

Anacostia Water-Quality Monitoring Program
Semi-annual Progress Report
U.S. Geological Survey

Reporting Period April 1, 2003 – December 31, 2003

Cooperating Agencies Maryland Department of the Environment (MDE)
Prince George County (PGC)
U.S. Geological Survey (USGS)

Project Personnel

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Project Objectives

1. Install housing and equipment for water-quality sample collection at two Anacostia River USGS stream gage sites in Prince George's County (01649500, Northeast Branch Anacostia River at Riverdale, MD; 01651000 Northwest Branch Anacostia near Hyattsville, MD);
2. Install equipment to provide real-time reporting of additional water-quality parameters (pH, dissolved oxygen concentration, temperature, specific conductance, turbidity); develop regression relations to estimate continuous nitrate (NO₃), total nitrogen, total phosphorus, bacteria (*E. coli*), and suspended-sediment concentrations;
3. Collect and analyze monthly base-flow as well as stormflow samples at the two sites for a suite of constituents;
4. Plan, coordinate, and oversee sample collection at both sites, including the quality-assurance data collection effort;
5. Manage all data collected for the project (excluding organics data, which is to be managed and reported by George Mason University) and publish annually in the MD-DE-DC District annual data report.

Deliverables

1. Water-quality data, to be published in WY03 Annual Data Report.
2. Real-time reporting of water-quality data for pH, specific conductance, dissolved oxygen, water temperature, and turbidity.
3. Semi-annual progress reports to MDE and PGC, due June 30 and December 31 of each calendar year.

Summary of project status as of December 31, 2003

Water-quality sample-collection effort

- Samples were collected monthly at both sites. Manual water-quality data collection began in July for nutrients and suspended sediment; BOD, TOC, and TSS were added to the collection schedule in August. The full suite of analytes began in October, and includes bacteria, trace metals, and mercury. Organics sample collection began in December by the George Mason University (GMU).
- Three stormflow samples were collected manually at each site. Note that until the automatic samplers can be installed, storm samples will be collected manually.
- DHMH performing BOD analysis; began in August.
- *E. coli* and *enterococci* analysis by USGS Ohio Laboratory began in October.
- Suspended-sediment loss-on-ignition analysis began in December; purpose is to determine organic content of a sediment sample.

Site installation

- Due to the complexity of the installation effort, it was decided to focus on installing one site at a time, the Northeast Branch at Riverdale (NE Branch), rather than installing both sites concurrently. As of the end of December, this sampling station was nearly complete, with the exception of power, of course. The instrumentation will run via battery until power is installed.
- In order to meet the data-collection objectives of the monitoring program at the Northwest Branch near Hyattsville (NW Branch), it was decided to install temporary conduit and the like that will accommodate the sampler intake lines and the continuous monitoring instrumentation; the temporary conduit will run overland (as opposed to being buried). In the spring when the ground thaws, a more permanent installation of these instruments will be completed. It is anticipated that the temporary installation will be completed by mid February.
- Over the past nine months, there have been numerous installation challenges/delays, and include the following (these were also discussed with our cooperators at the December meeting):
 1. permissions from property owners;
 2. vandalism concerns which necessitated fortified buildings, conduit, etc.
 3. weather; Hurricane Isabel exacerbated delays with electrician and Pepco;
 4. electrician/PEPCO (note: all power/phone lines to be underground).

Real-time data

- Continuous data *collection* began in mid-December at the Northeast Branch; anticipate mid-February for Northwest Branch. These data will be displayed on the web after several months of quality-control checks.
- Real-time display to the web depends upon telephone and electricity installation, as well as adequate QC checks of the instrumentation.
- Eventually want to display on the web: stage, discharge, precipitation, water temperature, pH, specific conductance, and turbidity.
- Dissolved oxygen is problematic: unreliable, high-maintenance.
- During water year 2004 we will not present DO in real-time on the web, nor store in our databases or publish the record of dissolved oxygen at these sites. The DO signal is not particularly important in this well-oxygenated system; furthermore, it is unlikely to be a predictor variable in our regression work (as has been the case in other studies around the country).

