

Passaic River Educational Environmental Monitoring Organization
Quality Assurance Project Plan
September 17, 2007

Project Name	Passaic River Educational Environmental Monitoring Organization
Agency	Passaic River Institute, Montclair State University, 1 Normal Ave. ML 116, Montclair, NJ 07043. web: www.csam.montclair.edu/pri
Program Managers	Dr. Kirk R. Barrett, PE, PWS, Director phone: 973-655-7117 fax: 973-655-6810 email: kirk.barrett@montclair.edu

APPROVALS

Kirk R. Barrett

Program Manager Kirk Barrett 9/17/07

Kevin Olsen
Program QA/QC Officer Kevin Olsen 9-18-07
Date

Teresa Ippolito
EPA Project Officer Teresa Ippolito 9-24-07
Date

Paula Zevin
EPA Region 2 Representative Paula Zevin 09/19/07
Date

Table of Contents

1	TITLE AND APPROVAL SHEET
2	TABLE OF CONTENTS
3	DISTRIBUTION LIST
4	PROJECT/TASK ORGANIZATION
5	SPECIAL TRAINING NEEDS/CERTIFICATION
6	PROBLEM DEFINITION/BACKGROUND
7	PROJECT/TASK DESCRIPTION
8	QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA
9	NON-DIRECT MEASUREMENT (SECONDARY DATA)
10	FIELD MONITORING REQUIREMENTS
11	ANALYTICAL REQUIREMENTS
12	SAMPLE HANDLING AND CUSTODY REQUIREMENTS
13	TESTING, INSPECTION, MAINTENANCE AND CALIBRATION REQUIREMENTS
14	DATA MANAGEMENT
15	ASSESSMENTS/OVERSIGHT
16	DATA REVIEW, VERIFICATION, VALIDATION AND USABILITY
17	REPORTING, DOCUMENTS AND RECORDS
18	REFERENCES

Distribution List

1. Dr. Kirk R. Barrett, PE, PWS, Director, Passaic River Institute, Montclair State University, 1 Normal Ave. ML 116, Montclair, NJ 07043, phone: 973-655-7117 fax: 973-655-6810 email: kirk.barrett@montclair.edu
2. Dr. Nicholas Smith-Sebasto, Montclair State University, smithseban@mail.montclair.edu, 973-655-7284
3. Dr. Katherine Herbert, Montclair State University, herbertk@mail.montclair.edu, 973-655-5398
4. Mr. Kevin Olsen, Montclair State University, olsenk@mail.montclair.edu, 973-655-4076
5. Mr. Billy Goodman, Passaic Valley High School, Little Falls, NJ, bgoodman@nasw.org, 973-746-7325
6. Mr. Brian Svetz, Wallington High School, Wallington, NJ, svetz@wboe.org, 973-471-2389
7. Mr. Louches Powell, Barringer High School, Newark, NJ, lpowell@nps.epals.com, powell905@verizon.net, 973-517-7773
8. Mr. Sam Huber, Newark Academy, Livingston, shuber@newarka.edu, 973.992.7000

4. Project/Task Organization

List key project personnel and their corresponding responsibilities.

Name	Project Title/Responsibility
Dr. Kirk Barrett	Project Manager
Mr. Kevin Olsen	QA/QC Manager
Dr. Nicholas Smith-Sebasto	Environmental Education Specialist
Dr. Katherine Herbert	Information Technology Specialist
Mr. Billy Goodman	Environmental Science Teacher
Mr. Brian Svetz	Environmental Science Teacher
Mr. Louches Powell	Environmental Science Teacher
Mr. Sam Huber	Sustainability Coordinator

5 SPECIAL TRAINING NEEDS/CERTIFICATION

Each participating teacher will attend a workshop for training in water quality monitoring and macroinvertebrate sampling and identification. The workshops will be run by leaders contracted to do so by the New Jersey Department of Environmental Protection's Environmental Education Program.

6. PROBLEM DEFINITION/BACKGROUND

The Passaic River winds for some 80 miles through northern New Jersey, starting in Morris County near the town of Mendham, and ending at Newark Bay. Along its way, the character of the River, its banks and local watersheds change dramatically. This project will monitor the chemical and biological quality of the River along the headwaters-to-bay gradient, in a school-based, education-oriented program.

The primary intended usage of the data is for education of the students that are conducting the monitoring. The data may possibly be used to notify and educate the communities around the schools about the quality of the water. It may possibly be used identify areas with poor water quality that could be targeted for further study, either by the project participants or others.

