Division of Water Quality
Biological Assessment Unit
November 3, 2003

MEMORANDUM

To: Jimmie Overton
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Through: Trish Finn MacPherson

From: Tracy Morman

Subject: TMDL stressor study of Little Alamance Creek, Alamance County, Cape Fear subbasin 03, June 2003.

BACKGROUND

Little Alamance Creek is a tributary to Big Alamance Creek that drains the municipalities of Burlington and Graham in Alamance County.* Urban runoff and sedimentation are the likely sources of water quality problems. Little Alamance Creek is listed on the 303d list of impaired waters from its source to Big Alamance Creek, covering 12.3 miles.

All previous DWQ sampling has been conducted at SR 2309 near the South Graham Municipal Park. Macroinvertebrates were first sampled in 1985, resulting in a Fair rating. A second basinwide sample taken in 1998 was rated Poor. Similar results were obtained from fish community samples: Good in 1993 and Fair in 1998.

In June 2003, the Biological Assessment Unit conducted a benthic macroinvertebrate survey of the Little Alamance Creek watershed to help determine sources of impairment to Little Alamance Creek.

METHODS

Benthic macroinvertebrates were collected at 3 sites using the Division of Water Quality's standard qualitative (Full Scale) method. The Qual 4 method was used for 2 sites.

The standard qualitative sampling procedure is comprised of ten composite samples, and includes two kicks, three sweeps, one leaf pack, two rock/ log washes, one sand sample, and visual collections. The Qual 4 procedure consists of one kick, one sweep, one leaf pack, and visuals. Qual 4 samples are not rated at this time.

* There is a second Little Alamance Creek at the headwaters of Big Alamance Creek in Guilford County.

The purpose of these collections is to inventory the aquatic fauna and produce an indication of the relative abundance for each taxon. Organisms are classified as Rare (1-2 specimens, denoted by "R" on taxa tables), Common (3-9 specimens, "C"), or Abundant (≥10 specimens, "A").

Several data summaries (metrics) can be produced from benthos samples to detect water quality problems. These metrics are based on the idea that unstressed streams and rivers have many invertebrate taxa and are dominated by intolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

EPT taxa richness (EPT S) criteria have been developed by DWQ to assign water quality ratings (bioclassifications) for Full Scale and EPT samples. Criteria for the Piedmont ecoregion were used for this survey. "EPT" is an abbreviation for Ephemeroptera + Plecoptera + Trichoptera, insect groups that are generally intolerant of many kinds of pollution. Higher EPT taxa richness values usually indicate better water quality. Bioclassifications for Full Scale samples are also based on the relative tolerance of the macroinvertebrate community as summarized by the North Carolina Biotic Index (NCBI). Both tolerance values for individual species and the final biotic index values have a range of 0-10, with higher numbers indicating more tolerant species or more polluted conditions. EPT abundance (EPT N) and total taxa richness calculations also are used to help examine between-site differences in water quality.

Habitat Evaluation

Habitat was evaluated using the Biological Assessment Unit's Habitat Assessment Field Data Sheet-Mountain/Piedmont Streams. This assessment assigns a numerical score from 0-100 for the reach of stream sampled, based on channel modification, instream habitat, bottom substrate, pool variety, riffle habitats, bank stability and vegetation, light penetration, and riparian vegetative zone width. Criteria are being developed to rate habitat scores; the higher the score, the better the habitat.

SITE DESCRIPTIONS

Headwaters of Little Alamance Creek begin around Glen Raven, south of NC 100. Gant Lake is the source of Gant Brook, which drains the eastern half of this general area. Gant Brook was inspected at Woodland Avenue as a possible sampling location. The stream was a channelized ditch about 2 meters wide with no visible flow. There was a telephone pole in the middle of the stream and the whole immediate area was heavily urbanized. Water chemistry measurements showed a conductivity value of 192 μhmos/cm. The western half of the headwaters region is drained by West Prong Little Alamance Creek. Gant Brook joins this stream just south of Woodland Ave.

West Prong Little Alamance Creek at Edgewood Avenue was also considered as a possible sampling location. At this location the stream was channelized, possibly from the construction of Rockwood Avenue, which runs parallel to the channel. The water

was turbid and there was no flow. Water chemistry measurements indicated a conductivity of 170 μhmos/cm.

