STREAM ECOSUMMARY

Pirate Canal at Burnt Store Road
WBID 2082A, Charlotte County
10/18/2018 and 5/8/2019



Figure 1. Pirate Canal in Charlotte County on 5/18/2018.

Physical, chemical, and biological sampling was conducted at Pirate Canal (WIN/STORET G2SD0037) in Charlotte County on 10/18/2018 and 5/8/2019 by the Florida Department of Environmental Protection's (DEP) Division of Environmental Assessment and Restoration South Regional Operations Center. This stream was sampled as part of the Strategic Monitoring Program (SMP). Overall, based on water quality data and floral assessments from the sampling events discussed in this report, this system does not meet the nutrient numeric standard for streams, but the site may be excluded from the numeric nutrient standard because it is a maintained ditch/canal.

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 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. However, Pirate Canal does not comply with the NNC because it is a man-made, physically maintained canal that is primarily used for water management purposes and has poor stream habitat components.

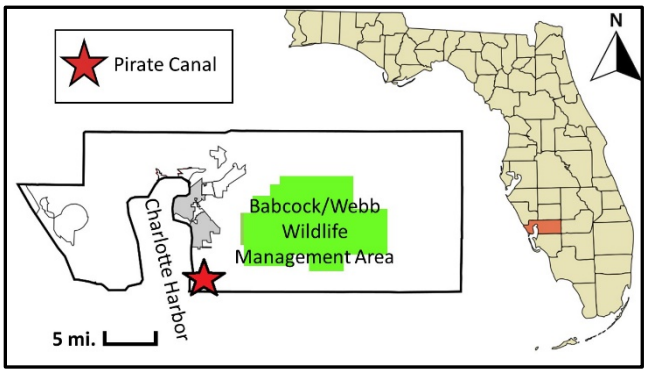


Figure 2. Location of Pirate Canal in Charlotte County.

Site Description

The Pirate Canal sampling site (Figure 1) is located near Burnt Store Road in the Charlotte Harbor Watershed (WBID 2082A, Figure 2). It is a first-order stream draining the Southwestern Florida Flatwoods**,** a subecoregion of the Southern Coastal Plain ecoregion. Pirate Canal receives a portion of the runoff from the Babcock-Webb Wildlife Management Area (WMA), and flows into Charlotte Harbor. The Babcock-Webb WMA is managed by the Florida Fish and Wildlife Conservation Commission. It is within the 90 square miles of hydrological restoration area of the Charlotte Harbor Flatwoods Initiative, whose goal is to restore slow velocity sheet flow across this landscape (https://chnep.wateratlas.usf.edu/charlotte-harbor-flatwoods-initiative/).



Figure 3. Mechanical removal of vegetation is apparent along the northern bank on 3/25/2020 (Photo by Miranda Carroll).

Current land use around Pirate Canal is a combination of natural and developed areas. The areas within the Babcock-Webb WMA are managed to preserve and restore habitats for native wildlife. Prescribed burns, physical and chemical removal of invasive species, and timber thinning are some of the methods used to manage this area.

The Landscape Development Intensity (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. The LDI score for this site is 2.86, which suggests relatively low human impact in the 100m buffer surrounding the stream. However, this score was determined using data from 2012 and recent construction on Burnt Store Road has likely affected the score, requiring reevaluation. An example of human disturbance is mechanical removal of vegetation, as is shown in Figure 3. The WBID is currently listed for dissolved oxygen (DO) on the Impaired Waters Verified List. Additional information about this WBID is available in the TMDL Tracker application (http://prodenv.dep.state.fl.us/DearTmdl/welcomehz.do

Methods

Water Quality

Surface water samples were collected for analysis of nutrients, chlorophyll *a*, and color during both events. In addition, metals, markers and tracers, and pesticides were also collected in 2019. All sampling was conducted 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 (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 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 Peninsula 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 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 Peninsula bioregion for DO criteria assessment. Factors such as temperature, atmospheric pressure, and salinity influence percent DO saturation.

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

Stream Habitat Assessments (HA) were conducted per DEP SOP FT 3100. The HA 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. HA 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 LVS accounts for each plant species' Coefficient of Conservatism (C of C) score which is assigned by expert botanists that indicates the plant's specific habitat requirements. Plants with higher C of C scores have a greater sensitivity to disturbances or changes to their habitat, while a plant with a score of 0 is highly tolerant of variable habitats, and includes invasive exotic species listed by the Florida Exotic Pest Plant Council (FLEPPC). 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.

