Quality Assurance Project Plan

Citizen Science Water Quality Testing Program

Riverkeeper

May-October 2014

Project Code 2013-066

July 24, 2014

Riverkeeper
20 Secor Road
Ossining, NY 10562

RIVERKEEPER®
NY's clean water advocate

Title and Approval Page

Riverkeeper, Inc.

Citizen Science Water Quality Testing Program

Effective Date of Plan: May-November 2014

_____ Date: 7/24/14

John Lipscomb/Boat Captain, Water Quality Program Director

_____ Date: 7/24/14

Jennifer Epstein/Citizen Science Manager, Project QA Manager

_____ Date: 7/24/14

Dan Shapley, Water Quality Program Manager

_____ Date: 7/29/14

Alene Onion, NEIWPCC/NYSDEC Project Manager

_____ Date: _____

Mike Jennings, NEIWPCC QA Program Manager

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Alene Onion, NEIWPCC/NYSDEC Project Manager

_____ Date: 7/29/14

Mike Jennings, NEIWPCC QA Program Manager

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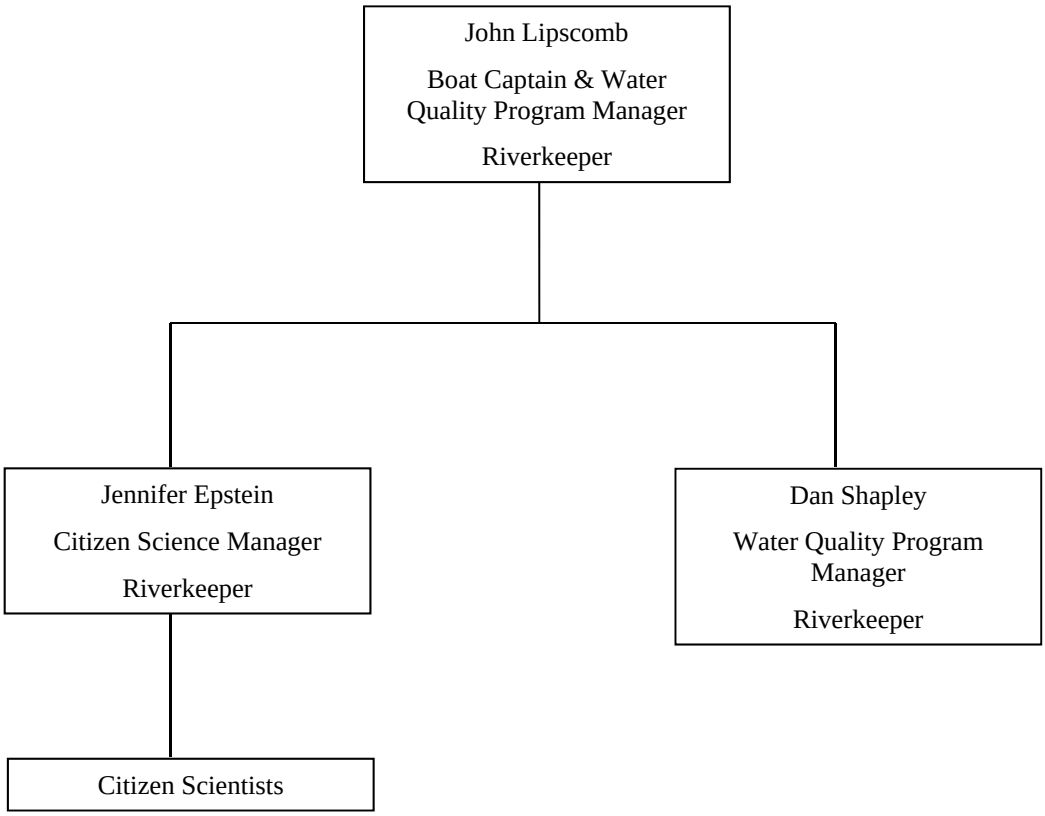
1 Project Organization Chart



2 Document Distribution List

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Citizen Samplers	via email and website

In addition being directly distributed to the individuals above, this document will be posted on the Riverkeeper website where it may be downloaded by the general public.

3 Project and Task Organization

Name	Title	Responsibilities
John Lipscomb Riverkeeper	Boat Captain Water Quality Program Manager	Provides overall direction for the Water Quality Program; Operates the Riverkeeper vessel and mobile laboratory, including supply purchasing and equipment maintenance; Performs sampling, sample processing, and sample analysis; Supervises program staff
Dan Shapley Riverkeeper	Water Quality Program Manager	Conducts public policy and outreach activities associated with the Water Quality Program; Writes blog updates and water quality reports; Oversees online database and program website
Jennifer Epstein Riverkeeper	Citizen Science Manager, Project QA Manager	Maintains online database and data records; Assists with water quality reports and program operations; Oversees training of citizen scientists; Coordinates site assignments, sampling equipment distribution and sample delivery to Riverkeeper vessel; Maintains the QA Project Plan

Partner Organization	Responsibilities
Catskill Creek Watershed Awareness Project	Approximately five sampling locations in Catskill Creek watershed
Town of Rochester Environmental Conservation Commission	Approximately six sampling locations in Rondout Creek watershed
Town of Wawarsing Environmental Conservation Commission	Approximately six sampling locations in Rondout Creek watershed
Rosendale Commission for Conservation of the Environment	Approximately three sampling locations in Rondout Creek watershed
Sparkill Creek Watershed Alliance	Approximately 16 sampling locations in Sparkill Creek watershed
Gardiner Environmental Conservation Commission	Approximately two sampling locations in Wallkill River watershed

4 Problem Definition and Project Objectives

4.1 Problem Definition

In 2006, Riverkeeper started testing for *Enterococcus*, an indicator of fecal contamination, at fixed locations in the Hudson River. We observed that fecal contamination occurred most frequently at tributary confluence sampling sites. While elevated *Enterococcus* counts are often triggered by wet weather, some tributary streams exhibited high counts even during dry weather, making them chronic sources of sewage contamination to the Hudson.

The public responded strongly when we published this finding, and Riverkeeper in 2010 began coordinating citizen sampling on select Hudson River tributaries. We coordinate this citizen science water quality testing alongside our Hudson River main stem water quality testing program, which is conducted entirely by Riverkeeper staff and science partners and is described in a separate QAPP.