7. PROJECT/TASK DESCRIPTION

This project will bring together a diverse set of schools within New Jersey's Passaic River basin to study and monitor river benthic ecology and water quality in the Passaic River near their school, and compare the results with those of other schools. Four high schools will initially participate, nearly spanning headwaters to bay, as depicted in Figure 1. These schools were chosen because they are located within short walking distance of the Passaic River or a tributary water body (where they will conduct their monitoring), eliminating the difficult problem of transporting students.

An interested science teacher at each school has volunteered to be the lead teacher at each school (see project organization). As mentioned above, each participating teacher will attend a workshop for training in water quality monitoring and macroinvertebrate sampling and identification. Each teacher will then lead his class in chemical and biological water monitoring as part of the regular school year curriculum. Each class will be split into 4 to 7 teams of 2 to 5 persons that will conduct monitoring independently. The Passaic River Institute will purchase and distribute the necessary equipment.

Biological sampling of macroinvertebrate will be conducted by each team at each school at least twice, in the fall and spring. Students will identify collected organisms using standard keys for volunteers (eg, the one developed by University of Wisconsin Extension, <http://clean-water.uwex.edu/pubs/pdf/wav.pondkey.pdf>), and classify them into three categories according to their pollution tolerance (sensitive, moderate, and tolerant), generally according to the Izaak Walton League Of America "Save Our Streams" classification method (www.iwla.org/publications/watersheds/01_sosdatasheet.pdf). An overall rating of biological integrity will be computed based on the number of taxa in each category.

Chemical/physical monitoring will be performed by each team at least once per month (ice-free conditions permitting). Standard field variables will be measured, namely, temperature, pH, dissolved

oxygen, transparency and conductivity. Phosphate and nitrate concentrations will also be measured in the field. Samples will be collected for lab analysis for *E. coli*, a bacterium which is an indicator of fecal matter. We also hope to collect additional samples shortly (within 24 hours) of significant rainfall (> .25”).

Each school will also be supplied with a recording (daily) tipping bucket rain gauge and a daily recording min-max thermometer.

All data will be input into a web based system for managing volunteer-collected water quality data, run by the NJ Dept. of Environmental Protection (<http://www.nj.gov/dep/online/>)

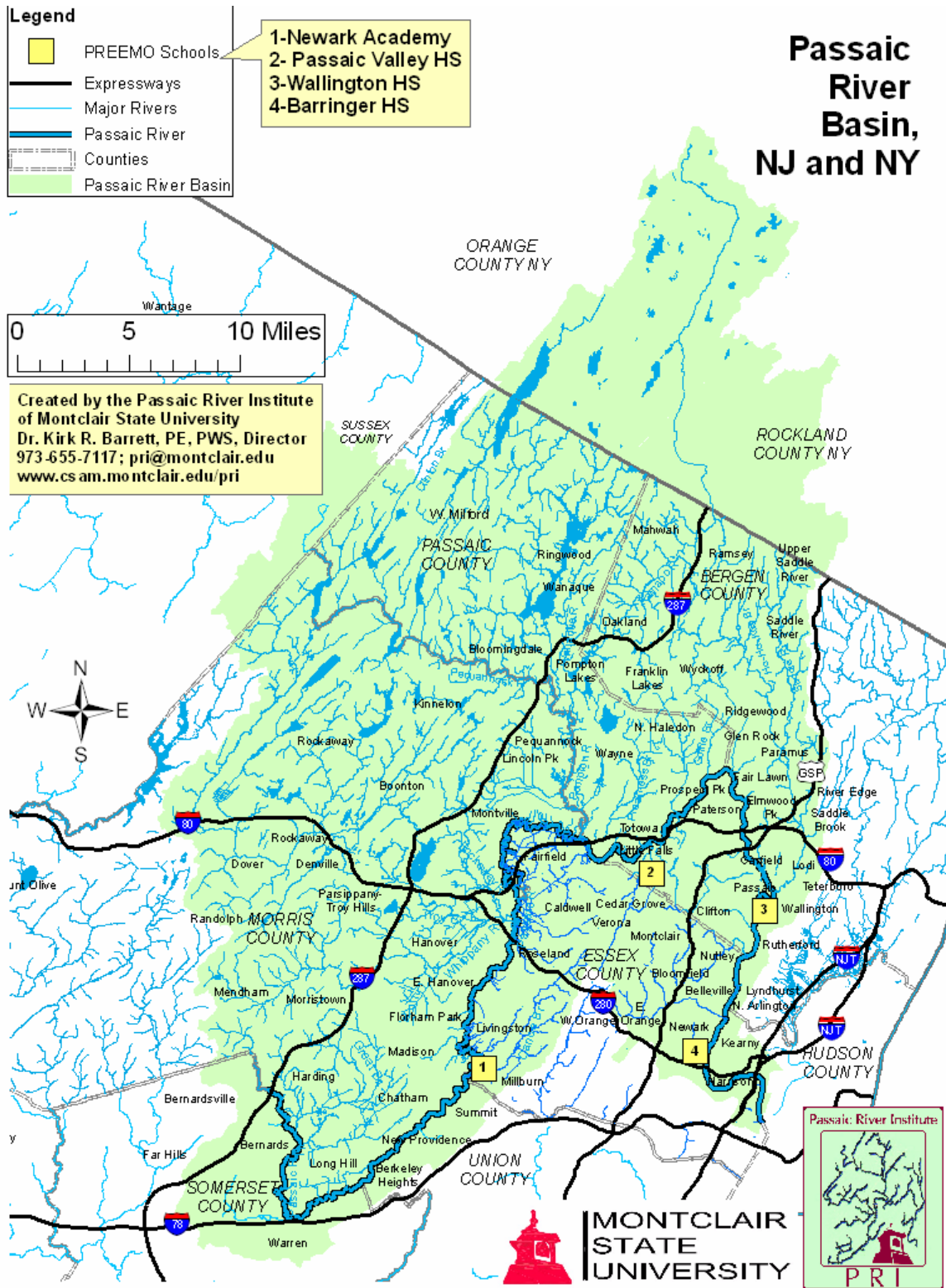
During the course of the school year, each team of students will use the data they collect, along with data collected by other teams and other publicly available environmental monitoring data, in a project of their own choosing. For example, students may investigate relationships between independent variables (e. g., preceding rainfall, water temperature, water level, land use) and dependent variables (e. g., dissolved oxygen, turbidity, nitrogen, phosphorus, conductivity, coliforms). They may also compare conditions between sites.

