



Neighborhood Water Watch

A Guide for Developing a Volunteer Bacteria Monitoring Program



Keeping Watch Over Our Waters

Acknowledgements

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Keeping Watch Over Our Waters

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1. Introduction

Established in 1994, Chattahoochee Riverkeeper (CRK) is a non-profit, environmental advocacy organization located in Georgia with 7,000 members dedicated solely to protecting the Chattahoochee River, its tributaries and watershed. We are a member of the Waterkeeper Alliance, an international coalition of 200+ Waterkeepers. Our mission is to advocate and secure the protection and stewardship of the Chattahoochee River, its tributaries and watershed, in order to restore and conserve their ecological health for the people and wildlife that depend on the river system.

Water quality in the Chattahoochee River has improved significantly in the last 20 years due to improvements in the City of Atlanta's sewer system. Still, many streams flowing through Atlanta's neighborhoods are polluted with high levels of *E. coli* and other pollutants due to cracked and overflowing sewers, failing septic systems and polluted stormwater runoff. Like many waterways across the nation, a majority of these streams rarely receive routine water quality monitoring from local, state and federal government agencies. Therefore, many of the pollution sources in the watershed often flow unchecked for long periods of time – resulting in environmental degradation and public health threats.



The Chattahoochee River

In an effort to fill this void of water quality data and address the many pollution sources plaguing these waterways, CRK initiated a large-scale volunteer *E. coli* monitoring program called Neighborhood Water Watch (NWW). Since the program's inception, we have been extremely successful in achieving all of our goals, which has resulted in real, measurable water quality improvements in our community's waterways.

CRK's NWW program started in 2010 with one stream and one concerned community organization. Four years later, the program has grown to monitor 66 stations in both Atlanta, Georgia and Gainesville, Georgia and includes over 30 partner groups. Because of this program, we have found and reported numerous sewer leaks and stopped thousands of gallons of raw sewage from reaching local streams and the Chattahoochee River.

The purpose of this document is to layout the framework for other organizations to start similar volunteer based water quality monitoring programs. Though our program is specifically geared towards monitoring freshwater and uses *E. coli* as an indicator of bacterial contamination, other methods and indicators may be used to detect any pollutant of concern in your watershed. While every watershed is different and can face a multitude of varying threats, basic principles

and lessons learned from the NWW program can be utilized to engage communities and improve waterways in any watershed across the nation.

2. Program summary

Starting in 2010, Chattahoochee Riverkeeper (CRK) began getting calls from residents in the Tanyard Creek watershed that the stream, a tributary of the Chattahoochee River, occasionally had an odd smell and color. Residents wanted to test the water, but didn't know how to get started or where to turn.

In response, CRK trained members of the local neighborhood association on how to collect water quality samples. The volunteers brought the samples to CRK's office where we analyzed the samples, confirming high levels of *E. coli* bacteria, which is an indicator of fecal bacteria from sewage. CRK followed up by sampling all pipes flowing into the stream and discovered that one was pouring raw sewage directly into the creek. CRK worked with the City of Atlanta to fix the pipe, and local residents started seeing an immediate improvement in water quality in Tanyard Creek.



NWW tests lead CRK pollution trackers to discover a major fish kill in Tanyard Creek.

Following this event, we began the Neighborhood Water Watch (NWW) program as a way to engage and educate the community while working to eliminate bacteria pollution, which is a concern to public health.

The Neighborhood Water Watch Program has 5 goals:

1. Increase public awareness of water quality issues and local waterway conditions.
2. Provide citizen groups with tools and training to protect their local waterways.
3. Collect quality baseline data.
4. Form new partnerships between citizen groups, non-profit organizations and government agencies.
5. Address and resolve poor water quality detected during monitoring.

Here's how it works: we designate one day (Thursday) each week for NWW sampling day. Every Thursday, our volunteers go out to their respective sampling stations and collect their water sample. They drive the sample to our closest lab location where we do the analysis.

We use the EPA approved IDEXX® Colilert® system to detect bacteria because of the ease of use and the reliability of results. Sending a bacteria sample to a private lab is expensive! We reduced the cost greatly by utilizing our own equipment, materials, staff and volunteers. Funds are provided by program participants (through a small, annual fee for service), grants and other sources.

What is *E. coli*?

Escherichia coli (*E. coli*) is a bacteria that is commonly found in the gastrointestinal tract and feces of warm-blooded animals and humans. According to the U.S. EPA, *E. coli* is the best indicator of the presence of pathogens in surface waters and its presence provides direct evidence of fecal contamination of the water.

All of our water quality data is made publically available. We upload our data to an in-house database at (www.chattahoochee.org/nww), the state-run Georgia Adopt-A-Stream database and the federal EPA STORET database. In the event that sewer leaks or spills are detected and warrant further investigation, we notify local municipalities and affected community members. We conduct follow-up monitoring to confirm that the problems are fixed.

We now collect more than 1,600 samples a year and work with approximately 50 volunteers. CRK works with a diverse group of community members from neighborhood associations, civic groups and schools who collect samples from over 60 sites in the metro-Atlanta area.

Because of this program, CRK has been able to enforce the environmental laws that state governments and municipalities haven't had the resources to pursue. With help from the City of Atlanta and other local governments we have been able to track down pollution sources — largely a product of miss-connected, leaking or overflowing sewer lines — and stop those sources from reaching our waterways.

That's just a brief overview of our NWW program — read on for how to start a similar program in your watershed!



A sample collected from the Chattahoochee River near Whitesburg using a PVC bridge sampler.

3. How to form partnerships

Perhaps the most integral component of a successful volunteer monitoring program is bringing community members, non-profit organizations and government agencies together to work towards a common goal: *improved water quality for public and ecosystem health*. In our case, it has certainly helped that we are well positioned to utilize partnerships gained over the years with community members, government agencies and other non-profits.

Working with citizen groups and other non-profit organizations

CRK has a long proven track record of river advocacy and working effectively in the community. We also have volunteer supported events and other CRK sponsored activities which have allowed our organization to create a large list of constituents, donors and a social media following. If you have the capacity to create networks within your organization, you will be able to draw



CRK Technical Programs Director, Jason Ulseth, meets with former Atlanta mayor and civil rights leader, Andrew Young.



City of Atlanta crews respond to a fish kill in Tanyard Creek.

from this base to inform people about your program, encourage participation and increase the legitimacy of your program as you expand and prove the value of NWW. Legitimacy of and confidence in your program will grow as citizen groups, government agencies and other organizations see proven successes in finding and eliminating sources of pollution in urban streams and tributaries.

Many of our volunteers have contacted our office to learn more about the NWW program after reading about it at events or on our web site www.chattahoochee.org where a link brings visitors to an interactive map which displays test locations, *E. coli* data and data for other parameters presented in graphical and spreadsheet form. If your organization has a web page, it may be helpful to post information about your program there. You may also consider creating poster boards and doing oral presentations which explain the program to interested neighborhood groups, non-profits and schools. Also, sending e-mails to local neighborhood associations and

community leaders to tell them about the program and to ask for help may be a great way to get the community involved. By expanding partnerships, working in the community, attending meetings, utilizing community bulletin boards and networking at community events and conferences, you will increase your ability to be effective in making connections and communicating your goals to citizens.

Working with government agencies

Your volunteer monitoring program may benefit greatly from working with government agencies to address problems revealed by your monitoring. In urban areas, problems with bacteria contamination in streams are often caused by leaking sewer lines or illegal sewer connections. By showing that your data can be used effectively to target and stop pollution sources, you may see that many of the problems brought to local municipalities can be addressed, resulting in cleaner water running through your community. CRK has also developed good working relationships with the Georgia Environmental Protection Division (EPD) and the US Environmental Protection Agency (EPA). In our case, we work with the EPA under the Urban Waters Small Grants Program and we partner with the state volunteer water quality monitoring program, Georgia Adopt-A-Stream. We encourage you to cultivate relationships with government agencies.



Dekalb County Watershed Department shows CRK staff and community members where residential sewer lines connect to main trunk lines and how they are tracked and cleaned.

4. How to select sample sites and conduct pollution tracking

Factors to consider when selecting sites

A waterway may be of interest due to its size or due to concerns of a citizen about the condition of their local stream. Most of the sites targeted by our program are 305(b)/303(d) listed waterways that are impaired due to fecal coliform contamination. As you select and adopt new sites, several factors may go into consideration including:

Will the site be accessible by pedestrians?

We suggest you select sites on pedestrian friendly bridges over waterways of interest and be mindful of trespassing.

Is the site going to yield a representative sample of the waterway?

The sample water collected should be characteristic of the waterway of interest.

What is upstream? Consider if there are tributaries, commercial industries of interest, dog parks, parking lots, recent development or other factors that will influence your sample. Also consider the distance from other NWW testing sites.

Will the volunteer be able to commit to consistent monitoring?

We suggest a minimum commitment of one sample, every two weeks for one year to fully assess the water quality in the stream of interest.

What if I can't find a volunteer for a site of interest?

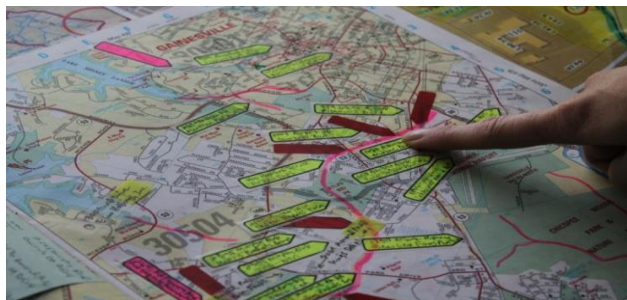
Some sites of interest may be easier to obtain volunteers for than others. At times, there may be sites that need to be monitored but are difficult to find volunteers that can get to the site and then get the sample to your lab. We sometimes use a stipend (up to \$20 per sample) to encourage participation in areas that we are interested in due to high pollution levels.



CRK staff utilizes a fluorometer to confirm a sewer leak.

