STREAM ECOSUMMARY

Beaver Pond Creek below Perdido Landfill

April 14, 2010 & February 16, 2011

FDEP conducted Stream Condition Index (SCI) biological and water quality sampling at Beaver Pond Creek below the Perdido Landfill (**Figure 1**) in Escambia County on April 14, 2010 and February 16, 2011 to assess attainment of designated uses, as requested by Florida's watershed assessment program. Since 1992, a total of nine bioassessments have been made at this site. Overall, the macro-invertebrate community and water quality data indicated that the stream did not meet expectations for a healthy, well-balanced stream.



Figure 1. Stream Condition Index site for Beaver Pond Creek below the Perdido Landfill February 16, 2011.

Beaver Pond Creek, Water Body Identification (WBID) 542 was included on the FDEP Basin Rotation Group 5 (Perdido Basin) Planning List of Impaired Waters. The FDEP Planning List is an inventory of surface waters or water segments for which impairment of one or more parameters is suspected and additional sampling is required to verify the suspected impairment(s). SCI assessments are required to verify biological impairment of a stream or water body segment (Rule 62-300.330, Florida Administrative Code [F.A.C]). If impairment is verified, a total maximum daily load (TMDL) will be developed, as provided in Subsection 403.067(2) in Florida Statutes, to determine reductions in the pollutant to restore the water body's designated use.

Background

Although healthy, well-balanced stream and river communities may be maintained with some level of human activity, such activities may result in water body degradation. Human stressors may include increased inputs of nutrients, sediments, and/or pesticides from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of nuisance (generally exotic) plants and animals. FDEP has methods to evaluate if human activities have resulted in the condition where a particular waterbody has exceeded water quality criteria (Chapter 62-302, FAC), including whether adverse impacts to biological communities have occurred. FDEP water quality standards are designed to protect designated uses of the waters of the state (*e.g.*, recreation, aquatic life support), and exceedances of these standards is associated with interference with the designated use. 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 stream and river habitat assessment evaluates the availability and quality of habitat for macroinvertebrates, and can help diagnose the cause of a low SCI score.

Methods

This stream was sampled April 14, 2010, September 2, 2010 (SCI sample damaged during shipment and discarded), and re-sampled February 16, 2011 by the FDEP Northwest District Office following FDEP Standard Operating Procedures (SOPs, see http://www.dep.state.fl.us/water/sas/sop/sops.htm for details). Sampling and analyses met FDEP quality assurance/ quality control standards (see http://www.dep.state.fl.us/water/sas/qa/index.htm).The Stream Condition Index (SCI) was sampled per FDEP SOP FS7420 and calculated per FDEP SOP LT7200. The SCI consists of collecting macroinvertebrates via 20 D-

frame dipnet sweeps (0.5 m in length) in the most productive habitats in a 100 m reach of stream. The organisms are sub-sampled, and identified to the lowest practical taxonomic level. The SCI is composed of ten metrics, eight of which decrease in response to human disturbance, with two metrics (% very tolerant and % dominant) increasing in response to human disturbance. According to FDEP SOP LT 7000, the SCI score ranges and categories are: (68-100) Exceptional; (35-67) Healthy; and (0-34) Impaired. Proposed biological health assessment criteria state that a site is considered to meet designated uses if the average of the two most recent SCI scores is 40 or higher and neither of those scores is less than 35. The Stream and River Habitat Assessment was conducted per FDEP 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).

Site Information

This site STORET 33010066 (Lat/Long N30° 34′ 10.9″ W-87° 24′ 16.4″) is located south of I-10 and east of the Perdido River near the Alabama border. (**Figure 2**). The location is about 11 miles northwest of Pensacola. Beaver Pond Creek at this location is a 2nd order stream and drains the Southern Pine Plains and Hills ecoregion (65f). Beaver Pond Creek drains to Rest Area Run, Perdido River, and Perdido Bay. Its headwaters originate in former wetlands and hillside seepage springs that are now within the footprint of a municipal landfill. Previous Beaver Pond Creek reports indicated biological impairment from landfill leachate and runoff A 2005 Ecosummary was written on Rest Area Run WBID 542 downstream of Beaver Pond Creek
The stream morphology appears to have been affected by sedimentation associated with the landfill, as the channel has become braided. The WBID 542 had been placed on the Impaired Waters list for biology and turbidity. It was previously verified as impaired for turbidity (**Table 1**), and was on the Planning List as potentially impaired for biology.

Table 1 Turbidity Beaver Pond Creek sites above and below I-10.