At the end of the school year, the students will come together for a conference at Montclair State where they will present their findings, compare results, and talk with other students about what the River is like and what it means to their community

The planned project schedule is shown below:

Activity	Approximate Date
1. Project kick-off meeting	July 2007
2. Participating teachers attend training workshops	Summer 2007
3. Monitoring equipment ordered and distributed to teachers	Summer 2007
4. Start-of-school-year participant meeting	Late August 2007
5. Administer pre-project evaluation instruments	September 2007
6. Start Development of the web site	September 2007
7. Monitoring begins	Fall 2007
8. Mid-year participant meeting	January 2008
9. Students start scientific investigations	January 2008
10. Conference planning meeting	March 2008
11. Scientific investigation reports submitted	June 2008
12. End-of-year conference	June 2008
13. Administer post-project evaluation instruments	June 2008
14. Meeting for debriefing and planning for next year	Late June 2008

Figure 1: Schools Participating in PREEMO



8 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

A. Data Precision, Accuracy, Measurement Range

Matrix	Parameter	Measurement Method	Measurement Range	Acceptable Accuracy	Acceptable Precision
Water	pH	pH sensitive paper strips	5-9 su	1.0 su	1.0 su
Water	Dissolved Oxygen	Indigo carmine method (ASTM D 888-87), Chemetrics visual kit	0-20 ppm	2 ppm	2 ppm
Water	Nitrate	Lamotte two-tablet (cadmium-free) system	0-20 ppm	4 ppm	4 ppm
Water	Phosphate	Stannous Chloride method (Std Methods 4500-P D), Chemetrics visual kit	0-5 ppm	1 ppm	1 ppm
Water	Conductivity	Oakton ECTestr 11 electronic probe	0 to 20,000 μ S/cm	100 μ S/cm	100 μ S/cm
Water	<i>E. Coli.</i>	Micrology Labs Coliscan EasyGel	0 – ~10,000 cfu/100ml	1000 cfu/100ml	1000 cfu/100ml
Water	Flow velocity	Float, stop watch and measuring tape	0 – ~5 ft/sec	2 ft/sec	2 ft/sec
Water	Temperature	Alcohol Thermometer	0 - 30 C	2 C	2 C
Water	Transparency	Transparency Tube, 120 cm	0 – 120 cm	20 cm	20 cm
Water	Benthic Macroinvertebrate Community	IWLA SOS method (kick nets and dip nets)	NA	NA	NA
Weather	Daily Precipitation	Tipping bucket rain gage	NA	.1 inches/day	NA
Air	Min/Max Daily Temperature	Digital thermometer	0 – 40 C	2 C	2 C

Data Representativeness

The purpose of monitoring is primarily educational, not to characterize a particular waterbody. or stream reach. Therefore, no claims are made about the representativeness of the data.

Data Comparability

Each school will be using the same equipment and methods to monitor. Therefore, the data should be comparable among sampling events and among sites.