Using technology for site selection

Using Google Maps or similar apps on a smartphone or computer makes site selection and pollution tracking more user friendly than ever before. Smartphone technology combines maps, satellite imagery, GPS location, communication, and photo and video applications. Use these technologies in the field to assess site accessibility, site relevance to the waterway of interest, and the influence of contributing upstream tributaries and features. Printed street maps and USGS topography maps are also very useful in providing detailed layout of street names, residential and commercial delineations, geographic features and distances, and clearly labeled streams, lakes, reservoirs and rivers.



CRK staff selects site after assessing potential pollutant sources.



Map showing distribution of NWW sample sites in Atlanta.

Pollution tracking

Pollution tracking to identify what may be influencing elevated bacteria or other pollutant levels upstream of a test site may require a combination of technology, printed street maps, observation, and vigilant testing. Walking the creek to visually check for potential sources while



NWW intern uses probe to measure dissolved oxygen at a potential sewer spill in Piedmont Park.

utilizing GPS positioning and satellite image technology, testing potential sources with pollution tracking equipment, and using visual inspections to assess potential sources can lead your tracking team to the source of contamination. Once sources have been found, municipalities and government agencies can be alerted to the identified source for repair of the problem. Follow-up testing through your program is recommended. It can reveal whether the repairs made were adequate enough to stop the pollutants from entering the waterway of interest.

5. How to train volunteers



A new generation of volunteers learns proper sampling techniques at Heards Creek.

CRK staff trains each new volunteer and provides them with specific instructions on proper sampling techniques, sanitary handling practices, and chain of custody. We typically work with the volunteer to select a water testing site and coordinate a 15 minute training session at the site. We provide the volunteer with a map of their test location in relation to the larger watershed, an information sheet about the program, directions to the lab, written sample collection instructions, custody forms, links to the databases, and the NWW sample collection kit (PVC bridge sampler, Whirl-Pak[®] bags, latex gloves, hand sanitizer, a sharpie, cooler and icepack). Sample collection techniques are available in the EPA approved procedures and methods section (found in Appendix B).



Volunteer sampling kit and sampling instructions.

Neighborhood Water Watch Bridge Sampling Procedures



1. Write on sample bag label
Current Time:
Current Date:
Site Location:
Your Name:
2. Put sample bag into bridge sampler and wrap tabs around metal screws.
3. Tear off bag “top” along dotted line.
4. Open bag over top of bridge sampler with white tabs but don’t touch the inside of the bag. Make sure the bag is open fully so that water can get in easily.
5. Take water sample.
Do this by dropping sampler into the water midway across the stream at mid-depth. You may have to bob the sampler up and down to fill the sample bag to bottom of white label on sample bag.
6. Pull the filled sample bag from the bottom of the sampler. The top of the sample bag will fit through the sampler by pushing (squishing) wire in the top of the bag together and then pulling it through.
7. Close sample bag by whirling or folding (4 or 5 times) it closed.
8. Put on ice in a cooler and deliver to Chattahoochee Riverkeeper office by 3 PM Thursdays within 6 hours of collection.

Thanks!



Keeping Watch Over Our Waters

www.chattahoochee.org

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6. How to set up a lab

Find a space

If you are planning on starting a Neighborhood Water Watch program in your watershed, you will need to carve out some space to serve as your lab. It can be as large as a room or as small as a table in the corner of an office. Either way, you will need a dedicated space only used for sample processing to prevent sample contamination (and to prevent your stuff from getting contaminated by samples).

What kind of space will you need?

- Small space for volunteers to sit and fill out their chain of custody forms and post announcements.
- Sturdy table for a refrigerator and sample incubator.
- A 3 to 6 foot table for sample processing with comfortable chairs. You will need enough room on the table for the IDEXX® sealer.
- Storage cabinet or shelves for supplies.
- An electrical outlet.
- It is convenient to have a sink nearby.



The lab at CRK's main Atlanta office is located in a wide hallway next to a bathroom and is not ideal, but functional.



The lab in CRK's Headwaters office is just a table in an office.

Gather your supplies

There are a variety of supplies you need for your lab. Below is a list to get you started. For details about pricing of equipment and IDEXX® consumables, see Appendix A.

Lab equipment (one-time purchase)

IDEXX® Quanti-Tray® Sealer and Quanti-Tray® Rubber Insert
Incubator
Refrigerator
IDEXX® UV Viewing Cabinet with UV lamp
Pipettor (fixed or variable volume)

General lab supplies (consumables)

Pipette tips
Latex gloves
Hand Sanitizer
Distilled Water
Paper Towels
Disinfectant surface cleaner
IDEXX® Vessels – 100 mL with Sodium Thiosulfate
IDEXX® Quanti-Trays®
IDEXX® Colilert-18® or IDEXX® Colilert-24® snap packs

How to maintain quality control

Volunteers collect our samples and interns help to process them in the lab. With all of those people involved, how do we maintain quality control? We think that the best way to ensure sample quality is to **(1) have detailed methods and procedures and (2) provide training.** Everyone who participates in CRK's Neighborhood Water Watch program receives a copy of our methods and procedures and is trained individually by a CRK staff person.

What do our methods and procedures look like? As a part of an Urban Waters Small Grant that we received to fund this program, we wrote something called a Quality Assurance Project Plan (QAPP) that has been approved by the EPA. While you don't need an EPA approved document to start your Neighborhood Water Watch program, a complete copy of our plan can be found in Appendix B. It includes detailed methods on sample collection, sample chain-of-custody, sample processing and record keeping. Use it as you develop the methods and procedures for your program.



*Interns are trained by CRK staff in methods and procedures.
A copy of procedures (our QAPP) is posted in the lab.*

7. How to test water samples

Testing for *E. coli*

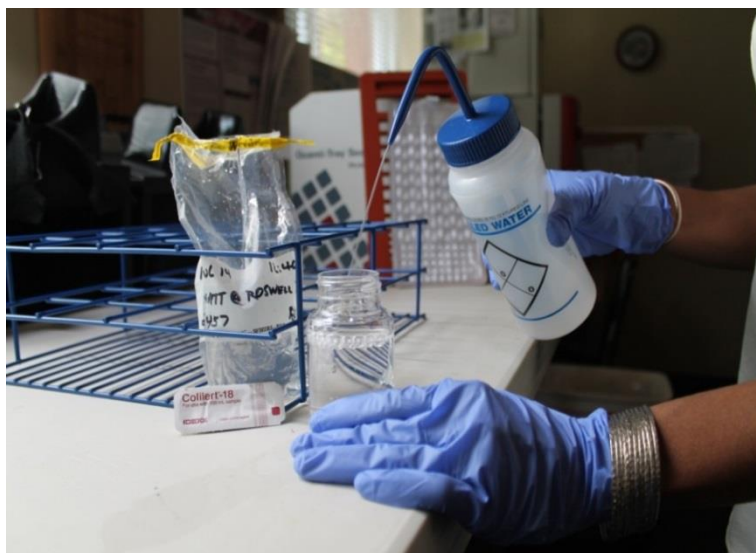
E. coli is the best indicator of the presence of fecal-related pathogens in surface waters. There are several ways of measuring numbers of *E. coli* bacteria in streams. CRK uses a relatively new method recently approved by the EPA called the IDEXX Colilert-18[®] system. It involves the collection of water from a stream or river using a sterile container, diluting it with distilled water and adding a chemical called MUG. This mixture is then poured into a container that separates the sample water into equal-sized compartments. The container is sealed and incubated for 18-22 hours. The sample water in the compartments containing coliform bacteria and *E. coli* will change color. The number of compartments which turn yellow indicates the most probable number, or MPN of total coliform bacteria in the stream, while the number compartments which fluoresce under ultraviolet light indicates the number of *E. coli* present.

What is an indicator organism and why do we measure indicators instead of pathogens?

A microbial indicator organism is a single celled organism that is usually harmless, found in high numbers, and originates from the same sources as the pathogens whose numbers you are interested in obtaining. Monitoring for indicator organisms is usually much easier and more cost effective than actually monitoring for the disease causing organisms. Pathogens are disease-causing organisms such as some types of bacteria, viruses, and protozoans and typically occur in very small concentrations. Field sampling and laboratory methods for measuring pathogens are very time consuming, expensive and sometimes put the analyst at more risk for being infected by the pathogen.

Diluting samples

It is important to dilute samples in order to target the correct range of bacteria. Urban streams usually have much higher concentrations of bacteria than rural streams and bacteria in stream water are typically higher during rain events than during dry weather. Fortunately, the IDEXX[®] method can detect a wide range of bacteria concentrations (from <1 MPN/100 mL to 483,000 MPN/100 mL). Diluting your sample water with sterile, distilled water can help you target the correct range. You can find different dilution volumes to target bacteria concentrations (MPN/100 mL) in the table below.



CRK staff dilutes bacteria sample with distilled water to target the correct bacteria range.

Since CRK is interested in high concentrations of bacteria in very urban streams, we dilute samples with distilled water to a concentration of 1% - 2%, targeting a bacteria range from <50 to 241,000 MPN/100 mL.

Sample Water (mL)	Distilled Water Added (mL)	MPN Range (MPN/100 mL)
0.5	99.5	200-483,920
1	99	100-241,960
2	98	50-120,980
5	95	20-48,392
10	90	10-24,196
20	80	5-12,098
50	50	2-48,392
100	0	1-2,419.6

How are the *E. coli* results interpreted to determine if they are acceptable?

EPA recommends an *E. coli* recreational safety level for primary contact of a geometric average of 126 MPN/100mL or less. Because it is common to find high bacteria counts in urban areas, Georgia Adopt-A-Stream advises that counts that exceed a 1000 MPN/100 mL threshold may warrant special attention. NWW results that show a “high” bacterial count may be a one-time event or occurrence or may be a part of a chronic problem. This information is useful, but before taking further action additional sampling is necessary to document bacterial levels over a long period to determine fluctuations caused by seasonal changes and rain events. This long term information is vital in assessing the overall health of the stream and determining if further investigation is needed.

What makes bacteria levels go up and down?

