STREAM ECOSUMMARY

Loxahatchee River above Cypress Creek

WBID: 3230, Palm Beach County

04/02/2012 & 10/27/2016



Figure 1. Sampling reach along the Loxahatchee River in Palm Beach County.

Physical, chemical, and biological sampling was conducted at the Loxahatchee River above Cypress Creek (STORET Station 28010081/28010224, SBIO nickname: PALMB25/NWFRLOXREF) in Palm Beach County on April 2, 2012 and October 27, 2016 by the DEP DEAR Southeast Regional Office. This stream was sampled as part of Strategic Monitoring Program. The water quality and macroinvertebrate community data indicated that the stream met expectations for aquatic life support, but the floral assessment was inconclusive. For one of the two sampling events, there were exceedances in the percentage of exotic plant species and chlorophyll-*a*. Thus, even though the stream met the numeric nutrient thresholds and the faunal assessment, all floral measures must pass for the stream to attain the Numeric Nutrient Criteria (NNC).

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 Northwest Fork of the Loxahatchee river (NWFLR) is a federally designated National Wild and Scenic River in Southeast Florida. Bordered with historic cypress trees and natural flood plains armored with wetland flora, the Northwest Fork of Loxahatchee River above Cypress Creek (Figure 1) borders southern Martin County and northern Palm Beach County in the Loxahatchee River watershed (WBID 3230, Figure 2). The river originates in both the Loxahatchee and the Hungryland Sloughs, draining the Eastern Florida Flatwoods a sub-ecoregion of the Southern Coastal Plain ecoregion. The Northwest Fork receives additional input from the other major tributaries of the Loxahatchee River: Cypress Creek/Cypress Creek Canal, Hobe Grove Ditch, and Kitching Creek. According to the Strahler

stream order system, this stream is classified as a second order stream. Water flows into the Loxahatchee River Estuary which feeds into the Intercoastal waterway and finally out the Jupiter inlet into the Atlantic Ocean. There are 8 major sub-watersheds within the Loxahatchee River watershed area: Kitching Creek Basin, Grove Basin, Pal-Mar Basin, Jupiter Farms Basin, Historic Cypress Creek Basin, Loxahatchee Estuary, C-18/Corbett basin, and the L-8 Basin (Figure 3.) Between 1957 and 1958, the United States Army Corps of Engineers constructed three Central and Southern Florida Project (C&SF) features (C-18 Canal, C-18W Canal, and S-46 Structure) which cut off the Northwest Fork of the Loxahatchee River from Loxahatchee Slough and the rest of its watershed and channelized the Southwest Fork of the Loxahatchee River. The flood control improvements resulted in reduced flows to the Northwest Fork by diverting freshwater that formerly flowed naturally to the Northwest Fork into the Southwest Fork. Urban and agricultural development that followed implementation of the C&SF project features further severed the connections of the watershed to the Loxahatchee River. The construction of canals, channelization of natural waterways, and barriers to flow also degraded wetland structure and function throughout the watershed. These drained wetlands cannot store water as effectively as they once did, which results in periods of excessive and insufficient freshwater inflow to the Loxahatchee River and Estuary. The Loxahatchee river above Cypress Creek has a Landscape Development Intensity (LDI) Index score of 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.



Figure 2. Location of Northwest Fork of the Loxahatchee River in Palm Beach County.

This site's score of 4 suggests moderate human activity in the 100m buffer surrounding the stream. On the Impaired Waters Verified List cycle 4, 2019 summary, the WBID is currently listed for Dissolved Oxygen (Percent Saturation). Additional information about this WBID is available in the Water Quality Assessments, TMDLs, and BMAPs map. (https://fdep.maps.arcgis.com/home/webmap/viewer.html?webmap=1b4f1bf4c9c3481fb2864a415fbeca77)

