STREAM ECOSUMMARY

North Creek near Oak Creek Court

WBID 1984AB, Sarasota County

09/20/2018 and 10/31/2019



Figure 1. Sampling reach along North Creek in Sarasota County.

Physical, chemical, and biological sampling was conducted at North Creek (WIN G3SD0064, SBIO NORTHCREEK) in Sarasota County on September 20, 2018 and October 31, 2019 by the FDEP South Regional Operations Center. The stream was sampled as part of Strategic Monitoring Program (SMP). Overall, the water quality and macroinvertebrate community data indicated that the stream did not meet 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 North Creek sampling site (Figure 1) is in the Oaks Club community east of US-41 in the Sarasota Bay Watershed (WBID 1984AB, Figure 2). It is a first-order freshwater stream draining the Southwestern Florida Flatwoods, a subecoregion of the Southern Coastal Plain ecoregion. It has a small drainage area of approximately 0.6 sq. miles. North Creek is a tributary of Little Sarasota Bay that flows into Sarasota Bay and eventually into the Gulf of Mexico. It has a Landscape Development Intensity (LDI) Index score of 4.4. 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 4.4 suggests moderate human activity in the 100m buffer surrounding the stream. The WBID is not currently 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)



Figure 2. Location of North Creek in Sarasota County.

Methods

Water Quality

Surface water samples were collected for analysis of nutrients, chlorophyll a, color, metals, microbiology, and pesticides 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 West 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 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.). North Creek is currently on the FDEP SMP Study List for Dissolved Oxygen.

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 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 North Creek.

Results

Water Quality

The water quality results are shown in Table 1. All results fell within the applicable Class III Water Quality Criteria except for the specific conductance value of 1,279 μmhos/cm measured on 10/31/2019. The value from 9/20/2018 was also elevated compared to undisturbed streams but was slightly below the 1,275 μmhos/cm freshwater standard (62-302 (22) F.A. C.)

Trace levels of multiple pesticides/herbicides were detected in the North Creek samples, including atrazine, hexazinone, norflurazon, imidacloprid, imazapyr, fluoridone, clothianidin, bentazon, and glyphosate. These compounds are typically used for controlling weeds and insects in residential landscapes.

NNC Threshold Assessment

Based on these two sampling events, the stream met the numeric nutrient thresholds for the West Central region. The thresholds, however, 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 (RPS, LVS, and chlorophyll *a*) in North Creek were inconclusive. There was less than 2 square meters of aquatic vegetation recorded for both sampling events, resulting in a passing score for the LVS. Similarly, no attached algae were measured on either sampling date, demonstrating passing RPS results. Meanwhile, the chlorophyll *a* values exceeded 3.2 μg/L (4.3 and 6.2 μg/L on 9/20/18 and 10/31/19, respectively), which is above the reference stream distribution. To determine whether it is an exceedance, the data must be compared to a similar reference stream under the same conditions as when the samples were collected. When the data were compared to the nearby reference stream, Deer Prairie Creek (WBID 1978), the values in North Creek were higher. However, because compliance with the threshold is based on the annual geometric mean (AGM) concentration, not to be exceeded more than once in a three-year period

and will be determined as part of the Impaired Waters Assessment process.

Table 1. Water quality results from 9/20/18 and 10/31/19 at North Creek.

Analyte	Result 9/20/18	Result 10/31/19	Applicable Class III Water Quality Criteria
Field Temperature (°C)	28.7	26.1	N/A
Field pH (SU)	7.4	7.3	Within 1 SU of natural background
Field Dissolved Oxygen (% saturation)	48	42	Peninsula: 9/20/18: above 44 10/31/19: above 37
Field Specific Conductance (µmhos/cm)	1,230	1,279	50% above background or 1,275, whichever is greater
Alkalinity (mg $CaCO_3$/L)	288	282	Shall not be depressed below 20
Color (PCU)	80	72	N/A
Total Phosphorus (mg/L) as P	0.21	0.17	West Central: below 0.49
Nitrate+Nitrite (mg/L) as N	0.26	0.26	N/A
Ammonia (mg/L) as N	0.070	0.099	9/20/18: Below 0.86 10/31/19: Below 1.09
Total Kjeldahl Nitrogen (mg/L) as N	1.2	1.1	N/A
Total Nitrogen (mg/L) as N	1.47	1.37	West Central: below 1.65

* Instantaneous DO criterion calculated per DO Saturation Calculator
** Annual geometric numeric nutrient threshold for West Central 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 9/20/18 and 10/31/19 at North Creek.

Floral/Faunal Metric	Evidentiary Threshold of No Imbalances	Results 9/20/18 Sample #78916	Results 10/31/19 Sample #80464
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	0%	0%
Chlorophyll *a* (corrected; µg/L)	< 3.2 ug/L. If 3.2 to 20 ug/L, site specific evaluation	4.3	6.2
Algal Community Composition	No adverse shifts in dominant taxa	N/A	N/A
SCI	Average ≥ 40	N/A	29

Habitat Assessment

The stream and river habitat assessment scores were 80 on 9/20/18 and 91 on 10/31/19, which are in the marginal and suboptimal range. The typical velocity measured averaged 0.20 m/s, which resulted in a suboptimal 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 48% and 42% on the two sampling dates, which is above the calculated Peninsula thresholds of 44% and 37% saturation, respectively. The average width within the assessment stretch was 1.25 m. The banks were well-armored, but relatively steep, potentially leading to instability during high flow events. The bank stability scores, as a result, were in the marginal range. Two productive habitats were noted: woody debris and roots, which comprised roughly 8% of the stream area on 9/20/18 and 6% on 10/31/19. Roots

were more prevalent in the 2018 assessment (7% compared to 4%), perhaps due to higher water levels during the wet/growing season. The stream averaged 0.3 meters deep in 2018, and only 0.1 meters in 2019. Habitats were slightly smothered by sand/silt on both visits and the stream had a minimum number of pools. These circumstances may result in less suitable conditions for colonization by aquatic invertebrates.