Levels of bacteria in a river or stream can be influenced by many factors. The most common cause of elevated levels of bacteria is due to runoff associated with storms, however, leaking sewage lines or spills from treatment plants can also cause levels to increase. *E. coli* concentrations are typically higher (1) during and after rain events, (2) in tributary streams than in the Chattahoochee River, (3) during the summer season than during the winter months, and (4) at night rather than during daylight hours.

What do *E. coli* levels tell us about safety?

The most recent recommendations developed by the US EPA for recreational primary contact state that surface waters should not exceed an *E. coli* level of 126 MPN/100mL on an average. Primary contact recreation includes swimming, bathing, diving, surfing, water skiing, tubing, water play by children, and similar water contact activities where a high degree of bodily contact with the water, immersion and ingestion are likely. Studies conducted by the EPA indicate that for surface waters with an average *E. coli* level of 126 MPN/100mL, the estimated rate of illness is 36/1000 for people having primary contact.

Bacteria are a natural component of all rivers, lakes and streams and most bacteria are harmless. However, certain species of bacteria in groups such as *Campylobacter*, *Salmonella*, and *Shigella* can cause sickness in humans. The most common side effects of these sicknesses may include a short period of vomiting and/or acute diarrhea, but can also cause much more serious complications in rarer circumstances. Those most at risk for the serious side effects associated with these waterborne diseases are the very young, old and immune-compromised.

Testing other parameters

Testing additional parameters may be useful in data interpretation and pollution source tracking. The following is a list of additional parameters that CRK runs on each sample in conjunction with *E. coli*:

- Specific Conductivity: This measures the water's ability to conduct an electrical current and can indicate foreign substances in a sample. This parameter is an excellent way to establish long-term baseline values and deviations from the baseline will indicate changes in the watershed. Handheld probes can be ordered from companies like Cole-Parmer and Ben Meadows for less than \$70.



CRK headwaters staff tests Flat Creek with hand-held conductivity probe.

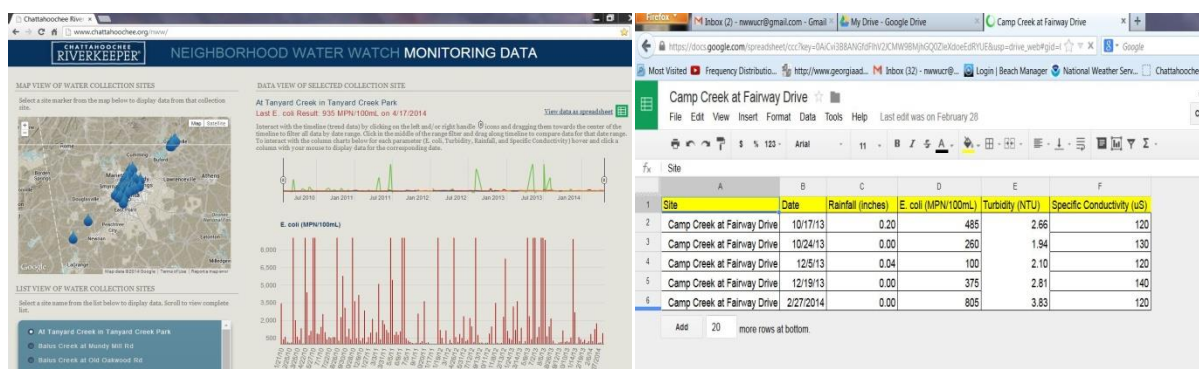
- Turbidity: This measures water clarity (suspended sediments) and is an excellent tool for evaluating *E. coli* data as it can be used for a reference in determining if stormwater is a pollutant source. In some cases, turbidity can even be used as a real-time surrogate parameter for *E. coli*. We recommend using the Hach 2100Q Portable Turbidimeter: \$1,039.00
- Optical Brighteners: Measuring optical brighteners with a fluorometer can be used in an urban setting to help differentiate between human and animal sources of *E. coli*. This is because optical brighteners are typically found in sewage from clothes washer detergents. So, a high level of *E. coli* found with a high level of optical brighteners can show that the source is human sewage rather than geese or a nearby dog park. This technology is still relatively new, however, and we have found that its use is somewhat limited as the unit scale of measurement is not very sensitive. But in an urban environment, testing for optical brighteners can be very effective for tracking and detecting sources of sewage into waterways. CRK recommends using the AquaFluor fluorometer by Turner Designs: \$3,000.00

8. How to make data publically available

One of the goals of the NWW program is to increase public awareness of water quality issues and local waterway conditions, so making data publically available is important. It can be as simple as posting a spreadsheet with site names, dates and bacteria levels posted on your website or as complex as an interactive map linking to data, graphs and spreadsheets. Below are descriptions of how we make our data available to the public.

CRK's NWW database

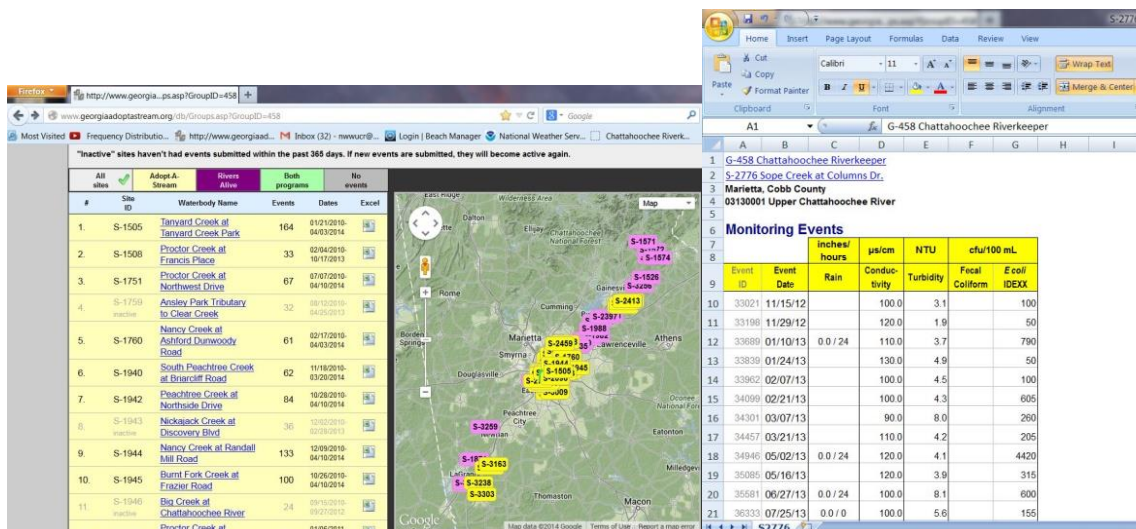
CRK uses Google Spreadsheet and Google Maps within Google Drive to display our data. This in-house database is hosted on our website at www.chattahoochee.org/nww. Sampling sites are displayed on an interactive map where visitors can view the various NWW sampling sites and click on a specific site to view all results for that site in a spreadsheet or graph. CRK's database was developed by a graduate student at the Georgia Institute of Technology as part of a thesis project. Consider potential collaborations with university students for large projects, such as the development of an in-house database for your data.



Examples of CRK's in-house database with map and graphs (left) and spreadsheet (right), created in Google Drive and hosted on our website at www.chattahoochee.org/nww.

Georgia Adopt-A-Stream database

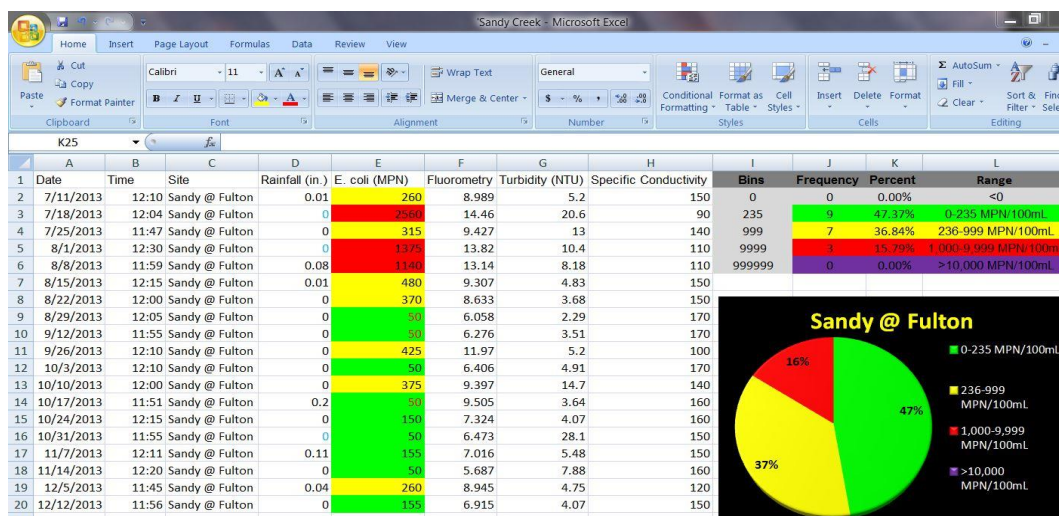
The Georgia Department of Natural Resources administers a volunteer citizen stream monitoring program called Georgia Adopt-A-Stream (AAS) www.georgiaadoptastream.org. The Georgia AAS program hosts a database used by groups all over the state. CRK's NWW program uses certified Georgia AAS methods for stream monitoring and "adopts" all of our NWW stations through the state program. CRK posts all of our data to the AAS database as another platform for public viewing. Before we developed our own database (described above) this was the primary way we distributed our data to the public. Many states other than Georgia have similar programs and provide a database.



The AAS database is similar the CRK NWW database with mapped locations, graphs and spreadsheets available.