The FLEPPC determines a list of invasive plants that effect the biodiversity of native plant communities to inform pest plant management decisions. DEP utilizes the FLEPPC list when conducting LVS assessments to determine the percent "LVS FLEPPC" for a stream or river, which is the percentage of aquatic macrophytes that are invasive within a waterbody.

Faunal Assessment

The 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 serves as a biological health assessment tool in 62-303, F.A.C., DEP's Impaired Waters Rule. An SCI was conducted at this location to evaluate whether further monitoring should be conducted, and whether this location would be appropriate as a reference for sites that may score low for HA but meet thresholds for biological sampling.

Evaluation of Stream Exclusions for Applying Nutrient Criteria

When assessing a stream for compliance with 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). A waterbody does not meet the stream definition for NNC assessment if: it is man-made or predominantly channelized or physically altered; it is primarily used for water management purposes, such as flood protection, stormwater management, irrigation, or water supply; and it has marginal or poor stream habitat components, specifically habitat availability and diversity, and artificial channelization. To fall under this exclusion, there must be evidence that this waterbody is man-made or has been physically altered, has poor habitat, and that the primary use is water management. Because of these exclusions, the NNC in Rule 62-302.531, F.A.C. may not be applicable to Pirate Canal. A definitive evaluation of factors will be conducted by DEP during the next assessment cycle.

Results

Water Quality

The water quality results are shown in Table 1. Alkalinity and conductivity were substantially lower while color and TKN were higher during October 2018 sampling. In addition to nutrients, samples were analyzed for metals, markers, tracers, and pesticides during the May 2019 sampling event. Several pesticides/herbicides were detected including: 2,4-D (0.038 µg/L), atrazine (3.8 µg/L), atrazine desethyl (1.9 I µg/L), hexazinone (1.2 µg/L), metolachlor (1.0 µg/L), imazapyr (0.082 µg/L), imidacloprid (0.0033 µg/L), and fluridone (0.0015 I µg/L). Sucralose was also detected at 0.052 µg/L.

Several metals were detected, including: barium (31.6 µg/L), calcium (97.8 mg/L), iron (660 µg/L), magnesium (6.39 mg/L), potassium (0.53 mg/L), sodium (25.7 mg/L), aluminum (170 µg/L), arsenic (0.82 µg/L), and boron (47.6 µg/L). None of the metals detected exceeded the Class III water quality criteria.

Table 1. Water quality results from 10/18/2018 and 5/8/2019 at Pirate Canal.

Analyte	Result [10/18/2018]	Result [5/8/2019]	Applicable Class III Water Quality Criteria
Field Temperature (°C)	27.84	27.4	N/A
Field pH (SU)	7.08	7.53	Within 1 unit of natural background
Field Dissolved Oxygen (% saturation)	74.8	69.3	*Peninsula: 38
Field Specific Conductance (µmhos/cm)	263	612	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	89	223	Shall not be depressed below 20
Color (PCU)	70	34 A	N/A

Total Phosphorus (mg/L) as P	0.048	0.041	*Peninsula: 0.12
Nitrate+Nitrite (mg/L) as N	0.120	0.004 U	0.35 for spring vents only
Ammonia (mg/L) as N	0.130	0.008	**2.10 and 2.75
Total Kjeldahl Nitrogen (mg/L) as N	1.2	0.74	N/A
Total Nitrogen (mg/L) as N	1.32	0.74	*Peninsula: 1.54

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

** Total ammonia criterion calculated per https://floridadep.gov/dear/water-quality-standards-program/documents/total-ammonia-nitrogen-calculator%C2%A0

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

U = Compound was analyzed for but not detected.

NNC Threshold Assessment

The NNC thresholds represent annual geometric mean concentrations (minimum of four samples) that are not to be exceeded more than once in any three-calendar year period and are used in combination with floral and faunal information. The results in Table 1 show that Pirate Canal did not exceed the TN and TP thresholds. Even though the thresholds were not exceeded for these samples, additional nutrient testing is needed to meet data sufficiency requirements to calculate and assess attainment of the water quality standard.