The Citizen Science Water Quality Testing Program addresses the following questions:

1. Where is fecal contamination entering the Hudson River's tributaries?
2. What is the severity of fecal contamination?

4.2 Project Objectives

The objective of the program is to collect water samples to analyze *Enterococcus* concentrations ("Entero counts") at fixed points in tributary waterways, including upstream and downstream of potential sewage pollution sources, at subtributary confluences, and at public access points.

4.3 Data Users

Riverkeeper urges citizens to use data from this program to inform themselves about water quality conditions in their communities and to pursue local solutions to pollution problems. Riverkeeper staff use the water quality data to advocate for increased investment in wastewater infrastructure, better enforcement of existing water quality protections, more frequent water quality sampling, and better prediction and public notification of sewage contamination.

Riverkeeper rates the water quality at each site in comparison to the U.S. Environmental Protection Agency's (EPA) 2012 Recreational Water Quality Criteria.[1] The Entero count and rating are uploaded to our website (http://www.riverkeeper.org/water-quality/citizen-data) promptly after each sampling event. The site explains the sampling method and rating system that we use.

The Riverkeeper website displays information gathered from our Citizen Science Water Quality Testing Program (the 96 sampling sites sampled approximately monthly as defined in this QAPP) and our Hudson River Water Quality Testing Program. Sampling sites and data from the two programs are separately located in the website and are distinguished using page headings and iconography. The Hudson River program QAPP will also be available for viewing and download on the Riverkeeper website once it is approved.

Periodically we release reports summarizing data and findings. These reports explain our methods, highlight key findings, and suggest ways for citizens to take action. Riverkeeper's reports include guidance about how our water quality data should be interpreted. The reports are available on the Riverkeeper website for viewing or download, and are available in print format upon request.

5 Background and History

5.1 Background

Riverkeeper began monitoring water quality in the Hudson River in 2006 to provide information that would help the public understand water quality in their communities and that would generate

[1] EPA 2012 Recreational Water Quality Criteria

public demand for better water quality monitoring, reinvestment in wastewater infrastructure, and enforcement of existing water quality standards.

One of the earliest conclusions from our study was that sampling sites at or near tributary mouths exhibit fecal contamination most frequently. (The other site types are mid-channel, near-shore, and sewage treatment plant outfalls). According to EPA single sample guidelines for safe swimming, we discovered unacceptable water quality at tributary confluences on 34% of the days sampled from 2008-2013.

While our data showed a correlation between heavy rainfall and poor water quality at some sites, we also found that certain tributaries show evidence of chronic sewage contamination, exhibiting high Entero counts regardless of whether heavy rainfall occurred in the days before we sampled.

After we released our 2010 Water Quality Program report, concerned community groups and individual citizens living in tributary watersheds where we recorded poor water quality began to contact Riverkeeper with questions about conditions in their waterways. To gain more information about this contamination, Riverkeeper began in 2010 to coordinate and assist citizen sampling programs in targeted Hudson tributary watersheds.

5.2 History

New York State has set the goal of a swimmable Hudson River, except after storms, by 2020. However, there is currently insufficient testing, or modeling and prediction, of water quality to properly assess whether it is safe to swim. This is true of the Hudson as well as its tributaries, which not only influence water quality near Hudson River bathing beaches, but also contain popular swimming holes well inland from the Hudson's shoreline. People also come in contact with the water while kayaking, canoeing, boating, tubing, and wading in tributaries.

The majority of beach closings and advisories in the United States are due to high levels of sewage contamination.[2] In the Hudson watershed, aging wastewater infrastructure and overburdened sewage systems are major causes of stream and river impairment.[3] Riverkeeper's water quality testing results clearly demonstrate that some tributaries are chronically

[2] Dorfman, M. and K.S. Rosselot. Testing the Waters: A Guide to Water Quality at Vacation Beaches, Natural Resources Defense Council, New York, NY, 2010.
[3] "2012 Section 305(b) Water Quality Report." New York State Department of Environmental Conservation, 2012, http://www.dec.ny.gov/chemical/66532.html

contaminated with sewage throughout their courses.[4] In others, contamination is locally or temporally constrained.[5]

As with the Hudson River, there is no comprehensive program in place to monitor the timing or level of sewage contamination in tributaries, or to identify its sources. In the ten counties where we sample, there are four official bathing beaches that are tested, and these are sampled only three times per month during the bathing season (May to October). Our preliminary tributary sampling findings show that the severity and persistence of contamination varies by watershed. Our sampling program seeks to raise public awareness about the need for better water quality monitoring and to provide information that will help communities resolve water quality problems.

6 Project Location

Riverkeeper selected tributaries for monitoring based on results of our main stem sampling program, public response to those results and knowledge of the Hudson River's hydrology. We coordinated sampling in one tributary in 2010, three in 2011, and seven in 2012. In 2014 we will monitor six tributaries.

Our tributary sampling program includes 96 fixed locations sampled by citizen scientists. The sites were selected by soliciting input from community watershed groups, state and local environmental agency staff, members of sports and outdoor associations, and other people with local knowledge. Ease of access, permanence of access, and volunteer safety were also considered during sample site selection. If sites become inaccessible relocation will be considered on a case-by-case basis.

An additional seven sites from the Hudson River Water Quality Testing Program are sampled by Riverkeeper staff from the Riverkeeper vessel. These are locations where our study results originally raised questions about tributary water quality. Testing procedures for these seven sites are described in the Hudson River Water Quality Testing Program QAPP.

From time to time, we also test water quality at additional, exploratory sites.

Sampling sites are listed below, grouped by watershed. The seven sites sampled by Riverkeeper staff are marked with asterisks.