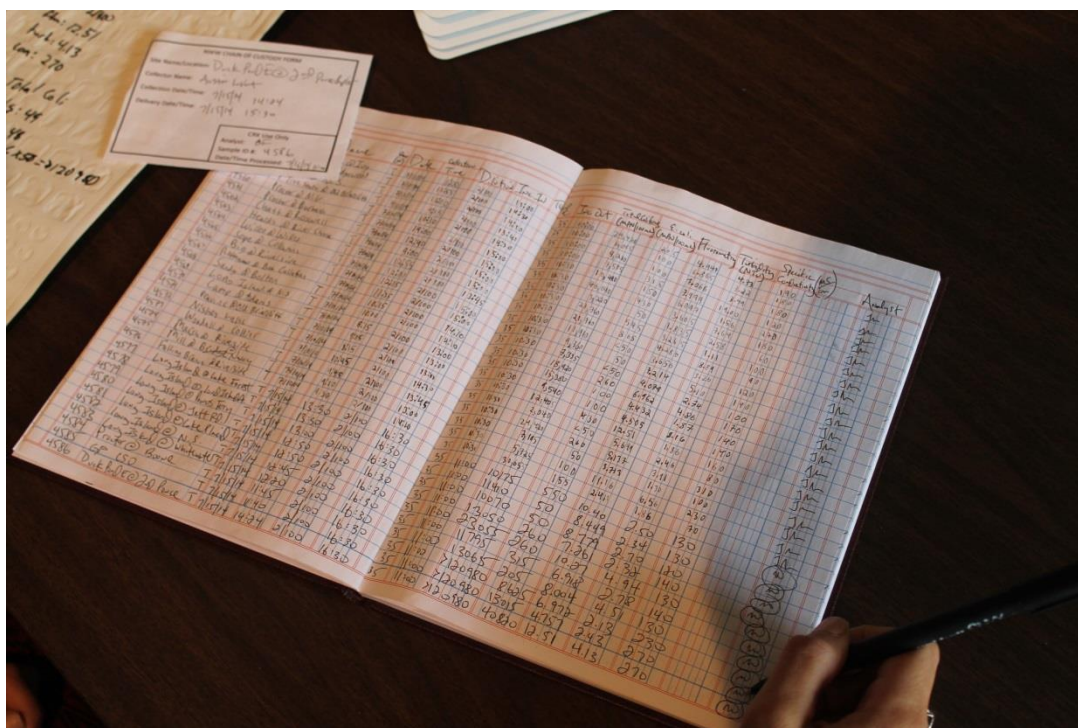
How to manage your data

Electronic Storage - CRK staff use Microsoft Excel to look at trends, create graphs, and simply catalog data. Graphs and other visual representations of the data are necessary to show trends of exceedances of standards, safety hazards or public health threats. Using Excel, one parameter such as *E. coli* can be compared to other parameters such as rainfall to assess whether any correlations can be drawn. Examining the data over time is useful in determining long-term trends and identifying “hot-spots.”



An example of a Neighborhood Water Watch Excel spreadsheet.

Logbooks - CRK staff keeps carefully maintained logbooks with each data entry initialed by the entrant. In addition, photo copies are made and stored in a binder so that a “hard copy” of the data is safely maintained at all times.



CRK maintains hard copies of all NWW data.

9. How to share results

Utilizing social media platforms such as Facebook, Twitter, and Instagram can help you to relay progress and success stories to your online community. This method of storytelling can be very captivating, generating interest and support for your brand as a whole and acting as a means to convey narratives as they unfold. Social media platforms have the advantage of real time updating, which is useful where public health threats are concerned. Volunteers may contact you after reading about your volunteer monitoring program on your program webpage. For a reference, CRK's NWW program summary can be



Surabhi Shah, EPA National Urban Waters Program manager leads opening remarks at our 2nd annual NWW forum in December 2013.

viewed from our website at <http://www.chattahoochee.org/neighborhood-water-watch.php>. You may find that it also helps to E-mail local neighborhood associations and community leaders to tell them about your program, to provide pertinent information, and to ask for support.

Off-line newsletters, mailings, hand-outs, poster boards, oral presentations and other visual aids help you explain your program overall and help to elucidate program specifics, such as data trends and health standard exceedances, to community groups and other interested parties. It also may also help to regularly attend community meetings and events to reaffirm important connections and to share information with your constituents.

As part of a grant commitment and to increase public awareness of water quality issues and local waterway conditions we hold a yearly, open to the public NWW forum where in-depth analysis and straightforward explanations of the data are provided. We have found that the forum is a great way to share and discuss data with community members and other program participants. Holding a forum can allow your organization an opportunity to bring community members and volunteers together with representatives from federal, state, local government agencies who are working to solve water quality issues so that analysis, discourse and volunteer comradely can be fostered.

10. Program Costs and Funding

To get started with an IDEXX® Colilert® system, you will need:

- IDEXX® Sealer: \$3,750.00
- Certified Incubator: \$1,895.00
- UV Viewing Cabinet and Lamp: \$300.00
- QA/QC Comparator Tray: \$22.00
- Refrigerator (if samples will not be processed immediately): Varies
- Supply of IDEXX® Quanti-Trays®, sample vessels, and Colilert-18® or Colilert-24® packets
 - One of each of the above is needed for each sample. Supply for 200 samples: \$1,530.00
 - You will need to decide between using the Colilert-18® or Colilert-24® packets. The only difference between the two is that the results using Colilert-24® can be read between 24-28 hours following incubation, while results using Colilert-18® can be read 18-22 hours following incubation. CRK uses Colilert-18® packets as results are available faster which allows for a faster response time when problems are revealed.



IDEXX® Supplies and a Turner Designs fluorometer, which measures optical brighteners.

- The price referenced above is for a pack of 200. The packets typically have a shelf life of 12 months, so if you do not anticipate running 200 samples in a one year period, you should order a smaller quantity although the unit price will be higher.
- A sample invoice from IDEXX® can be found in Appendix B which lists all of the equipment listed above and supplies for 200 samples, including tax and shipping the total is \$8,303.87.
- A list of additional supplies can be found in Chapter 7 and generally adds a cost of less than \$1.00 per sample.

Program Costs

The overall cost of a volunteer water quality monitoring program will vary significantly depending on the size of the target area, the number and frequency of sampling to be performed, and the parameters to be analyzed. The following is a description of general costs that you can expect to incur with an *E. coli* monitoring program as well as some potential costs of additional parameters that can be added if necessary.

Funding

The NWW program has been one of the most exciting programs in CRK's 20-year history and has caught the attention of many funders. NWW funds have come from a range of private foundation and government grants, corporate and individual donations, and partner organizations. This type of program is appealing to funders because it engages many partners including community members and can result in a significant impact for a relatively small investment. When preparing grant applications, it is important to stress these facts and to include letters of commitment when appropriate

In addition to grants and donations, some funding comes from our partner groups to cover the cost of lab supplies. For example, a civic association whom is concerned about the quality of a tributary that flows through their neighborhood may choose to join NWW and agree to pay \$8.00 per sample and provide a collection volunteer. This is easily justified when you consider that an *E. coli* test conducted at a private lab can cost \$40-\$50 per sample.

A note about interns

Unpaid student interns have been an integral part of the success of the NWW program. CRK has limited the cost of the NWW program by utilizing interns for lab work, data entry, supplemental sample collection, and other various program needs. By utilizing interns, the cost of sample processing is diminished greatly.



NWW intern Taylor Spear uses a LaMotte test kit to confirm low dissolved oxygen after a major fish kill in Tanyard Creek.

Sources of interns include but are not limited to, community members, local schools and universities, and CRK volunteers interested in “doing more.”

11. Conclusion

We’ve now covered some of the basics that may be helpful in constructing your own Neighborhood Water Watch program. With the mechanisms outlined in this guide in place, the task of tracking bacteria pollution in freshwater is simplified. By organizing a community-oriented, volunteer-driven water monitoring program, your organization will be giving people the means to participate in stream monitoring and be active in restoration. Your volunteer water monitoring program can have a measurable impact on water quality, clean-up local waterways and make a real difference in your community!

We hope this guide is helpful in developing a NWW program in your watershed. If you have any questions or need additional guidance, please feel free to contact Mike Meyer (mmeyer@chattahoochee.org), Watershed Protection Specialist, or Jason Ulseth (julseth@chattahoochee.org), Technical Programs Director.



Appendix A: IDEXX® invoice



QUOTE

Number / Date
20115343 / February/25/2014

Ship to Address
CHATTAHOOCHEE RIVERKEEPER
SUITE 3
916 JOSEPH LOWERY BLVD
ATLANTA GA 30318
UNITED STATES
UNITED STATES

Sold to Address
CHATTAHOOCHEE RIVERKEEPER
SUITE 3
916 JOSEPH LOWERY BLVD
ATLANTA GA 30318
UNITED STATES
UNITED STATES

Bill-to Customer 207596

Net weight : 108.093

<i>Material ID</i>	<i>Description</i>	<i>Quantity</i>	<i>UnitPrice</i>	<i>Total Value</i>
<i>Commodity/COO</i>	<i>Batch</i>	<i>Exp.Date</i>	<i>Backorder item</i>	
99-10893-01	SEALER, WQTS2X-115V, 2X Q	1	3,750.00	3,750.00
8422309187/US				
98-21322-00	WCM10 UV VIEWING CABINET	1	195.00	195.00
8539900000/US				
98-20724-01	WL160,6 WATT FLUOR LAMP	1	105.00	105.00
8539490040/US				
98-13818-02	WI600, LARGE INCUBATOR, 1	1	1,895.00	1,895.00
8419899585/DE				
98-08877-00	WP200I-18 GAMMA IRAD COLI	1	930.73	930.73
3822005090/US				
98-09221-00	WV120SBST-200,VESSELS W/S	1	119.00	119.00
2832301000/US				
98-21675-00	WQT2K QUANTI-TRAY 2000 DI	1	150.00	150.00
3926909910/US				
98-09227-00	WQT2KC, PRE-DISP.QT 2000	1	22.00	22.00
3822005090/US				
98-29000-00	UN3373-WQC COLIFORM / E.	1	158.00	158.00
3822005090/US				
Items total				7,324.73
Freight Value				384.05
Tax total				615.09
Total amount				USD 8,303.87
				=====

All local taxes at customer charge

Appendix B. EPA Approved QAPP



Keeping Watch Over Our Waters

www.chattahoochee.org

**Neighborhood Water Watch (NWW)
Quality Assurance Project Plan**

An EPA Urban Waters Small Grant Program Funded Project

**Atlanta, Georgia
September 2012**

Sally Bethea
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Atlanta, GA 30318.
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julseth@ucriverkeeper.org

Approval Sheet

Approving Officials:

Sally Bethea, Executive Director

Date

Jason Ulseth, Technical Programs Director

Date

Mike Meyer, Watershed Protection Specialist

Date

Danny France, EPA Quality Assurance Officer

Date

This quality assurance project plan (QAPP) has been prepared according to: EPA Requirements for Quality Assurance Project Plans (EPA QA/R5 EPA/240/B-01/003, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, March 2001.