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Construction history of the project

1. In the spring 2003, several visits were made to the sites during varying flow conditions to determine placement of the sampler intake lines and real-time water-quality instruments; this had implications for housing placement, estimates for electricity, etc.
2. After several on-site meetings with the USGS Surface-Water and Water-Quality Specialists, senior hydrologists, and technicians, it was decided that the location of the water-quality instrumentation at both sites would be shifted in order to ensure the collection of the most representative water-quality samples and real-time measurements. Both of these changes have resulted in increased costs, mainly for electricity. The Northeast Branch site has been located to the left edge of water about 170 feet downstream of the Riverdale Road bridge, due to concerns regarding inadequate mixing from a small stream upstream of the bridge. The Northwest Branch site has been located to the right edge of water about 135 feet downstream, next to the footbridge. There were two major concerns at this site that lead to this decision. These included the following.
 - a. Culverts at Queens Chapel Road bridge. The amount of flow that comes through these during a major event is unknown.
 - b. The initially proposed location at the left edge of water clearly has the finer sediments depositing out, and hence the sampler and real-time instruments would get buried very easily during a major event, resulting in lots of data loss.
3. After almost three months of on-site meetings and negotiations, permission was received in late June from the property owners on which we will install our housing and instrumentation. The Maryland National Capital Park and Planning Commission (MNCPPC), the property owner, and the USGS signed a Right-of-Entry Agreement and a Joint Use Agreement in order for the USGS to have access to the property during the construction and water-quality monitoring phases of the project. It should be noted, however, that in order to have this permission granted, the USGS agreed to several requirements and/or recommendations of the MNCPPC, which resulted in increased costs, and included the following.
 - a. Install buildings that are aesthetically pleasing and consistent with other such buildings on Park property;
 - b. All power/telephone lines need to be underground;
 - c. Agree to remove the water-quality stations and restore the properties to their original condition.
4. Two steel-reinforced concrete structures were purchased that will house the water-quality instrumentation. These structures were purchased because the property owners recommended them, they are resistant to vandalism, they are similar to those already on Park property, and are aesthetically pleasing. Additionally, after speaking with the MNCPPC police and visiting a vandalized building currently on park property, it was determined that the buildings that we had originally planned to purchase would not withstand the potential vandalism that would probably be

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Construction history of the project (continued)

- incurred. Note, however, that these structures cost about \$10,000 more each than was originally budgeted.
5. Several meetings with potential contractors were held on site, including meetings for the site preparation, electricity (including electrical contractors and Pepco), telephone, and building manufacturers.
 6. All major equipment items were purchased with FY 2003 funds, including the real-time instrumentation for both sites, bacteria equipment, sampling equipment, and Isco automatic-sampler retrofitting materials and sample bottles.
 7. The State Highway Administration's stream restoration activities at the Northwest Branch site (downstream of Queens Chapel Road bridge) began in August and were completed in the fall. The wet summer has led to delays in the restoration schedule (originally scheduled to be completed in August).
 8. Construction of the two water-quality monitoring sites commenced on 13 August with the groundbreaking for the site-preparation phase. Specific site-preparation requirements for the concrete structures were recommended by the manufacturer and necessitated creating a pad on which the structures will sit. An area 12 x 14 x 1 foot was excavated, onto which one foot of crushed stone was placed and compacted. The site preparation was completed on 18 August.
 9. The concrete structures were delivered to each site on 30 September; assembly completed the first week of October.
 10. The electrical contractor began work in November, but the job is not complete due to communication problems with Pepco.
 11. At the Northeast Branch site during the fall, USGS technicians were moving rip rap, pouring concrete, and placing steel conduit from the concrete structure down the embankment to the stream. This conduit will enclose the water-quality sampler intake lines, cables for the continuous monitor, and bubbler lines for the pressure transducer. A steel platform was fabricated on which the conduit is anchored. Additionally, steps were installed down the embankment, the precipitation gage was installed, and the interior of the structure was nearly completed.
 12. Finally, in mid-December, we successfully deployed the continuous monitor at the NE Branch, which began logging data for water temperature, pH, specific conductance, dissolved oxygen, and turbidity. Note that the data will not be displayed to the public for some time, pending telephone and power installation, and adequate internal quality-control checks of the data. Dissolved oxygen will not be displayed to the public during water year 2004.