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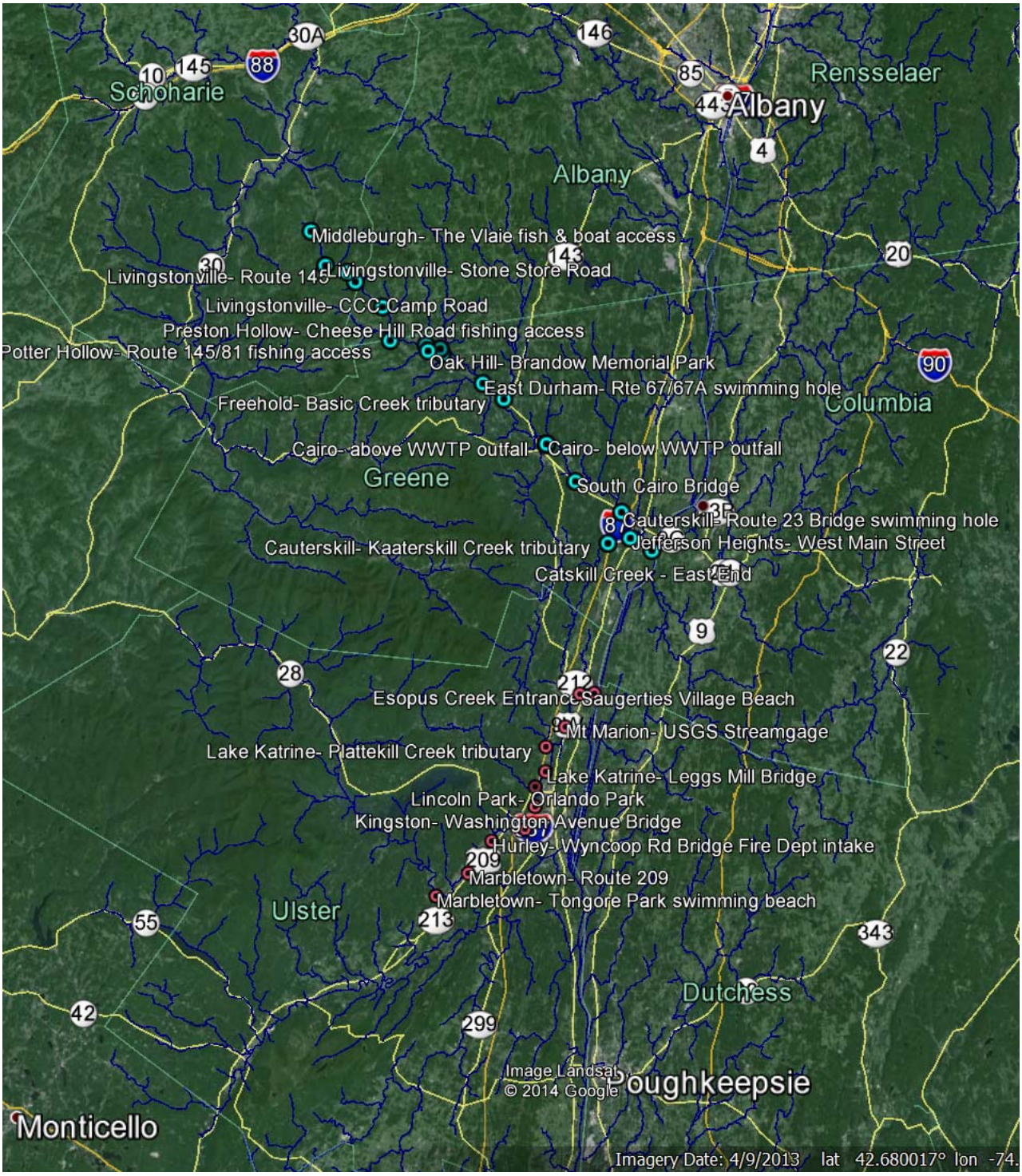
[4] Brown, T. and J. Lipscomb. How Is the Water? Sewage Contamination in The Hudson River Estuary, Riverkeeper, Ossining, NY, 2011.
[5] Brown, T. and J. Lipscomb. How Is the Water? Sewage Contamination in The Hudson River Estuary, Riverkeeper, Ossining, NY, 2011.

Site ID	Site Name	Approx. Latitude	Approx. Longitude
Catskill Creek			
113-CC2	Catskill Creek- East End*	42.210600	-73.856820
CC-2.64	Jefferson Heights- West Main Street	42.222778	-73.885278
CC-KC-1.83	Cauterskill- Kaaterskill Creek tributary	42.217798	-73.914686
CC-5.15	Cauterskill- Rt 23 Bridge swimming hole	42.247972	-73.896722
CC-6.14	Leeds- Fire Department intake	42.255630	-73.904700
CC-10.61	South Cairo Bridge	42.278122	-73.957263
CC-14.50	Cairo- Below WWTP outfall	42.314691	-73.99522
CC-14.68	Cairo- Above WWTP outfall	42.313733	-73.995987
CC-BaC-0.13	Freehold- Basic Creek tributary	42.357848	-74.051643
CC-22.56	East Durham- Route 67/67A swimming hole	42.373428	-74.07919
CC-26.86	Durham- Dean's Mill swimming hole & fishing	42.401927	-74.132807
CC-TMC-0.26	Durham- Ten Mile Creek tributary	42.406929	-74.135219
CC-28.16	Oak Hill- Brandow Memorial Park boating access	42.404881	-74.151308
CC-28.60	Oak Hill- Above Oak Hill	42.410773	-74.154125
CC-31.61	Potter Hollow- Route 145/81 fishing access	42.414874	-74.2012224
CC-34.20	Preston Hollow- Cheese Hill Road fishing access	42.447398	-74.211323
CC-36.97	Livingstonville- CCC Camp Road fishing access	42.471781	-74.247049
CC-37.96	Livingstonville- Route 145	42.481043	-74.257769
CC-39.57	Livingstonville- Stone Store Road	42.487333	-74.286614
CC-42.31	Middleburgh- The Vlaie fishing & boating access	42.521	-74.306048
Esopus Creek			
102-EC1	Esopus Creek Entrance*	42.071540	-73.933310
EC-1.57	Saugerties Village Beach	42.070910	-73.952140
EC-4.55	Mt Marion- USGS Streamgage	42.038929	-73.971461
EC-PC-0.53	Lake Katrine- Plattekill Creek tributary	42.019465	-73.99691
EC-8.37	Lake Katrine- Leggs Mill Bridge	41.995310	-73.997330
EC-SC-0.26	Lake Katrine- Sawkill Creek tributary	41.980502	-74.01098
EC-11.50	Lincoln Park- Orlando Park	41.961295	-74.011191
EC-14.26	Kingston- Washington Avenue Bridge	41.939358	-74.024324
EC-18.04	Hurley- Wyncoop Rd Bridge Fire Dept intake	41.927713	-74.068043
EC-21.38	Marbletown- Route 209 fishing access	41.89645	-74.09877
EC-24.22	Marbletown- Tongore Park swimming beach	41.874325	-74.140857
Pocantico River			
28E	Kingsland Point Park- Pocantico River*	41.091540	-73.870680
PR-0.57	Sleepy Hollow- Below Philipsburg Manor	41.088163	-73.864206
PR-0.82	Sleepy Hollow Cemetery	41.090418	-73.860620
PR-1.75	Sleepy Hollow- Rockefeller Park	41.102461	-73.854664
PR-GB-0.16	Sleepy Hollow- Gory Brook tributary	41.106175	-73.852076
PR-2.56	Sleepy Hollow- DEP Spillway	41.102658	-73.844596
PR-RB	Sleepy Hollow- Rockefeller Brook tributary	41.099465	-73.846899
PR-3.19	Briarcliff Manor- Below Pocantico Lake	41.111004	-73.842689
PR-CB-0.77	Briarcliff Manor- Caney Brook tributary	41.133230	-73.836779