Table 1. Site summary for Little Alamance Creek TMDL stressor study, June 2003.

Stream	**Coble Brook**	**L Alamance Cr**	**L Alamance Cr**	**L Alamance Cr**	**L Alamance Cr**	**Reedy Fork**
Location	Engleman Ave.	Overbrook Rd.	I- 85	NC 49	SR 2309	SR 2269
Sample Method	Qual 4	Qual 4	Full Scale	Full Scale	Full Scale	EPT
Date	6/24/03	6/24/03	6/24/03	6/23/03	6/23/03	6/19/03
COMMUNITY						
Ephemeroptera	2	3	2	2	3	4
Plecoptera	0	0	0	0	0	4
Trichoptera	2	2	2	2	2	6
Coleoptera	1	1	0	1	2	
Odonata	1	0	2	2	5	
Megaloptera	0	0	0	0	0	
Chironomidae	17	16	16	20	22	
Misc. Diptera	1	2	2	2	1	
Oligochaeta	0	0	1	1	0	
Crustacea	1	2	2	3	3	
Mollusca	2	1	3	0	2	
Other	0	2	2	0	1	
Total Taxa Richness	27	30	33	33	41	14
EPT Abundance	40	34	13	22	50	52
Biotic Index	6.96	7.25	7.60	6.85	6.69	4.43
EPT Biotic Index	7.00	6.84	6.47	6.67	6.70	4.43
Bioclassification	Not Rated	Poor	Poor	Poor	Fair	Good-Fair
PHYSICAL CHARACTERISTICS						
Drainage Area (sq. miles)	0.6	4.4	7.4	9.0	14.4	14
Width (in meters)	3	5	5	5	7	5
Average Depth	0.1	0.2	0.3	0.2	0.5	0.3
Canopy (% coverage)	90	40	90	90	60	85
Bank Erosion						
Substrate (%)						
Boulder	20	20	0	20	30	0
Rubble	10	20	10	10	10	0
Gravel	10	10	20	10	20	0
Sand	60	40	70	60	40	100
Silt	0	10	0	0	0	0
Habitat Score	56	64	57	75	73	43
CHEMISTRY						
Temperature (^{o}C)	20	25	21	20	19	21
Conductivity (μmhos/cm)	90	185	214	208	181	91
Dissolved Oxygen (mg/l)	5.8	6.9	6.1	7.0	6.8	7.4
LOCATION/COMMENTS						
County	Alamance	Alamance	Alamance	Alamance	Alamance	Guilford
Latitude	360510	360500	360354	360310	360204	360928
Longitude	792811	792710	792616	792606	792434	795006

Gant Brook at Woodland Avenue.

W Prong L Alamance Cr. at Edgewood Ave.

Coble Brook at Engleman Avenue

Coble Brook drains a largely residential area of west Burlington. Together with West Prong of Little Alamance Creek, this stream forms Mays Lake. At this site, the stream was only 3 meters wide with a drainage area of 0.9 square miles. A Qual 4 sample was taken here.

Coble Brook at Engleman Ave., upstream.

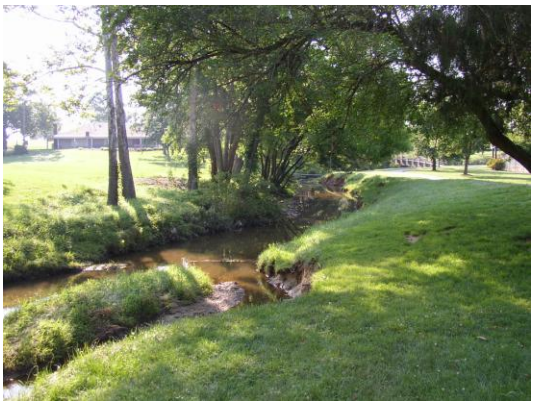
Coble Brook at Engleman Ave., downstream.

The substrate here was mostly sand, however, there was one riffle area that contained a significant amount of boulder and rubble. Downstream the stream bottom was all sand and the streambed appeared channelized. The banks were unstable and the riparian zone was a combination of a few larger trees and mowed lawns on both sides. The habitat score at this site was 56. The conductivity value of 90 μmhos/cm was the lowest recorded in this survey.

