STREAM ECOSUMMARY

Bethel Creek at Mill Creek Road

WBID 3480, Lafayette County

May 6, 2015 and August 30, 2016



Figure 1. Sampling reach along Bethel Creek in Lafayette County

Physical, chemical, and biological sampling were conducted at Bethel Creek at Mill Creek Road (STORET 21020030, BETHEL@MIL) in Lafayette County on May 6, 2015 and August 30, 2016 by members of the Aquatic Ecology and Quality Assurance section of the DEP Tallahassee Office. 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 to 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 applicable water quality criteria (Chapter 62-302, Florida Administrative Code), including whether adverse impacts to biological communities have occurred. DEP water quality criteria are designed to protect designated uses of the waters of the state (*e.g.,* recreation, aquatic life use support), and exceedances of these criteria are 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 Bethel Creek sampling location (Figure 1) is in northeastern Lafayette County in the Bethel Creek Watershed (WBID 3480, Figure 2). It is a third order stream draining the Tallahassee Hills/Valdosta Limesink, a subecoregion of the Southern Coastal Plain ecoregion. Bethel Creek flows into the Suwannee River and has a Landscape Development Intensity (LDI) Index score of 1.42. The LDI is calculated for the 100 m buffer of the waterbody for 10 km upstream of the point of interest. The LDI quantifies the intensity of human activity in the surrounding watershed 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 1.42 suggests minimal human activity in the 100 m buffer surrounding the stream.

The WBID is currently listed for fecal coliforms on the Verified List of Impaired Waters (posted list checked 06/27/2017). Additional information about this WBID is available in the TMDL Tracker application (http://prodenv.dep.state.fl.us/DearTmdl/tmdlReportAction.do?method=report).

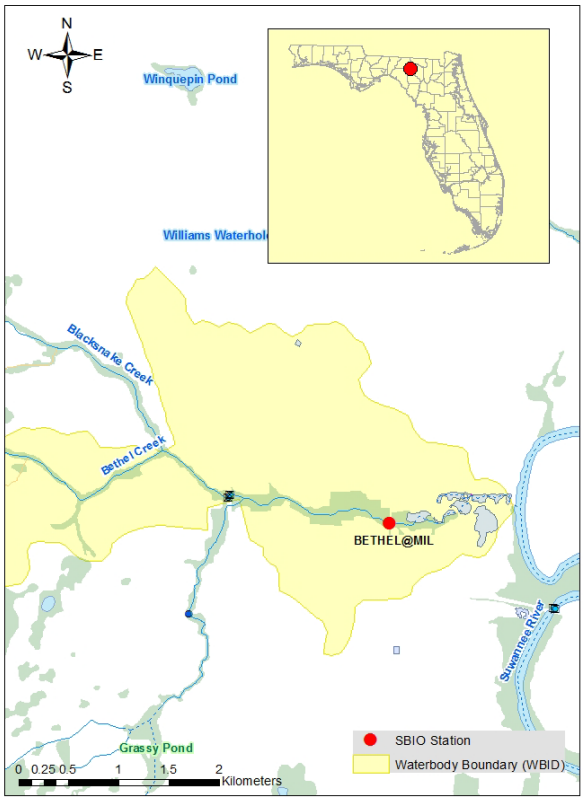


Figure 2. Location of Bethel Creek sampling point in Lafayette County

Methods

Water Quality

Surface water samples were collected for analysis of chlorophyll *a*, alkalinity, color, ammonia, nitrate+nitrite, total phosphorus, total Kjeldahl nitrogen, and microbiology 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 in Chapter 62-302, F.A.C., including nutrients, dissolved oxygen (DO), and other indicators.

Chapter 62-302.531, F.A.C., provides that Numeric Nutrient Criteria (NNC) 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 Index scores (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 North Central 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 DO saturation values shall be below 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 instantaneous value with a time-of-day-specific translation of the daily average criterion (subsection 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 using evidentiary thresholds derived from a population of minimally disturbed reference sites (see Table 2).

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 numeric nutrient standard for streams, as described above, and also serves as a biological health assessment tool in Chapter 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 the numeric nutrient standard for streams 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 numeric nutrient standard for streams in Rule 62-302.531, F.A.C., were applicable to Bethel Creek.

Results

Water Quality

The water quality results are shown in Table 1.

Fecal coliforms and *Escherichia coli* (*E. coli*) bacteria were detected in the 5/6/2015 sampling event; however, criteria were not exceeded. Bacteriological criteria are based on a monthly geometric mean based on a minimum of 10 samples taken over a 30-day period or a value not to be exceeded in more than ten percent of the values in a month (the Ten Percent Threshold Value or TPTV). While there were insufficient data to assess the monthly geometric mean criterion, the sample did not exceed the TPTV. Bacteriological samples were not collected on 8/30/2016.

Additional markers, sucralose and a human fecal genetic marker HF183-qPCR, were analyzed for samples collected 8/30/16 to further evaluate water quality, and sucralose was analyzed for samples collected 5/6/15. Sucralose passes through waste-water and septic treatment systems without degradation, so its presence can be used as a tracer for treated wastewater or septic system discharge. Sucralose was not detected in either sampling event. HF183-qPCR is a genetic marker used to determine if

humans are the source of fecal coliforms. HF183-qPCR was not detected on 8/30/16.