Table 2. Floral and faunal assessment results from 10/18/2018 and 5/8/2019 at Pirate Canal.

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Result [10/18/ 2018]	Result [5/8/ 2019]
LVS C of C	Site average ≥ 2.5	1.38	0.69
LVS FLEPPC (%)	Site average ≤ 25%	55.56	50.94
RPS (%)	≤ 25% rank 4-6 (algae > 6 mm thick) coverage. If 20 to 25 % rank 4-6 coverage, evaluate algal species	0	0
Chlorophyll *a* (corrected; µg/L)	< 3.2 ug/L. If 3.2 to 20 ug/L, site specific evaluation	2.7	1.5
Algal Community Composition	No adverse shifts in dominant taxa	N/A	*Anabaena, Closterium, Diadesmis conferacea, Fragilaria, Mougeotia, Oedogonium, Oscillatoria, Rhopalodia gibba, Spirogyra, Terpsinoe musica*
SCI	Average ≥ 40	N/A	26

Habitat Assessment

The HA scores for 10/28/2018 and 5/8/2019 were 71 and 63, respectively, which are in the marginal range. For the October 2018 event, the habitat availability was in the poor category and substrate diversity was in the suboptimal category. In the May 2019 event, both the habitat availability and the substrate diversity were in the marginal category. Three productive habitats were noted during the October 2018 event, including aquatic macrophytes, roots, rocks. Available habitat comprised 4% of the stream with the majority of habitat being aquatic macrophytes. Two productive habitats were noted in May 2019, including aquatic macrophytes and rocks. Available habitat comprised 8% of the stream area

with the majority of habitat being aquatic macrophytes.

The typical velocity measured on 10/18/2018 was greater than 0.25 m/s, resulting in an optimal score for stream flow. The typical velocity measured on 5/8/2019 was 0.07 m/s, which resulted in a marginal score for stream flow. For both sampling events, habitat smothering was moderate. The average width within the assessment stretch was 6.0 m on 10/18/2018 and 3.5 m on 5/8/2019. Artificial channelization is apparent at Pirate Canal, resulting in scores in the poor category for both sampling events. Bank stability scores were in the suboptimal category for the October 2018 assessment and in the marginal category in the May 2019 assessment. For both banks in the October 2018 assessment, the riparian buffer zone width scored in the marginal category, and both banks scored in the poor category for riparian zone vegetation quality. While the left bank scored optimal for riparian buffer zone width in the May 2019 assessment, the right bank scored in the marginal category. Both banks scored in the marginal category for riparian zone vegetation quality for in May 2019.

Table 3. Species list for the 10/18/2018 sampling event at Pirate Canal and the presence of each within the 100m sampling location.

Taxon Name	0-10	10- 20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Acrostichum danaeifolium					P					
*Alternanthera philoxeroides**	D	D	D	D	D	D	D	D	D	D
Bacopa monnieri	P									
Echinochloa crusgalli	P				P	P				
Hydrocotyle									P	
*Ludwigia peruviana**								P	P	P
*Panicum repens**		P								
Paspalum							P			
Phragmites australis			P	P				P		
Sacciolepis striata									P	P
*Sphagneticola trilobata**		P								

* Indicates an invasive plant species

P = Present

D = Dominant

C = Codominant

Table 4. Species list for the 5/8/2019 sampling event at Pirate Canal and the presence of each within the 100m sampling location.

Taxon Name	0-10	10- 20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
*Alternanthera philoxeroides**	P	P	P	P	P	P	P	P	P	P
Bacopa monnieri	P	P								
Echinochloa crusgalli	P	P			P	P		P	P	P
Eleocharis	P									
Hydrocotyle								P	P	P
Lemna	P	P	P	P	P	P	P	P	P	P
*Ludwigia peruviana**				P		P	P	P	P	P
Ludwigia repens	P	P								
Najas guadalupensis	P									
*Panicum repens**	P	P	P	P	P	P	P	P	P	P
Phragmites			P	P						
Phragmites australis										
*Ruellia simplex**							P			
Wedelia	P									

