the influence of habitat factors on the resident aquatic organisms. Habitat Assessment scores range from 11-160 and overall habitat quality is assigned to one of four categories: Optimal (120-160 points), Suboptimal (80-119 points), Marginal (40-79 points), and Poor (11-39 points).

Floral Assessment

Evaluations of stream flora include the Rapid Periphyton Survey (RPS, DEP SOP FS 7230), community composition information associated with dominant algal taxa (where applicable), Linear Vegetation Survey (LVS, DEP SOP 7320), and chlorophyll *a*. The RPS assesses the extent and thickness of algae in the stream reach, while the LVS assesses how closely the in-stream plant community resembles a minimally disturbed condition. Results are assessed as described beginning on page 8 of "*Implementation of Florida's Numeric Nutrient Standards*," dated April 2013, using evidentiary thresholds derived from a population of minimally disturbed reference sites.

Faunal Assessment

The Stream Condition Index (SCI) assesses how closely the macroinvertebrate community (*e.g.*, aquatic insects, clams, crayfish) of a stream resembles the macroinvertebrate community of an undisturbed or "reference" condition. The SCI was sampled and calculated per DEP SOP SCI 1000. For the SCI, ten measures of macroinvertebrate health are calculated and summed to yield a final score from 0-100. Average SCI scores ≥ 40 are considered "Healthy" (as long as neither of the latest two SCI scores were < 35) with scores ≥ 64 considered "Exceptional." The SCI is part of the NNC evaluation for streams, as described above, and also serves as a biological health assessment tool in 62-303, F.A.C., DEP's Impaired Waters Rule.

Evaluation of Stream Exclusions for Applying Nutrient Criteria

When assessing a stream for compliance with numeric nutrient criteria (NNC) in Rule 62-302.531, F.A.C., it is important to note that several waterbody types are excluded from the stream definition in Rule 62-302.200(36), F.A.C. These include lake-like portions of rivers (where the lake NNC apply) and ditches/canals used for water management purposes, non-perennial streams, wetlands, and tidally fluctuating areas (where the narrative criterion, "no imbalances in natural populations of aquatic flora or fauna," continues to apply). The NNC in Rule 62-302.531, F.A.C., were applicable to Lloyd Creek.

Results

Water Quality

The water quality results are shown in Table 1. *E. coli* exceeded the Applicable Class III Water Quality Criteria in 2019, but not in 2021. Bacteriological thresholds are based on a monthly geometric mean or lower percentile of data based on a minimum of 10 samples taken over a 30-day period. Therefore, even though the thresholds were exceeded in 2019, additional bacteriological sampling is needed to meet data sufficiency requirements to calculate and assess attainment of the water quality standard. The remaining water quality parameters did not exceed the water quality criteria. Sucralose and the majority of pesticide and herbicide results were below the method detection limit for both sampling events.

NNC Threshold Assessment

Based on these two sampling events, the stream met the numeric nutrient thresholds for the Panhandle East bioregion; however, the thresholds represent annual geometric mean concentrations (minimum of

four samples) not to be exceeded more than once in any three calendar year period, and are used in combination with floral and faunal information. Therefore, even though the thresholds were not exceeded, additional nutrient sampling may be needed to meet data sufficiency requirements to calculate and assess attainment of the water quality standard.

Floral Assessment

Results of the floral metrics show that this site is within the reference stream distribution and therefore attains the floral component of the NNC (Table 2). All floral measures must pass for the stream to attain the NNC. There were no instances of attached algae >6mm (0%) during the 2019 or 2021 sampling events. No aquatic plants were observed and chlorophyll *a* was not detected during either sampling event. The site achieves the RPS, LVS, and phytoplankton chlorophyll *a* components of the NNC floral metrics.

Table 1. Water quality results from December 18, 2019 and April 29, 2021 at Lloyd Creek.

Analyte	Result 12/18/19	Result 4/29/21	Applicable Class III Water Quality Criteria
Field Temperature (°C)	13.3	19.6	N/A
Field pH (SU)	5.98	6.98	Within 1 unit of natural background
Field Dissolved Oxygen (% saturation)	91.8	92.4	*37% for 12/18/19, 34% for 4/29/21
Field Specific Conductance (µmhos/cm)	64	64.3	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	9.4	17	Shall not be depressed below 20 (or if natural alkalinity is low, shall not be reduced by more than 25%)
Color (PCU)	160	100 A	N/A
Total Phosphorus (mg/L) as P	0.18	0.17	** 0.18
Nitrate+Nitrite (mg/L) as N	0.18	0.25	0.35 for spring vents only
Ammonia (mg/L) as N	0.005 I	0.027	***8.2 for 12/18/19, 4.88 for 4/29/21
Total Kjeldahl Nitrogen (mg/L) as N	0.77	0.41	N/A
Total Nitrogen (mg/L) as N	0.95	0.66	** 1.03
E. coli Bacteria (MPN/100 mL)	2419.6	90.8	≤ 410 Count/100 mL

* Instantaneous DO criterion calculated per DO Saturation Calculator

** Annual geometric numeric nutrient threshold for Panhandle East nutrient region, used in combination with information on flora and fauna.