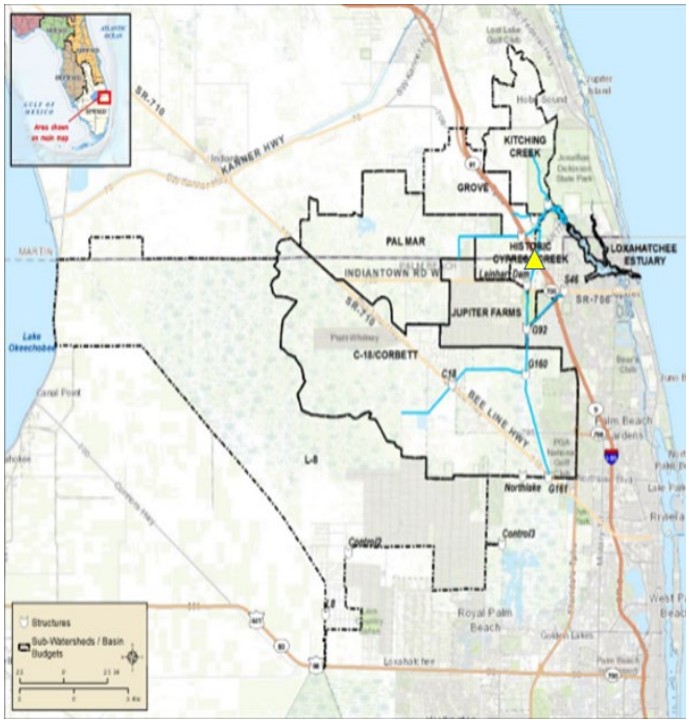


Figure 3. Major sub-watersheds within the Loxahatchee River (Picture attained from ACOE Loxahatchee River Watershed Restoration Project).

Methods

Water Quality

Surface water samples were collected for analysis of nitrite/nitrate, turbidity, chloride, sulfate, color, alkalinity, total dissolved solids, total suspended solids, fluoride, ammonia-N, total phosphorous, total organic carbon, orthophosphate, total Kjeldahl nitrogen, chlorophyll-α, fecal coliform, *Escherichia coli*, 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 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 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 Peninsula region for DO criteria assessment. Percent saturation considers 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" (if neither of the latest two SCI scores were < 35.
Scores ≥ 64 are 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.

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 the Northwest Fork of the Loxahatchee River.

Results

Water Quality

The water quality results are shown in Table 1. When comparing test results from the two individual samples, the sampling event conducted on 04/02/2012 showed that specific conductance and alkalinity were higher, and color was lower than observed during the 10/27/2016 sampling event. All analytes tested met the Class III-Fresh Water Quality Criteria, indicating water quality in the Northwest Fork of the Loxahatchee River above Cypress Creek is supporting healthy and well-balanced fish and wildlife populations.

NNC Threshold Assessment

Based on these two sampling events, the stream met the numeric nutrient thresholds; 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 numeric nutrient threshold 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 were inconclusive. All floral measures must pass during two temporally independent sampling events for the stream to attain the NNC. During the April 2012 sampling event, the LVS and RPS were not collected. The 2012 chlorophyll-*a* result exceeded the evidentiary threshold, but the 2016 result met the threshold. During the 2016 sampling event, the LVS results were not within the reference stream distribution (Table 2). The 2016 sampling event recorded a high percentage of Category I or II Florida Exotic Pest Plant Council (FLEPPC) invasive exotics, exceeding the evidentiary threshold. *Hygrophila polysperma* and *Pistia stratioides* were the dominant FLEPPC species present during the LVS assessment. The RPS results indicated no imbalance to the floral community as shown by little to no growth of algae in the stream.

Table 1. Water quality results from 04/02/2012 and 10/27/2016 at Northwest Fork of the Loxahatchee.