* Indicates an invasive plant species

P = Present

D = Dominant

C = Codominant

Floral Assessment

During both sampling events, the LVS C of C was lower than the evidentiary threshold (Table 2). The LVS percent FLEPPC macrophytes was greater than the NNC threshold of 25% of the total macrophytes observed. Table 2 shows the percent LVS FLEPPC for each sampling event, which is 56% for October 2018 and 51% for May 2019. Additionally, the LVS mean C of C did not meet its NNC threshold. Floral species present in the 10/18/2018 and 5/8/2019 assessments are shown in Table 3 and 4, respectively. FLEPPC species present included *Alternathera philoxeroides* (alligator weed)*, Ludwigia peruviana* (primrose willow)*, Panicum repens* (torpedo grass) and *Sphagneticola trilobata* (creeping-oxeye). Filamentous algae were not abundant or smothering habitat within the sampling reach, although some were noted outside the sampling reach and a sample was collected for community composition purposes (Table 2). Results indicate the RPS met the NNC thresholds.

Faunal Assessment (SCI)

The SCI results presented in this report are the first and only for this specific site within this canal. The SCI score on 5/8/2019 for this site was 26 out of a possible 100 points, corresponding with an Impaired designation (Table 2), failing the threshold that no score be lower than 35 (Chapter 62-302.531, F.A.C.). No sensitive benthic taxa were present in the macroinvertebrate samples taken although clingers were present. The dominant taxon was the snail, *Pyrgophorus platyrachis*, which is considered a very tolerant organism.

Conclusions

Water quality results (shown in Table 1) including D.O were within surface water criteria in Rule 62-302.530. While water quality of Pirate Canal met the NNC during the sampling events that took place on 10/28/2018 and 5/8/2019, the LVS component of the NNC floral metrics did not meet the evidentiary thresholds. All floral measures must pass for the stream to meet the NNC. Results of the floral metrics show that this site is not within the reference stream distribution and therefore does not attain the floral component of the NNC (Table 2).

Pirate Canal is characterized by its seasonal flow, artificial channelization, herbicide runoff, and silt and sand smothering. This waterbody is a man-made canal, has poor stream habitat components, and is subject to physical alterations including dredging for maintenance and hydrological purposes. The May 2019 sampling revealed presence of several herbicides that are commonly used for residential lawns, which are a potential source for the herbicides found in this waterbody. In addition to herbicides being used in combination with the mechanical removal of vegetation surrounding the canal, herbicide use in the Babcock-Webb WMA for management of invasive species could be contributing to the herbicide's presence in the canal. Because the assessment site is a canal, there is no sinuosity. The banks were well-armored and relatively steep, potentially leading to instability during high flow events. The HAs conducted in Pirate Canal determined that this site is in the marginal category and is appropriate for exclusion from SCI assessment. While this site would ordinarily be excluded from an SCI assessment in the DEP Strategic Monitoring Program, the assessment was requested to provide comparison with other waterbodies that have low HA scores. It is possible that a waterbody might have a low scoring HA and a high scoring SCI.

Overall, the SCI data are inconclusive as only one assessment has been performed at this canal. However, based on the latest IWR Run 58 (data extracted from WIN and STORET databases – 9/17/2019) Pirate Canal is impaired for dissolved oxygen. Alkalinity and conductance were significantly lower in the October 2018 sample than the May 2019 sample, suggesting a greater impact of runoff during 2018 sampling due to seasonal variances. Rainfall between May and October differs drastically in that May is the end of the dry season, and October is near the end wet season. The vascular plant community

was assessed using the LVS which showed that invasive aquatic plants are slightly more dominant than native plants in this canal, indicating that the stream has impaired flora. The low LVS C of C scores (Table 2) show the presence of very tolerant or invasive species of plants, indicating that sensitive taxa are not currently being supported in this waterbody. As for the causes of failure in the macroinvertebrate community, limited habitat availability, low dissolved oxygen, and periodic desiccation could be preventing sensitive benthic taxa from flourishing.

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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Babcock/Cecil Webb WMA resources:
https://myfwc.com/recreation/lead/babcockwebb/

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

Freshwater Algal Bloom resources:
https://floridadep.gov/dear/algal-bloom

CHFI:
https://chnep.wateratlas.usf.edu/charlotte-harbor-flatwoods-initiative/

and
http://chnep.wateratlas.usf.edu/upload/documents/CHFI-SteveSentes-17Sept2013.pdf