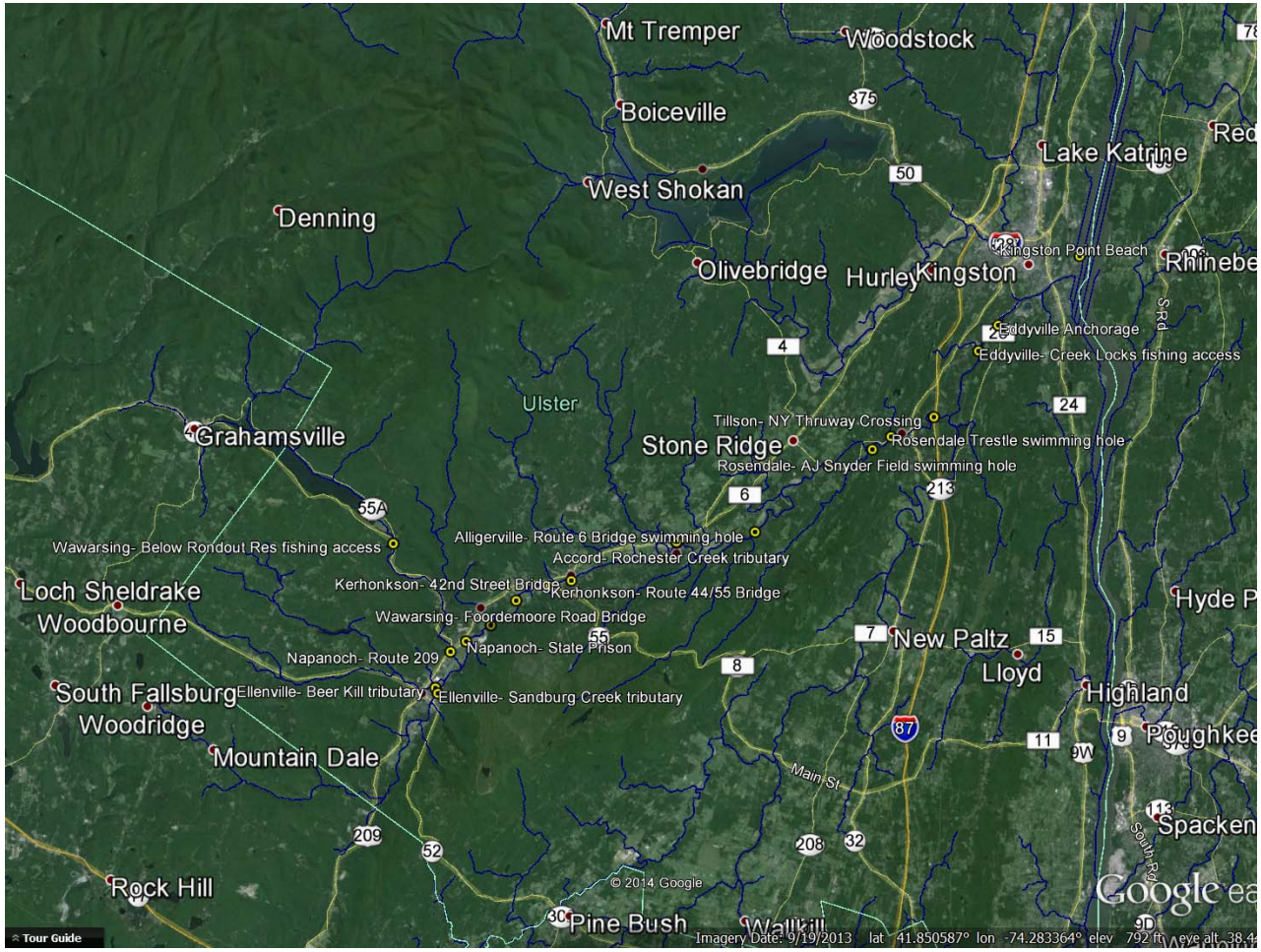
Site ID	Site Name	Approx. Latitude	Approx. Longitude
PR-5.11	Briarcliff Manor- Above Pocantico Lake	41.127108	-73.821193
PR-5.61	Briarcliff Manor- Long Hill Road	41.133054	-73.818568
PR-6.78	Briarcliff Manor- North County Trail	41.147989	-73.825023
PR-8.63	Briarcliff Manor- Stone Creek Lane	41.172049	-73.813696
PR-9.09	New Castle- Echo Lake	41.178675	-73.811209
Rondout Creek			
92W	Kingston Point Beach*	41.931580	-73.963030
92-RC3	Rondout- Eddyville Anchorage*	41.897700	-74.017000
RC-4.62	Eddyville- Creek Locks fishing access	41.885055	-74.029968
RC-8.04	Tillson- NY Thruway Crossing	41.852718	-74.059377
RC-10.37	Rosendale Trestle swimming hole	41.843153	-74.087637
RC-11.43	Rosendale- AJ Snyder Field swimming hole	41.836866	-74.099820
RC-13.61	High Falls swimming hole	41.828621	-74.128506
RC-18.65	Alligerville- Route 6 Bridge swimming hole	41.796539	-74.177009
RC-RhC-0.09	Accord- Rochester Creek tributary	41.791740	-74.228535
RC-24.34	Accord- Route 209 & River Street	41.791333	-74.228422
RC-29.10	Kerhonkson- 42nd Street Bridge	41.772732	-74.297487
RC-29.96	Kerhonkson- Route 44/55 Bridge	41.769927	-74.311366
RC-31.55	Wawarsing- Foordemoore Road Bridge	41.762914	-74.333579
RC-33.06	Wawarsing- Port Ben Road	41.750807	-74.350176
RC-34.49	Napanoch- State Prison	41.742879	-74.366427
RC-35.42	Napanoch- Route 209	41.737832	-74.376616
RC-41.35	Wawarsing- Below Rondout Res fishing access	41.790704	-74.413962
RC-SC-1.15	Ellenville- Sandburg Creek tributary	41.718428	-74.383785
RC-BK-0.14	Ellenville- Beer Kill tributary	41.720071	-74.386463
Sparkill Creek			
26.1W	Piermont Pier*	41.043160	-73.895540
26.2W	Piermont- Pirelli Park*	41.043417	-73.913700
SC-0.71	Piermont- Old Draw Bridge	41.037720	-73.915585
SC-1.50	Piermont- Skating Pond	41.029292	-73.925459
SC-1.79	Sparkill- Route 340	41.025410	-73.927440
SC-2.45	Tappan- Moturis	41.017918	-73.934915
SC-SB-0.14	Rockleigh, NJ- Sparkill Brook tributary	41.012596	-73.939081
SC-2.96	Tappan- State Line	41.015142	-73.942295
SC-3.47	Tappan- Oak Tree Road	41.020593	-73.946839
SC-4.24	Tappan- Route 303	41.030024	-73.943887
SC-4.94	Orangeburg- Orangetown STP	41.037839	-73.937329
SC-5.66	Orangeburg- Route 303/340	41.045058	-73.944951
SC-BA-0.02	Blauvelt- Blauvelt Arm tributary	41.054489	-73.945322
SC-6.35	Blauvelt- Clausland Arm	41.054588	-73.944913
SC-6.62	Blauvelt- Spruce Street	41.058629	-73.945322
SC-TT-0.12	Blauvelt- Tackamack trib at Greenbush Rd Bridge	41.058766	-73.943657
SC-TT-0.42	Orangeburg- Tackamack tributary	41.061175	-73.938923