*** Total ammonia criterion calculated per Total Ammonia Nitrogen Calculator, for single sample maximum.

A Qualifier: Value reported is the arithmetic mean (average) of two or more determinations.

I Qualifier: The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantitation limit.

Table 2. Floral and faunal assessment results from December 18, 2019 and April 29, 2021 at Lloyd Creek.

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Result 12/18/19 Sample 80615	Result 4/29/21 Sample 82163
LVS C of C	Site average ≥ 2.5	Pass (<2m^2)	Pass (<2m^2)
LVS FLEPPC (%)	Site average ≤ 25%	N/A	N/A
RPS (%)	≤ 25% rank 4-6 (algae > 6 mm thick) coverage. If 20 to 25 % rank 4-6	0	0

	coverage, evaluate algal species		
Chlorophyll *a* (corrected; µg/L)	< 3.2 ug/L. If 3.2 to 20 ug/L, site specific evaluation	1.6 U	0.82 U
Algal Community Composition	No adverse shifts in dominant taxa	N/A	N/A
SCI	Average ≥ 40	91	77

U Qualifier: Material was analyzed for but not detected. The reported value is the method detection limit for the sample analyzed.

Habitat Assessment

The stream and river habitat assessment scores were 120 and 110, which are in the optimal and suboptimal categories, respectively. The typical velocity measured was 0.25 m/s. However, in 2019 faster velocities were observed as well which was not the case in 2021, thus the habitat assessment score for velocity resulted in an optimal score in 2019 and a suboptimal score in 2021. Fish and aquatic insects require sufficient water velocity to maintain high dissolved oxygen concentrations in the stream; for both sampling events the dissolved oxygen was 92% saturation. The average width within the assessment stretch was 7-10 m. Between the 2019 and 2021 sampling events, a portion of the right bank of the Lloyd Creek sampling location collapsed. The collapse is unsurprising as the sampling location has steep and eroded banks. The bank stability scores, as a result, were in the marginal range. Three productive habitats (woody debris, roots, and leaf packs) were noted for both sampling events, which comprised roughly 8% (2019) amd 3% (2021) of the stream area. The reduction in substrate availability between sampling events may have been due to tree obstructions, high water levels, and bank instability causing the samplers to be unable to access and thus observe habitat in 20 meters of the 100 meter stretch (Figure 3). Habitat smothering was observed in >25% of habitats for both sampling events resulting in habitat smothering scores within the suboptimal range. Sand and silt smothering was observed in 2019, whereas sand, silt, and algae smothering was observed in 2021.



Figure 3. Example of steep embankments, bank instability, and large trees obstructing access to the 10m-30m sampling stretch of Lloyd Creek on April 29, 2021.

Faunal Assessment (SCI)

The average SCI score for this site for these two samples was 84 out of a possible 100 points, corresponding with an "Exceptional" (≥64) designation (Table 2). These results are within the range of the previous score for this site, which was 92 (2017). SCI scores at Lloyd Creek are generally expected to be high due to its designation as a reference stream and minimual human disturbance at the site. However, the most recent sampling date (4/29/2021) had an SCI score relatively lower (77) than the previous two scores (92 [2017], 91 [2019]). The average number of EPT taxa and percent very tolerant taxa decreased from 2019 (EPT: 10.5, Very Tolerant: 7.45) to 2021 (EPT: 5.5, Very Tolerant: 1.43). The average number of long-lived (2019: 2, 2021: 1) and sensitive (2019: 10.5, 2021: 10) taxa were similar between sampling events. Number of EPT, long-lived, and sensitive taxa are expected to decrease with increasing human disturbance, whereas percent tolerant taxa is expected to increase with increasing human disturbance. Habitat parameters were

consistent between sampling events with the exception of substrate diversity and availability, which was lower in 2021. Thus, the lower SCI score could be due to the inaccessibility of potential high quality habitat in a portion of the 100m sampling area during the April 29, 2021 sampling event (Figure 3).

Conclusions

Sampling at Lloyd Creek indicates that the stream met applicable State Water Quality Criteria. *E. coli* was elevated in 2019, but was below the applicable criteria in 2021. Standards were achieved for all other water quality parameters collected for both sampling events.

Habitat Assessment data indicated a near optimal physical condition of the creek with little disturbance in the watershed. Stream Condition Index data indicated the presence of a "healthy" macroinvertebrate community with sensitive taxa that are indicative of good water quality conditions. The lower Habitat Assessment and Stream Condition Index scores in 2021 were likely related to inaccessibility to a 20m portion of the sample site during that sampling event. The Linear Vegetation Survey and Rapid Periphyton Survey indicated vascular plant and algal communities, respectively, that are consistent with expectations for minimally disturbed sites.

Thank you for your interest in maintaining the water quality of Florida's aquatic resources. Please contact us if you have any questions.

Contact and resources for more information

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DEP biological assessment resources:
https://floridadep.gov/dear/bioassessment