Analyte	Result 04/02/2012	Result 10/27/2016	Applicable Class III Water Quality Criteria
Field Temperature (°C)	25.4	24.1	____
Field pH (SU)	7.3	7.2	Within 1 unit of natural background
Field Dissolved Oxygen (% saturation)	65	51	>37%, >45% *
Field Specific Conductance (µmhos/cm)	607	359	50% above background or 1275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	184	115	Shall not be depressed below 20
Color (PCU)	58	71	N/A
Total Phosphorus (mg/L) as P	0.041	0.029	0.12 **
Nitrate+Nitrite (mg/L) as N	0.043	0.13	N/A
Ammonia (mg/L) as N	0.021	0.038	Average of individual 30-Day TAN 1.06 mg/L 2012* 4.18 mg/L 2016*
Total Kjeldahl Nitrogen (mg/L) as N	0.81	0.78	N/A
Total Nitrogen (mg/L) as N	0.85	0.91	1.54 **

* Instantaneous DO criterion calculated per DO Saturation Calculator

** Annual geometric numeric nutrient threshold for Peninsular 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

Table 2. Floral and faunal assessment results from 04/02/2012 and 10/27/2016.

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Result 04/02/2012 Sample 28010081	Result 10/27/2016 Sample 28010224
LVS C of C	Site average ≥ 2.5	Not Assessed	3.1
LVS FLEPPC (%)	Site average ≤ 25%	Not Assessed	55
RPS (%)	≤ 25% rank 4-6 (algae > 6 mm thick) coverage. If 20 to 25 % rank 4-6 coverage, evaluate algal species	Not Assessed	0
Chlorophyll *a* (corrected; µg/L)	< 3.2 ug/L. If 3.2 to 20 ug/L, site specific evaluation	10	1.2
Algal Community Composition	No adverse shifts in dominant taxa	Not Assessed	None
SCI	Average ≥ 40	38	57

Habitat Assessment

The stream and river habitat assessment scores were 130 and 128, which are in the Optimal range. The typical velocity measured was >0.25m/s, which resulted in an optimal score for stream flow. Fish and aquatic insects require sufficient water velocity to maintain high dissolved oxygen concentrations in the stream; in this case the dissolved oxygen was 51– 65

percent saturation. The average width within the assessment stretch was 7m. The banks are well-armored with slopes well below 60 degrees from bankfull to top of bank. The low gentle banks provide ideal connection with the floodplain. The bank stability scores, as a result, were in the optimal range. Two productive habitats were noted (Figure 4): woody debris (snags) and undercut banks and roots, which comprised roughly 20% of the stream area.

Faunal Assessment (SCI)

The average SCI score for this site was 48 out of a possible 100 points, corresponding with a healthy designation (Table 2). The dominate taxa found was the snail family Hydrobiidea and the most common species was *Pyrgophorus platyrachis*. This species of aquatic snail is very tolerant to human degradation which supports the LDI score of a moderately disturbed stream. The sample contained several different types of organisms such as caddisflies that are sensitive to water quality, supporting the location's adequate water quality data.



Figure 4. NWFLR displaying habitat and optimal banks.

Conclusion

Samples from the Northwest Fork of the Loxahatchee River above Cypress Creek indicates that the stream met applicable State Water Quality Criteria for Class III-Fresh waterbodies but do not appear to attain the NNC due to an imbalance in the floral community. Evidence of low-moderate intensity land uses included the watershed Landscape Development Intensity Index (LDI) score of 4. The biological community was found to be healthy, indicating that the existing DO regime fully supports aquatic life uses. Within the sampling reach, the Habitat Assessment data indicated an optimal physical condition of the creek with moderate disturbance upstream in the stream corridor. Stream Condition Index data indicated the presence of a "healthy" macroinvertebrate community with sensitive and long-lived taxa that are indicative of good water quality conditions. The LVS results indicated vascular plant communities consistent with expectations for moderately disturbed sites. Due to the construction of canals, channelization of natural waterways, and barriers by the USACE for flood control measures, reduced the overall freshwater input to the Loxahatchee River. These drained wetlands do not store water as effectively as they once did, which results in periods of excessive and insufficient freshwater inflow to the Loxahatchee River and Estuary. These disturbances may explain the failing floral assessment.

Efforts are underway to improve the Loxahatchee river. The Loxahatchee River Watershed Restoration Project (LRWRP) is in its final stages of implementation (June 2020). This project is intended to improve the quantity, quality, timing, and distribution of water flows to the Northwest Fork of the Loxahatchee River and restore hydrologic conditions and connectivity of wetlands and watersheds that form the historic headwaters of the river.

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

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