Site ID	Site Name	Approx. Latitude	Approx. Longitude
SC-7.28	Blauvelt- Marsico Court	41.066457	-73.940593
Wallkill River			
WR-0.43	Tillson- Coutant Rd below Sturgeon Pool	41.848648	-74.048150
WR-2.41	Rifton- Cow Hough Road fishing access	41.821704	-74.046457
WR-3.24	Tillson- Rt 32 Bridge fishing access	41.814862	-74.057965
WR-10.63	New Paltz- Stewart's, Route 32	41.755150	-74.082833
WR-10.76	New Paltz- Springtown Road boat launch	41.752775	-74.094357
WR-SMB-0.10	New Paltz- Saw Mill Brook tributary	41.743257	-74.092506
WR-11.56	New Paltz- Plains Road boat launch	41.743696	-74.093597
WR-18.64	Gardiner- USGS Streamgage	41.686489	-74.165277
WR-SK-0.49	Gardiner- Shawangunk Kill tributary	41.687355	-74.172679
WR-22.90	Shawangunk- Galeville Bridge	41.635177	-74.188052
WR-25.86	Shawangunk- Orange/Ulster Line fishing access	41.595594	-74.184161
WR-30.11	Montgomery- Riverfront Park fishing access	41.542235	-74.209059
WR-33.54	Montgomery- Benedict Farm Park floating dock	41.526412	-74.254817
WR-36.63	Montgomery- I-84 Crossing	41.498205	-74.252680
WR-40.92	Middletown- Stony Ford Road	41.457044	-74.300413
WR-44.76	Middletown- Cemetery Road	41.438734	-74.365807
WR-RG-1.50	Goshen- Rio Grande tributary at Heritage Trail	41.401059	-74.359392
WR-46.94	Goshen- Echo Lake Road	41.412233	-74.377633
WR-47.96	Goshen- Route 6/17M	41.402306	-74.389020
WR-50.03	Wawayanda- Pellets Island Bridge	41.380761	-74.413570
WR-61.61	Unionville- Nat'l Wildlife Refuge boat & fishing	41.287959	-74.534687