This document will be used to ensure that environmental and related data collected, compiled, and/or generated for this project are of the type, quantity, and quality required for their intended purposes within the limitations of available resources.

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1. QAPP Distribution List

Table 1: QAPP Distribution List

Recipient	Organization	Telephone Number	Email Address
Sally Bethea	Chattahoochee Riverkeeper	404-352-9828	916 Joseph Lowery Blvd, Suite 3 Atlanta, GA 30318 sbethea@ucriverkeeper.org
Jason Ulseth	Chattahoochee Riverkeeper	404-352-9828	916 Joseph Lowery Blvd, Suite 3 Atlanta, GA 30318 julseth@ucriverkeeper.org
Mike Meyer	Chattahoochee Riverkeeper	404-352-9828	916 Joseph Lowery Blvd, Suite 3 Atlanta, GA 30318 mmeyer@ucriverkeeper.org
Chattahoochee Riverkeeper Interns	Chattahoochee Riverkeeper	404-352-9828	916 Joseph Lowery Blvd, Suite 3 Atlanta, GA 30318
Mary Jo Bragan	US EPA	404-562-9275	U.S. EPA - Region 4, 61 Forsyth Street, Atlanta, GA 30303 bragan.maryjo@epa.gov
Karen Gardner	Grant Project Officer	404-562-9275	U.S. EPA - Region 4, 61 Forsyth Street, Atlanta, GA 30303 Gardner.karen@epa.gov
Bonita Johnson	Designated Approval Official	404-562-9275	U.S. EPA - Region 4, 61 Forsyth Street, Atlanta, GA 30303 Johnson.bonita@epa.gov

2. Project Organization

Project Leader: Jason Ulseth
Technical Programs Director
Chattahoochee Riverkeeper

Responsibilities: The Project Leader will be responsible for planning and implementing the project to meet the data quality objectives. The Project Leader is responsible for:

- Quality Assurance Project Plan (QAPP) preparation
- Ensuring the QAPP is implemented as written
- All data collection and analysis activities
- Collation of study data
- Report preparation, and
- File preparation and completion

Table 2: Project Study Team*

Team Members	Organization	Responsibilities	Contact
Jason Ulseth	CRK	Project Leader	404-352-9828
Sally Bethea	CRK	Project Oversight	404-352-9828
Mike Meyer	CRK	Sample collection and analysis, lab operations, reporting of data, training collection volunteers and interns	404-352-9828
CRK Interns	CRK	Sample collection, assisting in sample analysis and lab operations	404-352-9828
Community Volunteers	Varies	Sample collection and delivery to CRK lab	Varies
Darryl Haddock	West Atlanta Watershed Alliance	Sample collection and identification of additional community volunteers	404-216-5759
Jo Ann Macrina	Atlanta Department of Watershed Management	Investigation of pollutant sources identified by study	404-330-6081
Mary Jo Bragan	EPA	EPA support/oversight	404-562-9275

*The roster of Project Study Team members may be changed according to other work commitments and personal schedules.

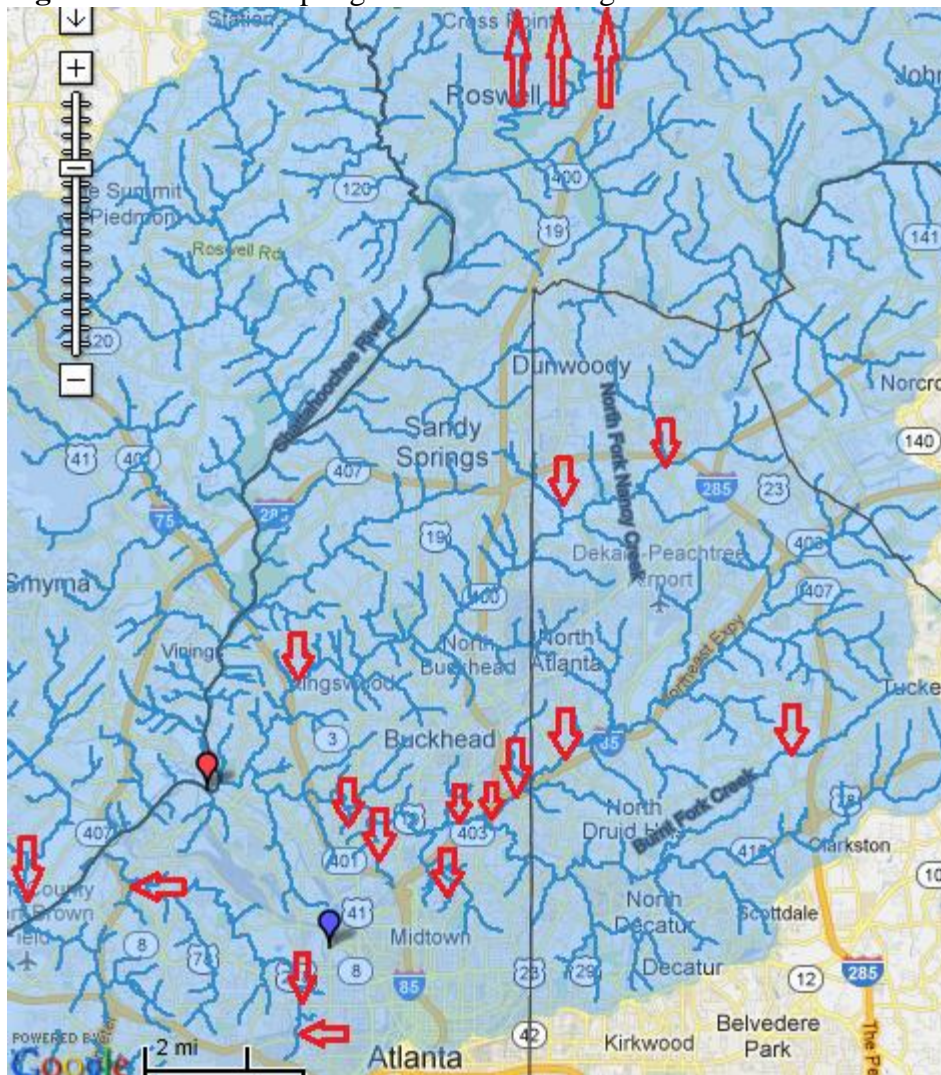
3. Project Management

3.1 Background

The Neighborhood Water Watch (NWW) Program is an existing collaborative partnership between CRK, civic associations, watershed groups, schools and government agencies to improve water quality in urban streams and protect public health. Begun in 2010, the NWW Program focuses on Atlanta's urban core, empowering citizens to help improve water quality in their neighborhoods. Water samples are collected weekly or biweekly by trained volunteers and are analyzed for *E. coli* by CRK. In June 2012, CRK was awarded an Urban Waters Small Grant (\$25,000 each year for two years). The funds from the EPA Urban Waters Small Grant Program

will support the existing 18 NWW sites and will allow for the expansion of the program to at least 26 sites. The long-term baseline data will be used to identify water quality problems and inform investigations working with city of Atlanta officials or other appropriate agencies to stop sewage pollution at its source.

Figure 1. Current Sampling Locations for Neighborhood Water Watch



3.2 Problem Definition

Many streams flowing through Atlanta's neighborhoods and into the Chattahoochee River are polluted with high levels of bacteria due to cracked and overflowing sewers, failing septic systems and polluted stormwater runoff. Landscapes are surrounded by industrial zones, dense business and residential areas with constant reshaping and development, and ever-expanding urban sprawl. According to the 2010 Census data, the population of the city of Atlanta was

420,003 with a density of 3,154 persons per square mile. Cracked, failing, or clogged sewer lines, failing septic systems, illegal sewer connections, and stormwater runoff leave these communities and their waterways vulnerable to contamination of fecal coliform bacteria. The threat posed by contaminated waters running through these areas is very real as most of Atlanta community waterways are on Georgia's 2010 Integrated 305(b)/303(d) Impaired Streams List. With state and local agencies underfunded and unable to adequately monitor local waterways, CRK has stepped up to meet this challenge.

CRK will work with citizen groups, individuals, and government agencies to monitor Atlanta's local waterways. NWW participants retrieve and test samples from local waterways for *E. coli* to indicate the presence of sewage pollution. CRK and the Neighborhood Water Watch (NWW) utilize the collected data to make water quality and public safety assessments, conduct pollution source tracking, and work with partners to stop pollution sources.

3.3 Project Description (Monitoring Plan)

This project focuses on tributaries to the Chattahoochee River basin within the heavily-urbanized city of Atlanta. Most of the sites targeted by NWW are 305(b)/303(d) listed waterways, impaired due to fecal coliform contamination and include but are not limited to Peachtree, Nancy, Tanyard, Clear, Burnt Fork, Proctor, Sandy, Utoy, Big, and Nickajack Creeks. NWW currently has numerous sites that are monitored on a weekly or biweekly basis and has been successful in involving communities in water quality protection, connecting citizens with the non-profit community and government agencies, collecting valuable baseline data, identifying polluted areas and finding and stopping sources of fecal contamination. Data from sampling locations will indicate the amount of *E. coli* and other pathogens flowing from and through these areas over long periods of time (two year project). According to the EPA, *E. coli* is the best indicator for the presence of fecal contamination by warm-blooded animals/humans of surface water and the presence of pathogens. Pathogens are disease-causing organisms such as some types of bacteria, viruses, and protozoans. Consumption of, or recreational contact with, water contaminated with feces of warm-blooded animals can cause a variety of illnesses. Levels of *E. coli* indicate threats to public health and water quality. Under the EPA Urban Waters Small Grant, monitoring will continue at the existing 18 sites and will identify and monitor at least 8 additional sites, focusing on waterways within underserved communities.