Little Alamance Creek at Overbrook Road

Little Alamance Creek begins at the overflow of Mays Lake and flows through an urban area and then through a Burlington city park from NC 62/70 to Overbrook Road. Within the park, the riparian zone consisted of mowed grass down to the edge of the stream with a few isolated large trees. The banks were eroded and the substrate was mostly sand and gravel.

Little Alamance Cr. at Burlington city park.



Little Alamance Cr. at Burlington city park.

Conditions improved slightly as the stream approached Overbrook Road. The riparian zone had more trees and shrubs and banks were more stable. The substrate had a large area of boulder and rubble that appeared to have been placed there. Further downstream, the substrate was again sand and gravel. The rocks were embedded, and other instream habitat was poor. The habitat score was 64. Conductivity was 185 μmhos/cm.

Little Alamance Creek at Overbrook Road, looking upstream.

Little Alamance Creek at Overbrook Road, looking downstream.

Willowbrook Creek at Mebane Street

Willowbrook Creek is a tributary of Little Alamance Creek that drains a heavily urbanized area of western Burlington. The city of Burlington Public Works is just upstream of Mebane Street. Here the stream is a channelized ditch with mowed grass lawn on both banks. At the time of sampling, there was no visible flow, and no benthos sample was taken. Water chemistry measurements indicated a conductivity of 285 μmhos/cm; the highest value recorded in this study. Willowbrook Creek joins Little Alamance Creek just upstream of Chapel Hill Road (NC 54).

Willowbrook Creek at Mebane Street
Upstream view of Burlington Public Works.

Willowbrook Creek at Mebane Street
Downstream view; stream is hidden by the trees on the right side of the photo.

Little Alamance Creek at I- 85

At this location, the stream flows through a heavy industrial area and is about five meters wide. The high, steep banks were badly eroded, and the riparian area was sparsely vegetated with widely spaced large trees and grasses. Infrequent riffles and pools, and a mostly sand substrate contributed to a low habitat score of 57. Margin and rootmat habitats were better than at upstream sites. Conductivity at this site was 214 μhmos/cm.

Little Alamance Creek at I- 85, upstream.

Little Alamance Creek at I- 85, downstream.

Little Alamance Creek at NC 49

Habitat at this site was much better than at upstream locations. The substrate was a mixture of boulder, rubble, gravel, and sand, with far less embeddedeness. Pools and riffles were frequent, and the water was less turbid. Both banks were steep and eroded but with much more vegetation and rootmats. The riparian areas were largely intact with large trees and a diverse understory providing good shading to the stream. Instream habitat was adequate. The habitat score was 75, however, a conductivity value of 208 μmhos/cm indicated water quality problems.

Little Alamance Creek at NC 49, upstream.

Little Alamance Creek at NC 49, downstream.

Bowden Branch at SR 2312

Bowden Branch is a tributary to Little Alamance Creek that drains the eastern portion of the catchment near Graham. This stream was considered as a possible benthos site, but was not sampled due to lack of flow. It was typical of other small streams in the area with high, steep banks that were badly eroded, and a sandy substrate with little instream habitat. Water chemistry measurements indicated a conductivity value of 161 μhmos.

Bowden Branch at SR 2312, upstream view.

Bowden Branch at SR 2312, downstream view.

Little Alamance Creek at SR 2309

This site is the last road crossing downstream on Little Alamance Creek, located at the South Graham Municipal Park. The stream was seven meters wide with a mixed substrate containing less sand than upstream sites. There was a well-defined riffle area with only slightly embedded rocks. Both banks were high and steep with erosion exposing large tree roots. The riparian zone was narrow due to the developed park, but otherwise intact with large trees. Favorable instream habitat produced a score of 73. Water chemistry indicated problems with a conductivity measurement of 181 μmhos/cm.

Little Alamance Creek at SR 2309, upstream.

Little Alamance Cr. at SR 2309, downstream.

Reedy Fork at SR 2269

This stream was used as a reference site. It is similar in size and geology to Little Alamance Creek, and has the same types of habitat degradation. The banks were badly eroded and the channel was filled with sand. Riparian areas were broken, and poor instream habitat. The habitat score was 43, however, conductivity was measured at 90 μmhos/cm.

Reedy Fork at SR 2269, upstream view.

Reedy Creek at SR 2269, downstream view.