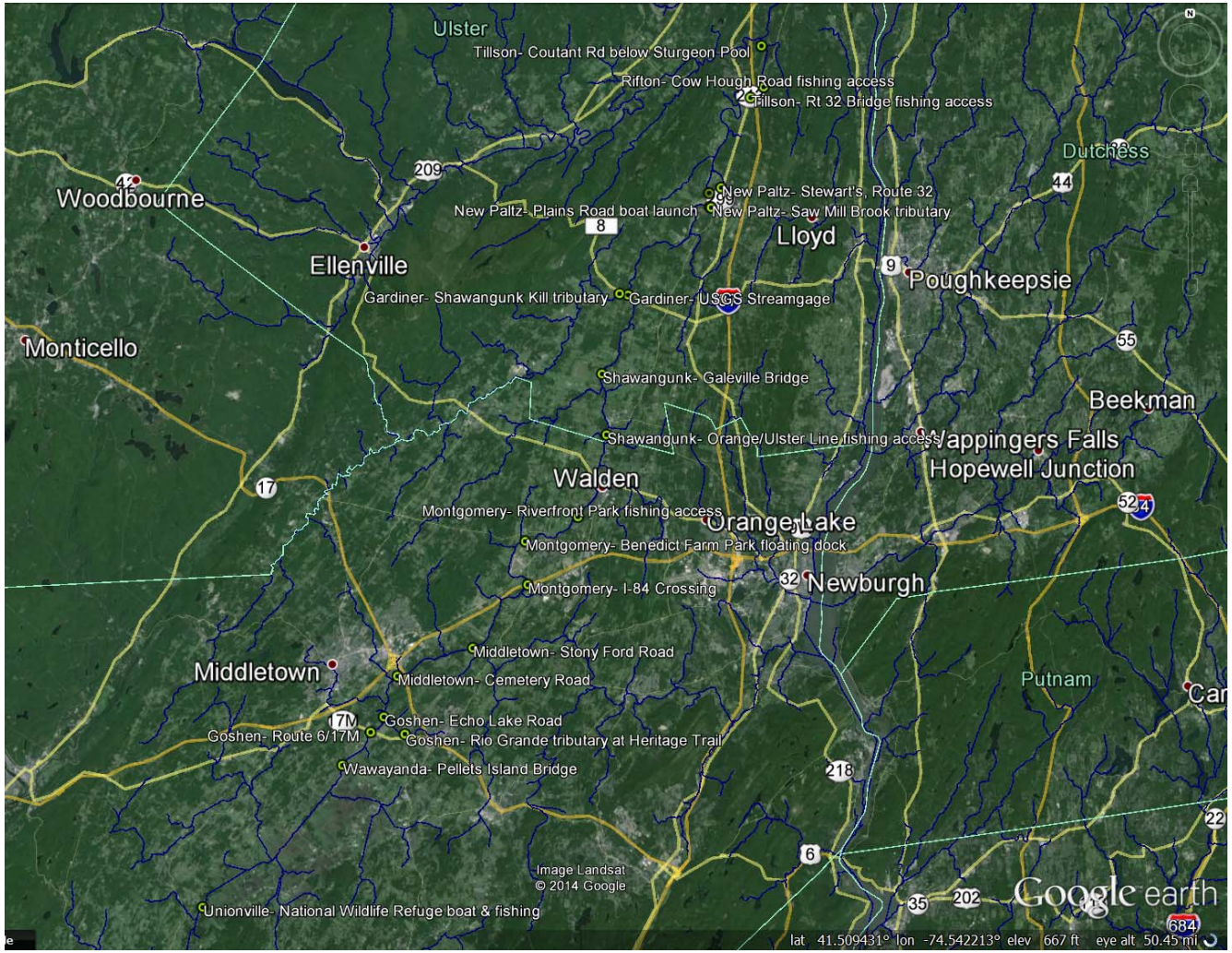
Site Map- Catskill Creek and Esopus Creek Watersheds