In NWW, local volunteers from civic organizations, schools, and watershed groups collect routine stream samples from nearby urban streams and deliver them to CRK's office. CRK then analyzes the samples for the presence of *E. coli* using EPA-approved equipment and procedures. All samples are analyzed using IDEXX Colilert-18 in accordance with standard operating procedures. Collection volunteers are trained on proper sample collection and transportation techniques by CRK's technical programs director Jason Ulseth, a certified Georgia Adopt-A-Stream Trainer.

CRK will maintain direct communication with the city of Atlanta Department of Watershed Management, EPA, and community partners to identify areas of concern. 'Source tracking teams' comprised of CRK and city staff will take additional outfall samples in the watershed as

appropriate to isolate and remedy potential pollutant sources. The long-term baseline data generated by the project will be used to measure the success of restoration efforts.

Table 3: Existing Neighborhood Water Watch Locations

Station Identification	Stream Name	Monitoring Location	GPS Coordinates (degrees, minutes, seconds)
NWW01	Tanyard Creek	Upstream from Collier Road Bridge	Lat: 33° 48' 29" N Long: 84° 24' 07" W
NWW02	Proctor Creek	At Donald Lee Hallowell Bridge near Gary Avenue	Lat: 33° 46' 48" N Long: 84° 25' 47" W
NWW03	Proctor Creek	At Northwest Drive near Bolton Road	Lat: 33° 47' 57" N Long: 84° 52' 08" W
NWW04	Proctor Creek	At Joseph E. Boone	Lat: 33° 45' 48" N Long: 84° 25' 41" W
NWW05	Nancy Creek	At Ashford-Dunwoody Road Bridge	Lat: 33° 54' 12" N Long: 84° 19' 52" W
NWW06	Nancy Creek	At Randall Mill Road	Lat: 33° 51' 34" N Long: 84° 25' 28" W
NWW07	South Peachtree Creek	At Briarcliff Road	Lat: 33° 48' 01" N Long: 84° 20' 12" W
NWW08	Nickajack Creek	At Discovery Boulevard	Lat: 33° 47' 24" N Long: 84° 31' 18" W
NWW09	Burnt Fork Creek	Near Frasier Road	Lat: 33° 49' 53" N Long: 84° 16' 01" W
NWW10	Big Creek	At Riverside Drive	Lat: 33° 00' 23" N Long: 84° 20' 59" W
NWW11	PHENA East	Upstream, East of pond	Lat: 33° 49' 37" N Long: 84° 23' 00" W
NWW12	PHENA West	Upstream, West of pond	Lat: 33° 49' 35" N Long: 84° 23' 05" W
NWW13	Clear Creek	Piedmont Ave Bridge	Lat: 33° 47' 47" N Long: 84° 22' 12" W
NWW14	North Fork Nancy Creek	At Murphey Candler Park	Lat: 33° 54' 55" N Long: 84° 19' 35" W
NWW15	Stream in Beaverbrook Park	Unnamed Tributary to Peachtree Creek at Beaverbrook Park	Lat: 33° 49' 01" N Long: 84° 25' 14" W
NWW16	Chattahoochee River	At Roswell Road	Lat: 33° 00' 15" N Long: 84° 21' 02" W
NWW17	Willeo Creek	At Azalea Drive	Lat: 34° 00' 24" N Long: 84° 22' 26" W
NWW18	North Peachtree Creek	At Lindberg	Lat: 33° 82' 07" N Long: 84° 35' 85" W

Sampling Schedule

All routine sampling will be conducted on Thursdays, excluding holidays. Community volunteers will collect and deliver the sample from their respective station every Thursday or every other Thursday (depending on the volunteer's availability). CRK will accept delivered samples between the hours of 8:00 AM – 3:00 PM.

Project Schedule

- Spring 2012:
 - Announcement of EPA Urban Waters Small Grant
 - Continue NWW Program at 18 existing sites
 - Coordinate with West Atlanta Watershed Alliance and others to begin identifying 8 new project partners, with a minimum of 6 partners being within minority and low-income communities
 - Begin preparation of Quality Assurance Project Plan, coordinating with EPA QA/QC staff
 - Begin web design project with in-kind partner Lauren Langley
- Summer 2012:
 - Receive EPA Urban Waters Small Grant Funds
 - Finalize Quality Assurance Project Plan and submit to EPA for approval
 - Train community volunteers from new partner groups regarding sample collection and delivery. Begin monitoring programs in these new communities once EPA approves the Quality Assurance Project Plan
 - Finish web design project and host new data reporting function on CRK's website.
- Summer 2012 – Summer 2014:
 - Continuously analyze weekly samples delivered by community volunteers from 26 stations. Upload data to CRK's website, the AAS database, and EPA's STORET Data Warehouse in a timely fashion.
 - Continuously review data generated by the project to identify areas of concern and possible places where restoration efforts can be effectively targeted. In partnership with the city of Atlanta Department of Watershed Management or other appropriate agency, form 'source tracking teams' to isolate and remedy possible sources of contamination.
- Fall 2012:
 - Host first public seminar in partnership with the city of Atlanta Department of Watershed Management for NWW participants and interested citizens.
- Winter 2013:
 - Present project summary and results to date at the Georgia Adopt-A-Stream Annual Conference, UGA Water Resources Conference, and the Georgia River Network Annual Conference.
- Fall 2013:
 - Host second public workshop in partnership with the city of Atlanta Department of Watershed Management for NWW participants and interested citizens.
- Summer 2014:
 - Project end, final report prepared and presented to EPA.

- Finalize program manual and workshop to assist other watershed protection organizations in establishing similar NWW Programs.

3.4 Quality Objectives and Criteria for Measurement Data

The main objective of this project is to “Maintain and expand a baseline monitoring program for routine water quality monitoring and support to identify areas of concern and possible places where restoration efforts can be effectively targeted.” This project objective is consistent with Section 104(b)(3) of the Clean Water Act and supports Goal 2, Objective 2.2, and Sub-objective 2.2.1 of the FY 2006-2011 EPA Strategic Plan, as well as Goal 2 and Objective 2.2 of the FY 2011-2015 EPA Strategic Plan. Data quality objectives (DQOs) for this study are provided in Appendix A.

3.5 Special Training Requirements

Sample collection volunteers will be provided with training and procedures for collecting water samples. All training will be provided by the project leader to ensure that efforts are in accordance with quality control measures and procedures listed herein.

CRK staff and interns will be provided with training and procedures for processing samples with IDEXX equipment. All training will be provided by the Project Leader to ensure that efforts are in accordance with quality control measures and procedures listed herein.

Georgia Adopt-A-Stream Certification for Chemical and Bacterial Monitoring is required for staff involved in data submission and sample processing. The project leader, also a certified AAS trainer, will verify AAS Certification. Documentation stating completion of this training can be obtained by contacting:

Georgia Dept. of Natural Resources
Environmental Protection Division
Watershed Protection Branch
404-675-6240 or aas@gaepd.org
4220 International Parkway
Suite 101
Atlanta, Georgia 30354

3.6 Documents and Records

Documents will be updated and distributed as needed. The current approved and revised approved edition of the QAPP will be distributed to those listed on the QAPP distribution list by the Project Leader by mail, electronic submission, or in person.

Documents produced and included in the data reports package are as follows:

- Logbooks
- Field notebooks
- Results from Quanti-Cult tests

- Xerox copies of Quanti-Trays
- Copies of data spreadsheets
- Mileage and travel records
- Supply receipts
- Staff time logs
- Chain of custody forms
- Data/Progress Reports
- Correspondences
- Presentation/Seminar

All records, documents, spreadsheets, staff time logs, chain of custody forms, reports, notes, and receipts will be stored in CRK's electronic server and/or in hard copy form at the CRK office. This information will be retained by CRK for a minimum of 3 years following project completion.

4 Data Generation and Acquisition

4.1 Study Design

Procedures and methods for this study are most consistent with a probability-based design. Areas of expected concern, areas where volunteers are available, and areas with historical problems are prioritized during the site selection process. "Hot-spots" with unacceptable *E. coli* levels will be noted and continuous monitoring of these spots will occur along with additional upstream "source tracking" samples. Due to the varied availability and scale of the volunteer base, simultaneous testing throughout the Chattahoochee Watershed will not be feasible. Participant testing and sample delivery will be carried out regularly on a weekly or bi-weekly basis between 8 AM and 3:00 PM on Thursdays regardless of weather conditions. The effect of seasonal variation on these urban waterways will become apparent and will be noted. No sample composites will be made during the course of this project.

Related Details and Outputs:

- Number of samples: Year 1 – 500, Year 2 – 600
- Number of sampling locations: 26
- Number of samples at each location: 1 sample per location weekly or biweekly
- Number of composites: 0
- Support for the sample: Varies from location to location
- Number of QC samples (field replicates, etc.): 1 replicate/month (24 replicates)
1 blank/month (24 blanks)

4.2 Sampling Methods

Stream samples are collected mid-stream, mid-depth in 18oz. Nasco Whirl-Paks by volunteers wearing one size fits all, unpowered latex disposable gloves. A minimum sample volume of 150ml is required (filled to the bottom of white labeling area on Whirl-Pak). Samples are collected in Whirl-Pak bags from pedestrian

friendly bridges with a line attached to a PVC bridge sampler (see Appendix B) or by accessing the stream from the streambank. All volunteers are trained to maintain a sterile technique by refraining from touching the inside of the Whirl-Pak bag at any time including while opening, sampling, and closing sample bags. Sample bags are properly labeled with the collector, site location, and collection date and time. Samples are stored in a dark cooler on ice immediately upon sample retrieval. All samples are delivered to CRK Atlanta lab and placed in a refrigerator with temperature between 1-4°C for processing within 6 hours. A chain of custody form with a sample ID number will be filled out by staff and volunteers at the time of transfer. All sample collection volunteers will receive training by the Project Leader on proper techniques for sample collection and transportation and delivery. Any dropped or contaminated samples will be promptly recollected and redelivered. Any surface in contact with the sample is disposable and disposed of immediately after use, including: sample bags, pipette tips, Quanti-trays, Quanti-bottles, and used Colilert-18 packets. Any lost and/or damaged supplies will be replaced by inventory located at CRK's Gainesville office. This includes sampling equipment and supplies, as well as large testing equipment such as the Quanti-Tray sealer, incubator, and refrigerator.