RESULTS

Coble Brook at Engleman Avenue

The macroinvertebrate fauna was sparse with only four EPT taxa; all of which are tolerant. Tolerant midges including *Polypedilum sp., Natarsia, Thienemannimyia group, and Ablabesmyia mallochi* were common to abundant. This assemblage of highly tolerant organisms produced a Biotic Index value of 6.96. This is in the Fair range for larger streams.

Little Alamance Creek at Overbrook Road

The macroinvertebrate fauna was similar to Coble Brook. One additional tolerant EPT taxon (*Caenis sp.)* was present here. Tolerant midges, including *Polypedilum sp., Natarsia, Glyptotendipes,* and *Ablabesmyia mallochi*, were the dominant organisms.

Blackflies (*Simulium)* were also abundant. The Biotic Index value (7.25) was slightly higher than the value recorded at Coble Brook, and this site received a rating of Poor.

Little Alamance Creek at I-85

Only four EPT taxa were collected at this site, with three of the four rare in abundance. *Cheumatopsyche* was the only abundant EPT taxon, resulting in the lowest EPT abundance (13) of all sites. *Polypedilum* was the most dominant midge genus with four species present. Other tolerant midges were also common, including *Ablabesmyia mallochi, Thienemannimyia group, Glyptotendipes,* and *Natarsia*. The Biotic Index score of 7.6 was the highest noted in this survey. This site received a rating of Poor. The increase in the Biotic Index and decrease in EPT abundance indicates a decline in water Quality relative to the Overbrook Rd site.

Little Alamance Creek at NC 49

The macroinvertebrate fauna here was very similar to the I- 85 site. Baetid mayflies were more numerous, increasing EPT abundance to 22. *Caenis* was absent, and *Hydropsyche betteni* was still rare. Tolerant midges were again the dominant group, including *Polypedilum scalaenum,* which outnumbered all other species. The Biotic Index improved slightly to 6.85, but this site was also rated Poor.

Little Alamance Creek at SR 2309

This location has been sampled twice previously. A full scale sample in 1985 produced a rating of Fair, and an EPT sample in 1998 turned up only six taxa, and a Poor rating. Five EPT taxa were found here in 2003, including *Stenonema modestum*.This species had not been collected at any sites upstream. *Stenacron interpunctatum* was abundant in the previous two collections here, but was not present in 2003. As with upstream sites, midges were the most common group of organisms. The Biotic Index improved slightly to 6.69, while EPT abundance (50) and total taxa richness (41) values were the highest of all sites. These improvements raised the rating to Fair.

Reedy Fork at SR 2269

An EPT sample here yielded 14 taxa. Most notable among the taxa collected were four species of stoneflies, which are fairly intolerant of pollution. No stoneflies were found in Little Alamance Creek. This demonstrates that even with degraded habitat, Little Alamance Creek should be capable of supporting a more diverse benthic fauna.

CONCLUSIONS

Little Alamance Creek is a typical urban stream. Nearly the whole of this small watershed is urban and residential, with large areas of impervious surface, often coming right up to the edge of the stream. In most cases, there is little to no riparian buffer to slow the flow of runoff into the stream. During rain events, runoff quickly fills the stream channel and causes massive bank erosion and flash flooding. The result is sedimentation problems, as evidenced by the large amounts of sand. This is a combination of sediment loading during high erosion events, and stream gradient. With all of the sand and flash floods, instream habitat is compromised by scour and embedded

substrates. Runoff from streets, parking lots and lawns contains a mixture of potential toxins that eliminate pollution sensitive taxa. The benthic fauna is soon dominated by tolerant organisms; in this case, midges. The most obvious sign of water quality problems in this stream is the consistently high conductivity measured at all locations. These values are more in line with those found downstream of a major discharger. Since there are no permitted dischargers in this watershed, these measurements are the result of nonpoint runoff or other unknown input. The macroinvertebrate fauna are not indicative of any specific pollutants (i.e., nutrients or toxic), just generally poor water quality.

The water quality problem appears to be evenly widespread across the watershed. There is a slight trend that headwaters are a little less impacted, then conditions degrade in the middle of the watershed, with some improvement downstream.

Primary cause of stress: High conductivity measurements across the watershed indicate pollutants from some source, most likely urban runoff.
Secondary cause of stress: Hydrologic changes, due to channelization, riparian removal, and large amounts of impervious surface, degrade instream habitat.

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