Faunal Assessment (SCI)

The 10/31/19 SCI score for this site was 29 out of a possible 100 points, failing the single sample threshold of 35. No SCI was conducted on 9/20/2018. The low score may be the result of several factors, such as a small drainage area, changes in hydrology due to increased development in the headwaters, pesticides, and elevated specific conductance. However, because this is the first SCI sampling event conducted on North Creek, additional samples are needed to confirm the impairment status.

Microcylloepus pusillus (Order: Coleoptera) was the dominant taxon in both replicates (31.8% and 36.2%, respectively). There were no sensitive taxa, one long-lived taxa, and a relatively high percentage of very tolerant organisms (27%), indicating high human disturbance levels in the stream ecosystem.

Discussion

Recently, there has been residential development in the headwaters of North Creek. Using historic aerial imagery, one can see that the creek originally flowed out of a natural cypress slough (Figure 3). Several cypress domes, visible on the right side of the image, are the source of the headwaters as the creek flows to the west.

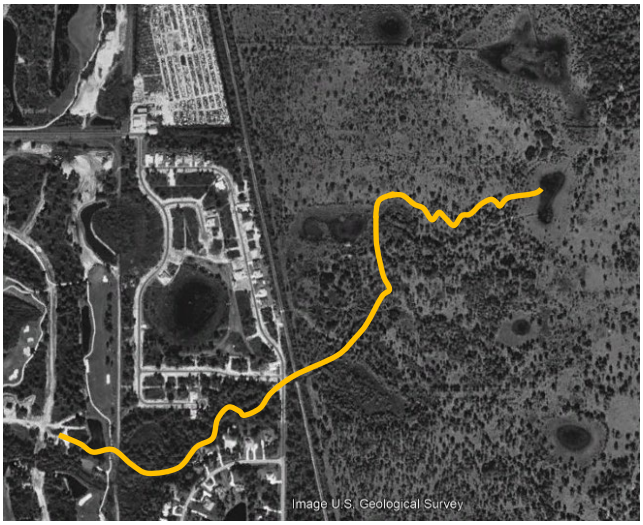


Figure 3. 1995 Aerial imagery showing historical headwaters of North Creek in Sarasota County.

Residential development began in the upper watershed around 1998 and has been gradually expanded upon. The most recent construction started around 2015, removing the last of the historical cypress domes contributing to North Creek (Figure 4).



Figure 4. 2018 Aerial Imagery showing recent development in headwaters of North Creek in Sarasota County. Historical flow represented by orange line. Newly constructed retention ponds can be seen on the right.

As a result of this residential development, the upper watershed draining into North Creek has changed from natural sources (cypress domes) to man-made sources (retention ponds using water control devices). These changes may have had significant impacts on the aquatic invertebrate community by

altering the hydrology downstream of the construction. Previously stable upstream water conditions likely resulted in better habitat and water quality for aquatic invertebrates. This change in stormwater management may also contribute to high specific conductivity results seen on 10/31/19 and in other past sampling events. Furthermore, the conversion of cypress sloughs to static retention ponds has reduced suitable habitat for stream-dwelling organisms in the upper watershed (Figure 4).

While present in low levels, collectively the pesticides may be having adverse effects on the invertebrate community in North Creek. Pesticides such as these have been found to "produce pronounced negative effects on the regional biodiversity of stream invertebrates" (Beketov et al., 2013). Specifically, sensitive species have been shown to be vulnerable to imidacloprid, potentially impacting populations in streams where it is present (Dijk et al., 2013).

Conclusions

Sampling at North Creek was inconclusive. The sampling events showed that the stream is meeting some of numeric nutrient thresholds but may not be meeting the chlorophyll-a levels. Additional data is needed to make a full determination. WBID 1984AB is not currently on the Impaired Waters Verified List, however, the specific conductance standard was exceeded and may represent an impairment of the Class III water quality standard for this parameter and these elevated levels may be the most influential factor resulting in the low Stream Condition Index score. The Stream Condition Index assessment indicates conditions are not supporting the designated uses although additional SCI assessments are necessary to confirm this finding.

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

Sources

Beketov, M., Kefford, B., Schäfer, R., & Liess, M. (2013, July 02). Pesticides reduce regional biodiversity of stream invertebrates. Retrieved June 11, 2020, from https://www.pnas.org/content/110/27/11039

Dijk, T., Staalduinen, M., & Sluijs, J. (2013, May 01). Macro-Invertebrate Decline in Surface Water Polluted with Imidacloprid. Retrieved June 11, 2020, from https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0062374