Water quality sample-collection effort

1. Sample collection for the project began in July. Monthly water-quality samples were collected at the NE Branch and NW Branch of the Anacostia River through December.
 - A total of 14 samples were collected at the NE Branch, and 14 at the NW Branch; this number reflects monthly, storm, and quality-control samples collected.
 - Monthly samples were collected during base-flow conditions at each site in August, September, November, and December. The July and October monthly

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Water quality sample-collection effort (continued)

samples were collected during stormflow conditions; in July, both were collected on the falling limb of the hydrograph, and the October sample at the NW Branch was collected during peak flow conditions, while at the NW Branch the sample was collected on the falling limb of the hydrograph. Additionally, manual stormflow samples were collected at each site in mid December, both at peak flow.

- The July samples were analyzed for nutrients and suspended sediment. In August and September, total organic carbon (TOC), total suspended solids (TSS), and biochemical oxygen demand (BOD) were added to the sampling schedule, and beginning in October, trace metals, mercury, and *E. coli* and *enterococci* were added.
 - The organics sample-collection effort began in December by George Mason University personnel, per contract agreement. This sample was collected during base-flow conditions.
 - Measurements of water temperature, pH, specific conductance, dissolved oxygen, and turbidity are made along the river cross section each time a sample is collected. This documents the variability within the river cross section and ensures proper number and location of sample-collection sections in the stream
 - Quality-control samples collected include field blanks for nutrients and suspended sediment; equipment blanks, including a predeployment Isco automatic sampler blank; replicates for nutrients, suspended sediment, TOC, TSS, and BOD; and cross-section variability determinations for suspended sediment (sand/fine fractions) and physical parameters, which include water temperature, specific conductance, pH, dissolved oxygen, and turbidity.
2. Logging of continuous physical parameters (water temperatures, specific conductance, pH, and turbidity) at the Northeast Branch began on December 17, 2003. The stream stage was too high to install automatic sampler intake lines, however.
 3. Biochemical oxygen demand (BOD) analyses will be completed by the Maryland Department of Health and Mental Hygiene (DHMH) Laboratory in Baltimore, for the following reasons: (1) Oxitop technology (listed in proposal) is not an approved methodology; (2) equipment expense; (3) to minimize technician time.
 4. The USGS Sediment Laboratory in Kentucky will analyze loss-on-ignition (LOI) samples for the project. LOI analysis began in December. This gives estimate of organics in the sediment and is particularly important for modeling.

In-house bacteria: The equipment for bacteria has been purchased. We're awaiting some modifications to the Baltimore lab before the analyses can be performed in house. In the interim, samples for *E. coli* and *enterococci* are being sent to the USGS bacteriology lab in Ohio for the October sample. These samples will be coded as noncompliance since they exceed the six-hour hold time. Note, however, that new research just published in Applied and Environmental Microbiology shows that there is no significant difference in *E. coli* concentrations through 48 hours. Reference: Pope, M. and others, 2003, Assessment of the effects of holding time and temperatures on *Escherichia coli* densities in surface water samples, Applied and Environmental Microbiology, v. 69, no. 10, p. 6201-6207.