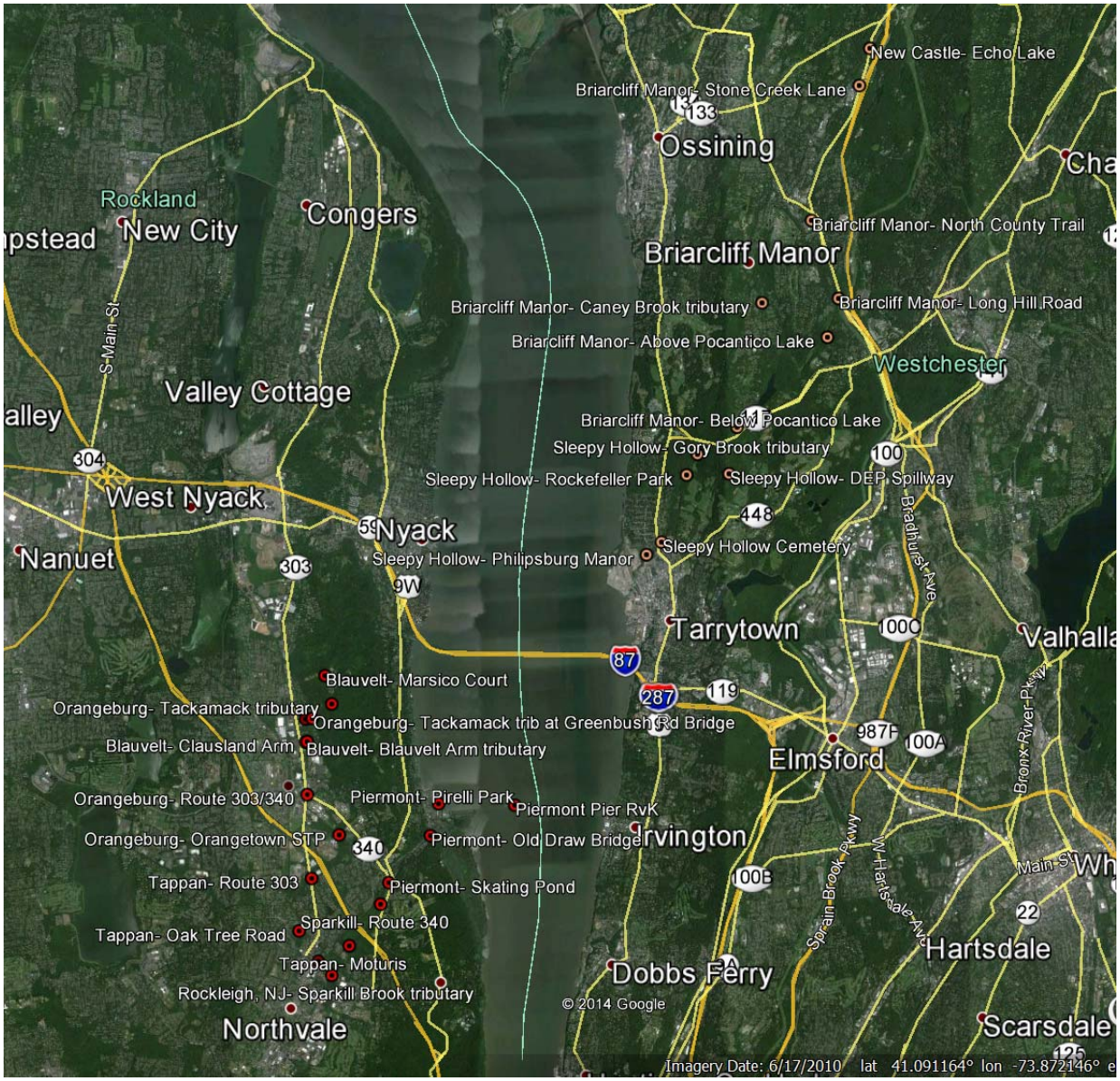
Site Map- Rondout Creek Watershed



Site Map- Wallkill River Watershed



Site Map- Pocantico River and Sparkill Creek Watersheds



7 Project Schedule

Activities	Person Responsible	Timeframe
Organize and train samplers	Citizen Science Manager Water Quality Program Manager	April-May 2014
Purchase supplies	Citizen Science Manager	Year-round
Conduct Sampling	Citizen Samplers Riverkeeper Staff	May 2014-October 2014
Perform Sample Analyses	Riverkeeper Staff	May 2014-October 2014
Post Results Online	Citizen Science Manager	May 2014-October 2014
Data QA/QC	Citizen Science Manager	May 2014-October 2014
Report QC Results to NYSDEC/NEIWPCC	Citizen Science Manager	Final grant report

8 Quality Objectives

8.1 Precision

Laboratory:

At least one sample will be processed in replicate on each sampling date by dividing one 250-mL grab sample into separate sample processing bottles. At least one duplicate will be processed on each sampling date by collecting two separate 250-mL grab samples at a randomly selected site. If results vary greatly, we will examine handling and storage of the reagents and sampling equipment currently in use to ascertain whether contamination has occurred. Reagents and supplies will be replaced where necessary.

8.2 Bias

Field:

Our study is intended to detect fecal contamination at specific locations and times. Sampling points are distributed to provide insight into possible sewage exposure by river users, to locate contamination hot spots, and to identify potential pollutant sources. The full subset of samples may not describe general waterway conditions.

Laboratory:

At least one blank sample will be processed alongside field samples on each sampling date. If a blank has a positive *Enterococcus* measurement greater than 3 cells/100 mL, the field samples

since the last acceptable blank will be removed from the data set and additional blanks will be included until the source of contamination has been eliminated.

8.3 Representativeness

Field:

Citizen scientists will sample once approximately monthly from May to November, which is the time of year when most people get in the water. The data is not meant to be representative of average conditions for the recreational season, nor is it to be used to predict conditions at a specific time and place along a waterway. In addition, data should not be used to draw conclusions about conditions during the winter months.

8.4 Comparability

Field:

The Hudson River Estuary and its tributaries include saltwater, freshwater, and brackish environments. We use *Enterococcus* as an indicator of sewage contamination because it is the only indicator that can be used in all three types. This way, we can compare results directly among all of our sampling sites in the Hudson River Estuary system.

Laboratory:

We will rate water quality in comparison to EPA guidelines for safe swimming so that our results can be compared with results nationally.

8.5 Completeness

Field:

Citizen scientists will collect and analyze samples from the 96 sites identified above on an approximately monthly basis from May to November, totaling at least 576 samples per year. We intend to analyze three QC samples (one replicate, one duplicate and one blank) per sampling day for an approximate total of 12 QC samples per month, for a total of at least 72 QC samples per year. Sampling will be conducted unless weather conditions make access unsafe for samplers. If a sampling event must be cancelled or rescheduled, we will sample when conditions are clear, as scheduling permits within a month and QC samples will be included each day in the altered scheduled.

8.6 Sensitivity

Laboratory:

The IDEXX Quanti-Tray 2000 Enterolert Most Probable Number (MPN) method allows detection of 1 Enterococci per 100 mL in undiluted samples. As per standard methods, samples collected in saline or brackish water (or when higher maximum detection levels are required) is diluted tenfold, so the lower limit at those sites is 10 Enterococci per 100 mL. The MPN method can quantify up to 2,419.6 Enterococci per 100 mL without dilution (24,196 with a tenfold dilution).

9 Data Collection Methods

9.1 Site Names

Each site is assigned a ID consisting of the waterway initials and approximate river mile (e.g., "WR-18.64"). In the case of secondary tributaries, the initials of both the main and secondary tributary are included, and the approximate river mile recorded is the location within the subtributary (e.g., "RC-BK-0.14"). Each site is also assigned a name usually consisting of the municipality in which the site is located, followed by a descriptor (e.g., "Ellenville- Beer Kill tributary).

9.2 Sampling Design

Sampling will occur approximately monthly from May to November. Water samples will be collected for *Enterococcus* using sterile polypropylene bottles or sterile Whirl-Pak bags. Riverkeeper staff will pre-label all sample containers with the site number, site name, sampling date, and a blank space for the sampler to mark the sampling time. Samplers will collect the containers from Riverkeeper staff up to two months prior to sampling.

Samples will be taken from the stream banks with minimal disturbance to sediments. The sampler will wear disposable gloves to avoid contamination. The sampler will record the time of sampling on the bottle. Samples will be immediately placed on ice in a dark container for transport to Riverkeeper's mobile laboratory, which is located on the patrol boat *R. Ian Fletcher*. Upon sample delivery, Riverkeeper staff will note on a spreadsheet the time of receipt and the name of the sampler for each sample.

Sample processing will be conducted on the Riverkeeper vessel following IDEXX instructions (https://www.idexx.com/water/products/enterolert.html). Maximum holding time is six hours. All samples will be incubated and scored on the Riverkeeper vessel. All sample bottles and distilled water will be sterilized using an autoclave at LDEO.

Matrix	# of Sampling Locations	# of Samples per Location	Parameter	Field QC Samples	Total Number of Samples/ Measurements	Sampling SOP Reference	Project Objective for Sampling and Analysis or Monitoring
Water	96	6	*Enterococcus* concentration	1 duplicate/ sampling date 1 replicate/ sampling date 1 blank/ sampling date	576 samples/year 72 QC samples/year	Standard Methods for the Examination of Water and Wastewater Section 9060	Meets Objective 1

10 Equipment List and Instrument Calibration

10.1 Equipment

Field:

- Cooler with ice
- Sample bottles
- Nitrile or latex gloves
- Marker
- Watch

Laboratory:

- IDEXX 100-mL sealed sterile disposable plastic bottles with sodium thiosulfate
- IDEXX Enterolert reagent powder snap packs
- IDEXX Quanti-Tray 2000 incubation trays
- Incubator
- Quanti-tray sealer
- Quanti-tray holder
- UV viewing cabinet
- IDEXX MPN table

Seals on the IDEXX Quanti-trays and IDEXX sample containers will be checked before use. These materials will be stored on the Riverkeeper vessel.