Product/Utensil Descriptions:

- 18oz. Nasco Whirl-Pak
- IDEXX Quanti-Tray Sealer Model 2X
- Incubator - Binder APT.line BD (E2)
- Spectroline E-Series Ultraviolet lamp in CM-26 UV viewing cabinet
- One size fits all, unpowered latex disposable gloves
- IDEXX EZ-QZ Coliform Kit---Colilert-18 Quick dissolving pellet
- Fixed volume 1mL Micropipette
- Black & Decker 1.7 Cu. Ft. 130W Refrigerator Model BNA17
- Bridge Sampler for Use with 18 oz Whirl-Pak Sample Bags – See Appendix B for directions to construct the bridge sampler

Sample plans may have to be altered in extreme or unusual circumstances. If alterations of the sample method are considered, the data users will be notified and guidance will be requested. Any problems encountered while sampling will be recorded in logbooks. In the event of problems, corrective actions taken (where possible) will be documented by the project leader, along with the results of such actions.

4.3 Sample Handling and Custody

The samples collected in accordance with section 4.2, will be placed directly in a dark cooler on ice. The samples are then transported directly to CRK's Atlanta lab where they are placed in a 1.7 Cu.ft. 130W Black & Decker refrigerator set between 1-4 ° Celsius. A chain of custody form is then signed for each sample and left in the care of CRK staff. The maximum holding time for the samples is 6 hours.

CRK staff will maintain the field notebooks and is responsible for sample receipt, custody, processing, and ultimate disposal in the laboratory. Sample collection volunteers are responsible for sample custody in the field and during transport and will fill out a chain of custody form for each sample which will be kept on file by CRK staff. Each sample will be assigned a unique sample ID number which will also be on the chain of custody form. This sample tracking system

will identify where and when samples were obtained. A copy of the chain of custody form shown in Figure 2 will be completed by the collection volunteer and CRK staff for each sample.

Figure 2. NWW Chain of Custody Form

NWW CHAIN OF CUSTODY FORM	
Site Name/Location:	
Collector Name:	
Collection Date/Time:	
Delivery Date/Time:	
CRK Use Only	
Analyst:	
Sample ID#:	
Date/Time Processed:	

4.4 Laboratory Processing

Procedure for Running a Sample in CRK Laboratory Utilizing IDEXX Colilert-18:
(*gloves and goggles must be worn at all times for safety and sterility*)

1. Turn on sealer machine and incubator.
(Incubator is programmed to automatically set at 35 degrees Celsius)
2. In the notebook record the samples name, date, collection time, incubation time, and dilution, and analyst name.
3. Put on gloves and lather with sanitizer, allow to dry.
4. Remove sample from fridge and place in bucket to hold the bag upright. (Samples can remain in the fridge for up to six hours from collection time)
5. Obtain a sterilized IDEXX 100ml disposable sealed bottle from the cabinet. Remove seal and open. (Be sure when placing the cap on the counter that the inside is facing upward)
6. Use the pipette to place the chosen amount of the sample into the bottle. Pipette tips are located in the cabinet. (The pipette is set to 1ml, so a 5/100 dilution would be 5 pipes of the sample.) For this project, a dilution of between 1-5% will generally be used. See Table 4 for a list of dilutions and the corresponding detection ranges. Dispose of used pipette tip.

7. Fill the remainder of the bottle with distilled water from the labeled bottle to the top of the 100ml line
8. Pour one Colilert-18 packet into the bottle, replace the cap, and shake vigorously until the powder is completely dissolved.
9. Pour the solution into the Quanti-Tray 2000 sealer tray and knock out the air bubbles.
10. Place the Quanti-Tray 2000 sealer sheet into its holder and carefully feed into the sealer. (White side facing up with the opening of the sheet facing away from the sealer)
11. On the back on the sealed Quanti-Tray 2000 record the sample number, site name, date, dilution, collection time, and incubation start time.
12. Place sample into incubator and record incubation start time in notebook.
13. Turn off sealer when finished. Dispose of used bottle, sample and gloves.
14. Wipe down the lab bench with sanitizer and wash hands.

Procedure for Reading Results:

1. Between 18-22 hours after incubation time, remove sample from incubator and record incubation end time in notebook.
2. To count total coliform bacteria, count up the number of large wells (including the large rectangle well on the top) and the number of small wells that appear yellow under the natural light of the room. These are positive wells. (If unsure of coloration distinction, use the comparator sample located by the lab bench for comparison.) Using a permanent marker, place a vertical line on the positive wells. Use the IDEXX Quanti-Tray*/2000 MPN Table on the wall to find the MPN number by following the correlation line between the number of large and small wells you counted. Then multiply that number by the appropriate dilution factor as determined by the dilution/multiplication table below.
3. Record this number in the notebook.
4. To count *E. coli* bacteria, place the sample tray into the black-light box. Turn on the black-light and count up the number of large wells (including the large rectangle well on top) and the number of small wells that are illuminated under the black-light. These are positive wells. (If unsure of illumination distinction, place the comparator sample located by the lab bench under the black-light for comparison.) Place a horizontal line on the positive wells. Use the IDEXX Quanti-Tray*/2000 MPN Table on the wall to find the MPN number by following the correlation line between the number of large and small wells you counted. Then multiply that number by the appropriate dilution factor as determined by the dilution/multiplication table below.

5. Record this number in the notebook. (Be sure to record all mathematical work in the appropriate notebook as well for future reference.)
6. Make a photocopy of the front and back of each sample and file in the appropriate folder.

Before data is available for public use, the data is reviewed for discrepancies or anomalous information, and the mean MPN/100 mL are checked and re-calculated if needed. The person reviewing the data places a check mark beside all entries checked, then dates and initials the bottom of each page. Any changes to the data because of a miscalculation or typos are struck out with a single line through the incorrect value, the correct value is written as close as possible to the stricken incorrect value along with the initials of the person making the correction. All data must be logged into main lab book in blue or black ink.

Table 4: Dilution/Multiplication Table

Sample Water (ml/100)	Distilled Water Added (ml)	Multiplication Factor	MPN Range
0.5	99.5	200	200-483,920
1	99	100	100-241,960
2	98	50	50-120,980
5	95	20	20-48,392
10	90	10	10-24,196
20	80	5	5-12,098
50	50	2	2-48,392
100	0	1	1-2,419.6

Table 5: IDEXX Quanti-Tray Cell Color Result Interpretation

Appearance	Result
Less yellow than the comparator	Negative for total coliform and <i>E. coli</i>
Yellow equal to or greater than the comparator	Positive for total coliform
Yellow and fluorescence equal to or greater than the comparator	Positive for <i>E. coli</i>

4.5 Analytical Methods

The methods used by personnel in the CRK Atlanta lab to analyze water samples for bacteria density are those approved for compliance monitoring of indicator bacteria in drinking water

sources and in ambient surface and ground water. Local and State agencies may compare these data with drinking water and ambient water quality standards developed for the protection of public health as promulgated in Georgia statutes and in provisions of the Federal Clean Water Act and its amendments (PL 92-500).

The personnel using the CRK Atlanta lab will analyze water samples for indicator bacteria such as total coliform and *Escherichia coli* (*E. coli*). The analytical methods used in the GML for those two bacteria groups are those approved for the analysis of drinking water as published by the U.S. Environmental Protection Agency (USEPA) in the Federal Register and in the Code of Federal Regulations (40 CFR 141.74, revision July 2000). Furthermore, these methods also are approved for the analysis of ambient waters as published by the U.S. Environmental Protection Agency in the Federal Register (July 21, 2003, vol. 68, no. 139, p. 43271) and in the Code of Federal Regulations (40 CFR 136, revision July 2003).

The Project Leader is responsible for corrective actions in the laboratory. The Project Leader will review data and make determinations for accepting, rejecting, or qualifying it. Data that does not meet all method requirements will not be reported to EPA.

4.6 Quality Control

Field Quality Assurance

EPA has developed operating procedures establishing uniform methods and requirements for the field collection of data, quality assurance, field safety, personnel training as well as other activities. These guidance documents were developed to document and ensure the validity of measurements, analyses, and the representativeness of samples collected. This project will comply with the applicable sections of the EPA's Field Branches Quality Management Plan (USEPA 2012). More specifically, field collection of surface water samples for microbial analysis will follow Standard Methods for the Examination of Water and Wastewater, 20th edition (1998), Section 9060 and EPA's Operating Procedure for Surface Water Sampling, (USEPA 2007j). Samples will consist of a grab sample collected from each of the identified monitoring locations.

Sterility and Cleanliness in the Laboratory:

Clean and sterile conditions in the laboratories and among the bottles, utensils, and equipment used to process water samples for bacteria are paramount to preventing sample contamination. A clean laboratory and clean equipment are the most controllable of all QC activities when dealing with water samples. The following general procedures are needed to ensure sample integrity:

- Traffic through the laboratory is minimized especially when samples are being processed
- Countertops are wiped down with a 1% bleach solution or methyl (or isopropyl) alcohol before and after use. Alternatively, clean aluminum foil can be laid over the work area.
- Anti-bacterial hand soap is available at the laboratory sinks to wash hands before and after laboratory work.

- Technicians will use antibacterial gel on their gloved hands. Such gel must contain at least 60 percent ethyl alcohol.