Station ID	Date	Characteristic	Value	Units
33010066	6/21/2005	Turbidity	38	NTU
33010066	8/16/2005	Turbidity	46	NTU
33010066	8/23/2005	Turbidity	39	NTU
33015424	2/1/2006	Turbidity	92	NTU
33015424	2/9/2006	Turbidity	80	NTU
33015424	2/9/2006	Turbidity	80	NTU
33015424	7/19/2006	Turbidity	90	NTU
33015424	8/10/2006	Turbidity	40	NTU
33015424	9/13/2006	Turbidity	36	NTU





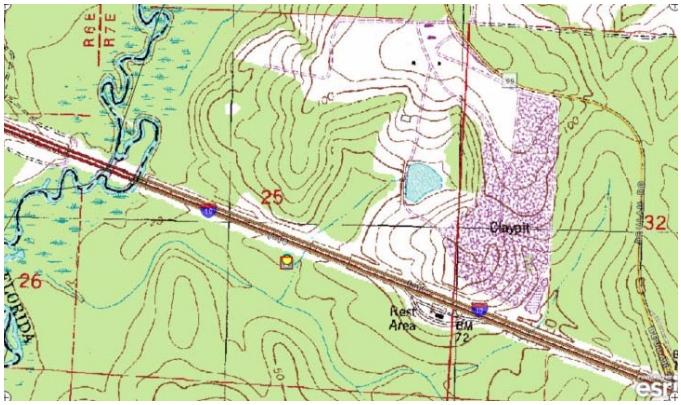


Figure 2. Location of Beaver Pond Creek below Perdido Landfill in Escambia County.

Results

Water Quality

The water quality samples did not comply with all water quality criteria (**Table 2**). Total nitrogen (0.94 mg/L, 1.89 mg/L and 1.3 mg/L) and total phosphorus (0.06 mg/L, 0.15 mg/L and 0.12 mg/L) for 2010 and the 2011 water quality samples exceeded the criteria of ≤0.67 for total nitrogen and ≤0.06 for total phosphorus. Additional water quality samples will be needed to determine annual geometric means along with rapid periphyton surveys/linear vegetation surveys to verify WBID 542 not meeting the nutrient thresholds in Chapter 62-304.531, F.A.C. The macroinvertebrate community was not healthy, as indicated by both SCI samples scoring less than 35. Compared to its receiving water, the Perdido River, the nutrient concentrations were significantly elevated in the second order Beaver Pond Creek (**Table 2 and 3**) with the landfill being the most probable source of the nutrient enrichment. Although the Perdido River is larger, both drain the same sand and gravel aquifer noted for very low concentrations of minerals and nutrients. Although the Perdido River receives nutrients from Atmore and Bay Minette wastewater treatment plants in Alabama, its total nitrogen concentration of 0.4 mg/L is well below the Panhandle West TN threshold of 0.67 mg/L, which is based on minimally disturbed reference streams.

). Beaver Pond Creek ammonia concentrations (0.055 mg/L, 0.15mg/L 0.27mg/L) were 5 to 23 times higher than the Perdido River (less than 0.012 mg/L. The pH was also higher in Beaver Pond Creek (ranging from 6.99 to 7.6 SU) than in the Perdido River (5.4 SU), with the landfill being the probable source of the elevated pH (the calcium concentration was significantly higher than the Perdido River area background). Additionally, the specific conductance (272 to 318 µmhos/cm) was higher in Beaver Pond Creek than the Perdido River (26 µmhos/cm). The 2010 dissolved oxygen measurements (49% saturation and 48% saturation) did not meet the recently revised Class III Water Criteria (≥ 67% saturation). Other analytical results (alkalinity, chloride, sulfate, and organic carbon) were present in higher concentrations in Beaver Pond Creek compared to the Perdido River and other western Panhandle streams.

Table 2. Water quality results from 4/14/10, 9/2/10, and 2/16/11 at Beaver Pond Creek below landfill.

Analyte	Result 4/1/10	Result 9/2/10	Result 2/16/11	Applicable Class III Water Quality Criteria
Field Temperature (°C)	18.3	24.23	11.05	
Field pH (SU)	7.11	6.99	7.59	1 SU over bkgd
Field Dissolved Oxygen (mg/L)	4.75	4.08	7.91	
% Dissolved Oxygen Saturation	49%	48%	71%	67% saturation
Specific Conductance (µmhos/cm)	272	269	318	Not to exceed 50% of background or 1275 µmhos/cm
Alkalinity (mg $CaCO_3$/L)	119	93	69	
Chloride (mg/L)	15	25	24	
Calcium (mg/L)	31.7	22.4	21.3	
Sulfate (mg/L)	3.5	2.5	14	
Total Phosphorus (mg/L)	0.055	0.15	0.12 Y	*≤0.06
Nitrate+Nitrite (mg/L)	0.084	0.19	0.044 Y	
Ammonia (mg/L)	0.15	0.27	0.055 Y	
Total Kejldahl Nitrogen (mg/L)	0.86	1.7	1.3 Y	
Total Nitrogen (mg/L)	0.944	1.89	1.344 Y	*≤0.67
Organic Carbon (mg/L	10	22	15 Y	

Table 3. Water quality results from 11/19/09 Perdido River Old Bridge Road STORET 31010140.