10.2 Instrument Calibration and Maintenance

Proper functioning of the autoclave will be tested regularly by LDEO staff using spore test kits.

11 Analytical Methods

Matrix	Analytical Group/ Parameter	Reporting Limit	Detection Limit	Analytical & Preparation Method/ SOP Reference	Sample Volume	Containers	Preservation Requirements	Max Holding Time	Laboratory Used for Analysis
Water	*Enterococcus*	Fresh water: lower limit 1 Entero/100 mL, upper limit 2,420 Entero/100 mL Brackish and salt water: lower limit 10 Entero/100 mL, upper limit 24, 196 Entero/100 mL	Fresh water: lower limit 1 Entero/100 mL, upper limit 2,420 Entero/100 mL Brackish and salt water: lower limit 10 Entero/100 mL, upper limit 24, 196 Entero/100 mL	Standard Methods for the Examination of Water and Wastewater Section 9230D	100 mL Fresh water: no dilution Brackish and salt water: 1:10 dilution	For collection and transport: 250-mL polypropylene bottles or 207-mL Whirl-Pak bags For processing: IDEXX containers and Quanti-trays	Store bottle on ice in dark container	6 hours	Riverkeeper mobile laboratory Used Quanti-trays will be returned to LDEO for disposal

12 Field Data Sheet

Esopus Creek Raw Sampling Data: _____ **EXAMPLE**

Site ID	River Mile	Sample Site Name	Date collected	Time collected	Start incubation	Time & date read	Sample (ml)	Dilution (ml)	# Small (max 48)	# Large (max 49)	Count (MPN) per 100 ml	Comments
Esopus Creek												
102-EC1		Esopus Creek Entrance										
EC-1.57	1.57	Saugerties Village Beach										
EC-4.55	4.55	Mt Marion- USGS Streamgage										
EC-PC-0.53	6.32	Lake Katrine- Plattekill Creek tributary										
EC-8.37	8.37	Lake Katrine- Leggs Mill Bridge										
EC-SC-0.26	9.44	Lake Katrine- Sawkill Creek tributary										
EC-11.50	11.5	Lincoln Park- Orlando Park										
EC-14.26	14.26	Kingston- Washington Avenue Bridge										
EC-18.04	18.04	Hurley- Wyncoop Rd Bridge Fire Dept intake										
EC-21.38	21.38	Marbletown- Route 209										
EC-24.22	24.22	Marbletown- Tongore Park swimming beach										
		DUPLICATE										
		REPLICATE										
		BLANK										

13 Training and Specialized Experience

13.1 Training

Field personnel will be trained in sample collection and handling by Riverkeeper staff or an experienced sampler. Trainings will be organized on a case-by-case basis and will take about 30-60 minutes, depending on the number of people. The Citizen Science Director will keep a list of trained samplers which will be stored on the Riverkeeper server.

13.2 Specialized Experience

Person	Specialized Experience	# of Years Experience
John Lipscomb	Collection and analysis of water samples for presence of pathogens	7
Jennifer Epstein	M.S., Biological Sciences Collection and analysis of water samples for multiple parameters	7
Dan Shapley	Collection and analysis of water samples for presence of pathogens	3

14 Assessments and Oversight

Assessment Type	Frequency of Assessment	What Is Being Assessed	Who Will Conduct the Assessment	How Issues or Deviations Will Be Addressed
Sampling protocol	Each sampling date	Sample container and transport Sample volume Record of sampling time	Riverkeeper Staff	Personal communication with field personnel
Data transcription	Each sampling date	Verification of field data sheets against sample trays Completeness and accuracy of online data Accuracy of water quality rating	Citizen Science Manager	Correct errors

NEIWPCC may implement, at their discretion, various audits or reviews of this project to assess conformance and compliance to the Quality Assurance Project Plan in accordance with the NEIWPCC Quality Management Plan.

15 Data Management

Laboratory Data:

Trained Riverkeeper staff will count the number of large and small fluorescing wells on the Enterolert trays and record the corresponding Entero count from the IDEXX MPN table after accounting for dilution factor. Results will be written on datasheets.

Original or scanned data sheets will be delivered to the Citizen Science Manager, who will transcribe all results into a digital spreadsheet and upload the data to the Riverkeeper website. A minimum of 10% of sites will be checked online for accuracy immediately after uploading.

Field data sheets will be scanned and saved on Riverkeeper's server and original paper copies will be stored. Riverkeeper's server is backed up regularly.

16 Data Review and Usability Determination

16.1 Data Checks

Field/Lab	Data Management
• Check blank and duplicate sample results • Check rating errors	• Retrieve and/or document missing data • Correct errors • Compile master data spreadsheet

Deviations from established QA procedures will be discussed among the Riverkeeper project staff. Data usability will be determined on a case-by-case basis.

At the end of each year's sampling period, after all data have been entered, 3% of data lines in the master spreadsheet (cumulative going back to 2010) will be selected at random to check for data entry errors. A data line contains all data recorded for a given sampling site (date, time, Entero count). The values in the master spreadsheet and the Riverkeeper website for each entry on the selected data lines will be verified against the field data sheets. If discrepancies are found, the data lines for the rest of the samples collected on that date will also be verified. The number of data lines per year will be checked to ensure that there are no missing data lines. Any errors will be corrected in the master spreadsheet, any summary spreadsheets, and on the Riverkeeper website.

17 Reporting

Data will be uploaded to the Riverkeeper website (http://www.riverkeeper.org/water-quality/locations/) promptly after each sampling date.

The Citizen Science Manager will report the results of data checks to the Boat Captain/Water Quality Program Director each year after the close of the sampling season. Program staff will make data usability determinations on a case-by-case basis.

A summary of data usability determinations will be submitted with the quarterly project report to NYSDEC/NEIWPCC that follows the close of the sampling season.