No reusable bottles or utensils will be used:

- Used bottles and utensils are disposed of properly and new sterile bottles and related utensils are used for each sample ran.
- Used bottles and utensils will not be stored on countertops where sample processing takes place.

Quanti-Tray Sealer:

The Quanti-Tray sealer that is used to seal the trays in the Colilert-18 is cleaned once per month (depending on amount of use) with 2 percent Liquinox and isopropyl alcohol. Cleaning Procedure for the IDEXX Quanti-Tray Sealer:

1. Ensure power is off, sealer is unplugged and unit has completely cooled down for 90 minutes. Remove input tray shelf. Loosen the four quarter-turn fasteners and remove the access panel.
2. Loosen hold-down screws, which secure the lower roller assembly to the bottom plate of the sealer.
3. Remove lower roller by lifting straight up and then out to ensure roller clearance of locating pins on the bottom plate of the sealer.
*Be careful not to touch the upper roller if it is hot.
4. Use mild detergent, diluted bleach or isopropyl alcohol to clean all accessible surfaces inside the sealer and the lower roller assembly.

*Never use abrasive materials for cleaning.
*Never use caustic cleaners.
*For stubborn deposits, allow soak time for cleaner to work.
*do not disassemble lower roller assembly.
5. Dry interior and roller assembly with paper towels.
6. Reinstall bottom roller assembly on locating pins and tighten hold-down screws.
7. Fasten access panel and reattach tray shelf. Sealer is now ready for use.

Laboratory Blank:

To verify laboratory sterility, monthly blanks will be run with distilled water from the laboratory bottle. The pipettor will also be used to ensure its sterility. All blanks should read zero for total coliform bacteria and *E. coli*. The results from the analysis of these blanks are recorded in laboratory logbook. A total of 24 blanks will be run over the two year project.

Sample Duplicates:

One sample will be analyzed in duplicate each month. Replicates should read within the 95% confidence limits found in Appendix C. The results from the analysis of these duplicates are recorded in the laboratory logbook. A total of 24 duplicates will be run over the two year project.

Incubator and Refrigerator:

The incubator must be capable of maintaining temperatures within $\pm 0.5^{\circ}\text{C}$ of the required incubation temperature of the method. For this method the temperature is 35°C . The American Public Health Association (Clesceri and others, 1998a) recommends that water samples are stored before analysis in a refrigerator where temperatures are between 1 to 4°C . Samples must be processed within 6 hours of collection. The temperatures of the incubator and refrigerator are monitored continuously by a certified thermometer or data logger.

Pipettors:

A dispenser is used to accurately measure and transfer specific volumes of sample water for diluting a water sample when the Colilert-18 method is used in the lab. The dispenser is a pre-set 1 mL non-adjustable model with an accuracy of 0.5 percent at 50 mL and reproducibility of 0.1 percent. A new sterile pipette tip is used with each sample and disposed of after it is used.

Distilled Water:

Distilled water is used for all dilutions and is purchased in one gallon containers. Distilled water is transferred to labeled polypropylene bottles for dispensing to sample bottles.

4.7 Data Management

The project leader will be responsible for ensuring that all requirements for data management are met. All field data generated during this study will be recorded, stored, and managed according to the SESD Operating Procedures for Control of Records (USEPA 2007a), Sample and Evidence Management (USEPA 2007i), and Logbooks (USEPA 2007e).

All data generated at each site will be maintained in the logbook and will be uploaded to CRK's website, Georgia Adopt-A-Stream database (www.georgiaadoptastream.com), and EPA STORET Data Warehouse. This data will be available to the public and government agencies and will be presented at citizen workshops and water quality conferences. CRK will maintain direct communication with the city of Atlanta Department of Watershed Management and community partners to identify areas of concerns.

5 Assessment/Oversight

5.1 Assessments and Response Actions

Assessments may be conducted during the field investigation according to the SESD Operating Procedure for Project Planning (USEPA 2007f) to ensure the QAPP is being implemented as approved. The project leader is responsible for all corrective actions while in the field. Any

issues that may arise during the study will be documented in the logbooks. This documentation and any corrective actions taken will be used to determine the overall quality and usability of the data. Project leader Jason Ulseth or coordinator Mike Meyer will be reviewing the data to determine whether or not it is acceptable.

5.2 Reports to Management

CRK will issue one final report and provide quarterly preliminary results. The project leader will be responsible for notifying EPA if any circumstances arise during the field study that may adversely impact the quality of the data collected. Any problems noted during field sampling that could result in unusable data will be addressed in the final report. Data that does not meet all method requirements will not be reported.

Appendix A: Data Quality Objectives

Step	Data Quality Objectives		Description
1	State the Problem	<ul style="list-style-type: none"> • Concise description of the problem. • Identify members of the planning team and the primary decision maker. • Develop a conceptual model of the environmental hazard to be investigated. • Determine resources – budget, personnel, and schedule. 	<p><u>Description of the Problem</u> Many streams flowing through Atlanta’s neighborhoods and into the Chattahoochee River are polluted with high levels of bacteria due to cracked and overflowing sewers, failing septic systems and polluted stormwater runoff. Contaminated water running through these areas threatens water quality and public health. With state and local agencies underfunded and unable to adequately monitor local waterways, this project will provide very valuable data to identify problem areas.</p> <p><u>Planning Team</u> Jason Ulseth, CRK – Primary Decision Maker Mike Meyer, CRK Mary Jo Bragan, USEPA</p> <p><u>Conceptual Model</u> The long-term baseline data will be used to identify water quality and public health problems and inform investigations working with city of Atlanta officials or other appropriate agencies to stop sewage pollution at its source.</p> <p><u>Resources/Personnel/Schedule</u> Equipment, personnel support, and funding are available and in place. The project schedule is listed in Section 3.3.</p>
2	Identify the Goal of the Study	<ul style="list-style-type: none"> • Identify the principal study question. • Define the alternative actions that could result from resolution of the principal study question. • For decision problems, develop decision statement(s), organize multiple decisions. • For estimation problems, state what needs to be estimated. 	<p><u>Principal Study Questions</u> Which streams in urban Atlanta are the most contaminated with fecal bacteria and are in need of remediation?</p> <p><u>Alternative Action</u> Any actions will be determined by CRK/EPA/COA based on data generated by this field study.</p> <p><u>Estimation Statement</u> This study will characterize <i>E. coli</i> contamination found in urban streams to determine if a public health threat is present. The data generated from this field study will provide CRK/EPA/COA with information that will support decisions pertaining to watershed improvements.</p>
3	Identify Information Inputs	<ul style="list-style-type: none"> • Identify types and sources of information needed to resolve decisions or produce estimates. • Identify the basis of information that will guide or support choices to be made in later steps of the DQO process. • Select appropriate sampling and analysis methods for generating the information. 	<p><u>Information Type and Source</u> Analytical laboratory results for <i>E. coli</i> and will be reported to EPA.</p> <p>Water quality data will be used in assessing bacterial data. Turbidity, specific conductance, and optical brighteners will be used to characterize the current conditions at the time of sampling but these parameters will not be reported to EPA.</p>

4	Define the Study Boundaries	<ul style="list-style-type: none"> Define the target population of interest and its relevant spatial boundaries. Define what constitutes a sampling unit. Specify temporal boundaries and other practical constraints associated with sample/data collection. Specify the smallest unit on which decisions or estimates will be made. 	<u>Target Population Spatial Boundaries</u> This study will target designated stations along urban streams in Atlanta, Georgia for bacteria water quality. <u>Practical Constraints</u> Routine sampling for each station depends on the volunteer's availability and personal schedule.
5	Develop the Analytic Approach	<ul style="list-style-type: none"> Specify appropriate population parameters for making decisions or estimates. For decision problems, choose a workable Action level and generate and "If....then....else" decision rule which involves it. For estimation problems, specify the estimator and the estimation procedure. 	Results from the analysis will be assessed and evaluated by CRK/EPA/COA.
6	Specify Performance or Acceptance Criteria	<ul style="list-style-type: none"> For decision problems, specify the decision rule as a statistical hypothesis test, examine consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors. For estimation problems, specify acceptable limits on estimation uncertainty. 	<u>Decision Ruling</u> Final decision regarding watershed improvements for problem area identified will depend on the number and extent of problems and resources available to project partners.

Appendix B: Directions for Assembling PVC Bridge Sampler

Bridge Sampler for Use with 18 oz. Whirl-Pak Sample Bag:

Materials needed:

- 1 ½" diameter PVC pipe (approximately 2" long)
- (2) Stainless Steel Eye Bolts (1/4x2-5/8" or similar size) with (4) hex nuts
- Any household glue that can be used on metal surfaces (Gorilla Glue works great)
- 1/8" diameter nylon rope (or similar size) cut to approximately 18" long, ends heated to prevent fray

---All materials should be readily available at your local hardware store---

Tools needed:

- Hacksaw or preferably a miter saw (for cutting the PVC pipe)
- Hand drill with 1/4" drill bit
- Pliers

Step 1: Using a hand hacksaw, or preferably an electric miter saw for a straighter cut, cut the PVC pipe to approximately 2" long.



Step 2: Using a handheld drill, drill two opposing 1/4" holes in one end of the pipe approximately ½" from the end.



Step 3: Thread one of the hex nuts about halfway up each of the eye bolts. Insert the first eye bolt into one of the holes and apply a small drop of glue on the end of the threads.



Step 4: Screw on the second hex nut so that it threads over the drop of glue and sits flush with the end of the eye bolt.



Step 5: Screw the first hex nut (that was previously screwed on the eye bolt) towards the PVC pipe, applying a drop of glue on the threads next to the pipe. Tighten the hex nut over the drop of glue with the pliers. The glue will prevent the hex nuts from becoming loose during use. Be sure that the eye on the eye bolt is in a vertical position as you tighten with pliers (see picture).



Step 6: Repeat steps 3-5 for the second eye bolt.

Step 7: Tie each end of the 18" nylon rope to the eye of each eye bolt.



Step 8: Let the glue dry and the sampler is ready for use.