Analyte	Result	Remark	Applicable Class III Water Quality Criteria
Field Temperature (°C)	13.8		
Field pH (SU)	5.40		1 SU over bkgd
Field Dissolved Oxygen (mg/L)	9.93		≥5.0
% Dissolved Oxygen Saturation	95.5		
Specific Conductance (µmhos/cm)	26		Not to exceed 50% of back-ground or 1275 µmhos/cm
Alkalinity (mg $CaCO_3$/L)	1.2	I	
Color (PCU)	40		
Chloride (mg/L)	4		
Calcium (mg/L)	1.06		
Sulfate (mg/L)	1.4		
Turbidity (NTU)	2.7	A	
Total Dissolved. Solids (mg/L)	27	I	
Total Suspended Solids (mg/L)	4	U	
Total Phosphorus (mg/L)	0.01	I	*≤0.06
Nitrate+Nitrite (mg/L)	0.22		
Ammonia (mg/L)	0.012	U	
Total Kejldahl Nitrogen (mg/L)	0.18	U	
Total Nitrogen (mg/L)	0.4		*≤0.67
Organic Carbon (mg/L	3.7	I	

A – Average of two values
I – Result was between the method detection limit (MDL) and the practical quantitation limit (PQL)

U – Compound was analyzed for but not detected
Y – Laboratory analysis from an improperly preserved sample. The data may not be accurate
* F.A.C. Chapter 62-302 Surface Water Quality Standards. Criteria are applicable to the annual geometric means. – DRAFT

Habitat Assessment

The 2010 stream/river habitat assessment score was 91, which is in the suboptimal range. Substrate Diversity, Substrate Availability, and Habitat Smothering were rated poor. The 2011 stream/river habitat assessment score was 85 in the suboptimal range. Substrate Diversity and Habitat Smothering were rated poor. Substrate Availability and Water Velocity were rated marginal. The stream reach land-use was forest with some silviculture, with the landfill in the headwaters. The watershed experiences rapid runoff and is flood prone as a result of impervious surfaces associated with the landfill and to lack of forest/vegetative cover.

Stream Condition Index

The SCI scores for this site were 34 (2010) and 20 (2011) corresponding with a Category 3 "Not Healthy" designation. The 2010 sample's EPT taxa count, mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) consisted of only 1 caddisfly taxon. This is much lower than what is normally found in healthy Panhandle streams. The EPT are the more sensitive orders of the stream community. Six stonefly (order most sensitive to pollution) taxa and 29 EPT taxa were collected during1995 in Rest Area Run above Beaver Pond Creek (representing background conditions). However, since 1996 that area is affected by runoff from the eastern expansion of the landfill. In 2010 the stream community in Beaver Pond Creek was dominated by three taxa (82% of the sample), including *Rheotanytarsus*, a filter-feeding midge (45%), *Cheumatopsyche*, a filter-feeding caddisfly (19%), and *Stenelmis*, a scraper riffle beetle (19%). The 2011 SCI had also only 1 EPT taxon, *Callibaetis*, a mayfly that is more tolerant than other Ephemeropterans. The 2011 sample was dominated by only two taxa (82% of the sample), *Stenelmis (*68%) and the fingernail clam, Sphaeriidae, a filter-feeder (14%). The elevated alkalinity and calcium input from the landfill allowed the clams to survive and exploit the normally low pH streams of the Western Panhandle.

Periphyton

Attached algae were visible in the stream during both sample dates. The periphyton consisted of filamentous strands and small mats of cyanobacteria (blue-green algae). Algal growth was to some extent limited by canopy cover (moderately in spring, heavily in summer, and lightly shaded in winter) and turbid water conditions **(Figure 1)**. Vascular plants present included alligator weed (*Alternanthera philoxeroides* http://plants.usda.gov/java/profile?symbol=ALPH), spadeleaf (*Centella asiatica* *http://www.floridata.com/ref/c/cent_asi.cfm*,) and dollar weed (*Hydrocotyle sp.* *http://www.botany.com/hydrocotyle.html*). The invasive exotic alligator weed is listed as an ecological threat by the Florida Department of Agriculture and Consumer Services Rule**: 5B-64.011 Prohibited Aquatic Plants.**(1) Class I Prohibited Aquatic Plants , which states, "Under no circumstances will these species be permitted for possession, collection, transportation, cultivation, and importation except as provided in Rule 5B-64.004,F.A.C." (https://www.flrules.org/gateway/RuleNo.asp?id=5B-64.011)

Some growth of algae (typically diatoms) is expected in a fully functioning stream, but an over abundance of algae (especially filamentous algae) may reduce habitat quality (from smothering) and lead to excess organic matter production (and decomposition), which can harm fish and invertebrates.

Conclusions

Both the 2010 and 2011 SCI samples scored a "Not Healthy" designation. Although a causative pollutant was not clearly identified, suboptimal habitat, sedimentation, elevated alkalinity/ions and turbidity appeared to be factors most limiting to the invertebrate community. It is recommended that the TMDL program conduct a stressor identification study to identify pollutants of concern in Beaver Pond Creek.

Thank you for your interest in conserving the water quality of Florida's streams and rivers. Please feel free to contact us if you have any questions.

Contact and resources for more information

Donald H. Ray 850 595-0636 donald.ray@dep.state.fl.us
FDEP biological assessment resources:
http://www.dep.state.fl.us/water/bioassess/index.htm