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Water quality sample-collection effort (continued)

5. For safety purposes, there will be no sampling at nighttime; therefore, we will miss some/lots of storms. This impacts the number of bacteria samples, in particular, since automatic samplers cannot be used to collect bacteria.
6. The Isco automatic samplers have been retrofitted with Teflon where possible; one retrofitted sampler, complete with Teflon intake tubing and glass sample bottles, was given to Greg Foster at George Mason University so he can become familiar with it and eventually deploy to the field.
7. The project chief and water-quality specialist met to determine the quality-control samples to be collected for the project. A draft quality-assurance and quality-control plan was completed; revisions are necessary due to budget constraints.
8. Several modifications to the trace-metal analyses were made, with MDE's and PGC's concurrence:
 - a. The total-recoverable fraction, not the total fraction, will be analyzed. The USGS National Water Quality Laboratory (NWQL), not the Severn-Trent Laboratory, will be completing the analyses for total-recoverable and dissolved trace metals.
 - b. The following trace metals will be analyzed: arsenic, cadmium, chromium, copper, lead, nickel, zinc, aluminum, cobalt, iron, and manganese.
 - c. The following trace metals will not be analyzed: antimony, barium, beryllium, selenium, silver, thallium, tin, and vanadium.
 - d. Mercury was to be analyzed by the Frontier-Geosciences Laboratory (F-G), for the total and dissolved fractions. However, due to the prohibitive cost, this needs to be revisited. One option we're currently pursuing is for the NWQL to perform the mercury analysis; however, NWQL's reporting limits (0.02 µg/L) are much higher than F-G (0.00015 µg/L), which will probably result in lots of censored data particularly during base-flow conditions.

ICPRB (1996 study) Total Mercury Data, µg/L:

[NE Branch: 0.0055 - 0.012 base flow; 0.0067 – 0.082 stormflow]

[NW Branch = 0.0020 – 0.010 base flow; 0.0023 – 0.048 stormflow]

Miscellaneous

1. The requisition for GMU's funds for organics sample collection and analysis is currently being processed in Reston.
2. A meeting was held in December between the USGS and the project cooperators (MDE, PGC), and GMU. The USGS notified the cooperators of the project status, revised timeline, and project cost overruns.
3. Personal safety concerns, particularly at the Northwest Branch, necessitated a site visit to both sites by the USGS District Safety Officer and, on separate occasion, an officer with the Federal Protective Service. Several murders have taken place in and around the area since the program's inception in April.
4. A project web page was established.
5. Established contacts to inform the public about the project.

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Miscellaneous (continued)

6. The Mayor of Riverdale was concerned about the building. Dr. Cheng's office intervened at our request and contacted town officials on our behalf.

Plans for January through June 2004

1. Complete the site installation phase, which includes installing the real-time water-quality instrumentation at the NW Branch, and the two automatic samplers at both sites (USGS' for all constituents except organics and bacteria, and GMU's for organics), and precipitation gages at both sites. Once the automatic samplers are installed, storm samples can be collected more frequently.
2. In January when, hopefully, the stream level falls a bit, the autosampler intake lines and pressure transducer will be installed in the stream at the NE Branch. The autosampler will be run by battery until power is installed.
3. Temporary conduit at the NW Branch will be installed by early Feb. Once this is in, the Isco automatic sampler and continuous water-quality monitor will be installed, which will enable the collection of storm samples, precipitation data, and continuous water-quality parms at this site.
4. Electricity and telephone service will, hopefully, be installed during this period.
5. Continue to collect manual monthly water-quality samples for all constituents. Organics samples will be collected by George Mason University concurrently with USGS when possible.
6. Manual storm sampling, when possible, will be done until the Isco automatic samplers are installed. Once installed, the samplers will run via battery power until electricity is in.
7. In-house bacteria analysis by USGS, pending installation of autoclave.
8. Display continuous water-quality parameters on the real-time web page at both sites as soon as internal quality-control checks are performed. Also required for this is electricity and telephone service.
9. Follow up with action items from December 12 meeting, which includes the mercury and bacteria issues.
10. Revise the project web page, to include water-quality data and graphs.
<http://md.water.usgs.gov/watershed/9B209/index.html>