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 (0%) during the August 30, 2016 sampling event. During the May 6, 2015 event, an RPS survey was not conducted, however, according to the Physical-Chemical Characterization Field Sheet, no attached periphyton was observed in the stream during sampling. A second sample is required to confirm the findings, but the results of the August 30, 2016 sampling event and observations in May 6, 2015 indicate that the stream achieves the floral component of the NNC. The stream was heavily shaded, so thick algae growth would not be expected. No aquatic plants were observed, and chlorophyll *a* was not detected during either sampling event; thus, the site also achieves the LVS and phytoplankton chlorophyll *a* components of the stream floral metrics.

Table 1. Water quality results from May 6, 2015 and August 30, 2016 at Bethel Creek.

Analyte	Result 5/6/15	Result 8/30/16	Applicable Class III Water Quality Criteria
Field Temperature (°C)	20.3	24.2	
Field pH (SU)	6.7	6.87	Within 1 SU of natural background
Field Dissolved Oxygen (% saturation)	87	80	*Big Bend Criterion: 35% and 33%.
Field Specific Conductance (µmhos/cm)	95.0	141 J	50% above background or 1275 µmhos/cm, whichever is greater
Alkalinity (mg $CaCO_3$/L)	38	63	Shall not be depressed below 20
Color (PCU)	820	660	N/A
Total Phosphorus (mg/L) as P	0.032	0.032	**0.30 mg/L
Nitrate+Nitrite (mg/L) as N	0.018	0.044	0.35 mg/L for spring vents only
Ammonia (mg/L) as N	0.012	0.018	***5.04 mg/L and 3.76 mg/L
Total Kjeldahl Nitrogen (mg/L) as N	1.0	1.0	N/A
Total Nitrogen (mg/L) as N	1.018	1.044	**1.87 mg/L
Sucralose (µg/L)	0.010 U	0.020 U	
Escherichia coli Bacteria (MPN/100 mL)	119.8	Not collected	≤ 410 Counts / 100 mL
Fecal Coliform Bacteria (cfu/100 mL)	82	Not collected	N/A
HF183-qPCR (GEU/100 mL)	Not collected	1.4E+04 U	

* Instantaneous DO criterion calculated per DO Saturation Calculator and adjusted for time of day.

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

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

J – Indicates that the reported value was estimated.

U – Indicates that the compound was analyzed for but not detected.

Table 2. Floral and faunal assessment results from May 6, 2015 and August 30, 2016 at Bethel Creek.

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Result 5/6/15 SBIO# 74275	Result 8/30/16 SBIO# 76968
LVS C of C	Site average ≥ 2.5	Pass (< 2m^2)	Pass (< 2m^2)
LVS FLEPPC (%)	Site average ≤ 25%	Pass (< 2m^2)	Pass (< 2m^2)
RPS (%)	≤ 25% rank 4-6 (algae > 6 mm thick) coverage. If 20 to 25 % rank 4-6 coverage, evaluate algal species	Not collected	0 %
Chlorophyll *a* (corrected; µg/L)	< 3.2 µg/L. If 3.2 to 20 µg/L, site specific evaluation	0.55 U	0.61 I
Algal Community Composition	No adverse shifts in dominant taxa	N/A	N/A
SCI	Average ≥ 40	76	69

I – The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
U – Indicates that the compound was analyzed for but not detected.

Habitat Assessment

The stream and river habitat assessment scores were 139 and 129, which are in the optimal range. The typical velocity measured was 0.5 m/s on 5/6/2015 and 0.13 m/s on 8/30/2016, which resulted in optimal and suboptimal scores, respectively, for stream flow. Fish and aquatic insects require sufficient water velocity to maintain high DO concentrations in the stream; in this case the dissolved oxygen was on average 84% saturation.

The average width within the assessment stretch was 5 m. The banks were well-armored, containing limestone rock in some areas, but relatively steep, potentially leading to instability during high flow events. The bank stability scores, as a result, were in the suboptimal range. Three productive habitats were noted: woody debris, roots, and rocks, which comprised greater than 30% of the stream area.

Faunal Assessment (SCI)

The average SCI score for this site was 73 out of a possible 100 points, corresponding with an "Exceptional" designation (Table 2). Bethel Creek has only been sampled three times, with the most recent SCI version including the two sampling events discussed in this report. Additionally, the site was sampled on 3/7/2011 and received an SCI score of 82.

In both sampling events, *Microcylloepus pusillus* (Coleoptera) was identified as the dominant taxon and comprised roughly 50% of all taxa. In the May 6, 2015 SCI sample, 10 sensitive taxa were identified, and 8 sensitive taxa were identified in the August 30, 2016 SCI sample.

NNC Threshold Assessment

The TN and TP values measured during the two sampling events (Table 1) were below the stream numeric nutrient thresholds for the North Central region; however, the thresholds are expressed as 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. Although the annual geometric mean concentrations are based on a minimum of four samples, additional nutrient sampling is not needed to assess the thresholds because Bethel Creek passed the numeric nutrient standard for streams based on the passing SCI scores and passing floral metrics.

Conclusions

Results from these sampling events at Bethel Creek indicate that the stream met applicable State Water Quality Criteria.

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 an "Exceptional" macroinvertebrate community, with sensitive and long-lived taxa that are indicative of good water quality conditions. The LVS and RPS 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