Data Completeness

There are no legal or compliance uses anticipated for the data collected. Therefore, no specific level of completeness is required. At each site, we hope to monitor water chemistry in at least 6 months of the 10 months between September and June; we hope to monitor benthos one time in the fall and one time in the Spring

9 NON-DIRECT MEASUREMENT (SECONDARY DATA)

Some non-direct measurements maybe used to supplement our data and for comparison. Namely, USGS flow and water quality data may be used, as well as NJDEP AMNET stream bioassessment data. All of this data is available through USGS's NWIS (<http://waterdata.usgs.gov/nj/nwis/nwis>) and/or EPA's STORET (www.epa.gov/storet) online data retrieval systems.

10 FIELD MONITORING REQUIREMENTS

Students from each of the four high schools will monitor a waterbody within short walking distance of the school, to eliminate the difficult problem of transporting students (listed with latitude and longitude of their sampling site):

- Newark Academy: Passaic River near South Orange Ave., Livingston, NJ (40°46'45.10"N, 74°22'5.40"W)
- Passaic Valley High School: Peckman River at the end of Hopson Ave., Little Falls, NJ (40°52'52.31"N, 74°13'7.49"W)
- Wallington High School: Passaic River, Main Ave. at Reservoir Ave. in Wallington, NJ (40°51'20.78"N, 74° 6'27.75"W)
- Barringer High School: Branch Brook Park Lake, Branch Brook Park, Newark, NJ (40°45'18.04"N, 74°10'57.02"W)

The supervising teacher at each school will lead his class in chemical and biological water monitoring as part of the regular school year curriculum. Each class will be split into 4 to 7 teams of 2 to 5 persons that will conduct monitoring independently.

Biological sampling of macroinvertebrate will be conducted by each team at each school at least twice, in the fall and spring. The Izaak Walton League of America "Save Our Streams" method will be generally followed. Students will collect invertebrates with kick nets and/or dip nets. The collected

organisms will be identified using standard keys for volunteers (eg, the one developed by University of Wisconsin Extension, <http://clean-water.uwex.edu/pubs/pdf/wav.pondkey.pdf>), and classify them into three categories according to their pollution tolerance (sensitive, moderate, and tolerant), according to the IWLA SOS method (http://www.iwla.org/publications/watersheds/01_sosdatasheet.pdf). An overall rating of biological integrity (excelling, good, fair, poor) will be computed based on the number of taxa in each category.

Chemical/physical monitoring will be performed by each team monthly, weather permitting. Standard variables will be determined in the field, namely, temperature, pH, dissolved oxygen, transparency and conductivity; phosphate and nitrate concentrations will also be determined in the field. Samples will be collected for lab analysis for *E. coli*, a bacterium which is an indicator of fecal matter. Measurement methods are listed in the table above.

The primary field quality control check will be the collection/analysis of samples by multiple teams. These teams will be collecting samples close enough in time and space to be considered pseudo-replicates. We will compare the data from the different teams to assess precision.

The only instrument requiring calibration is the conductivity probe. It will be calibrated at the start of each year, and checked and recalibrated if needed before each use with 1413 $\mu\text{S}/\text{cm}$ standard, purchased from the probe manufacturer.

11 ANALYTICAL REQUIREMENTS

As stated above, we will analyze for these variables in the field: temperature, pH, dissolved oxygen, transparency and total dissolved solids, phosphate and nitrate, using the methods listed in the table above.

E. coli, a bacterium which is an indicator of fecal matter, will be measured using Micrology Labs's Coliscan EasyGel method (http://www.micrologylabs.com/Home/Our_Methods/Coliscan_Easygel).

The primary quality control check will be the collection/analysis of samples by multiple teams. These teams will be collecting samples close enough in time and space to be considered pseudo-replicates. We will compare the data from the different teams to assess precision.

12 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Samples will be analyzed for all parameters (except *E. Coli*) in the field, immediately after collection, by the same team of students that collected the sample.

Sample for *E. Coli* analysis will be labeled with the team number and the date and time of sampling, and immediately placed in a 4 C cooler. The samples will be returned to the lab at the school within 2 hours. Upon return, a member of each team will immediately remove their sample from the cooler and place it on a prepared and labeled petri dishes with the appropriate sample information. The Petri dishes will be left alone to incubate at room temperature for at least 48 hours. At that time, each team will retrieve their own Petri dish and determine the number of *E. Coli* colonies.

13 TESTING, INSPECTION, MAINTENANCE AND CALIBRATION REQUIREMENTS

All equipment will be inspected before each use.

The consumables in the pH, dissolved oxygen, nitrate and phosphate methods will be replaced every August.

The only instrument requiring calibration is the conductivity probe. It will be calibrated at the start of each year, and checked and recalibrated if needed before each use with 1413 $\mu\text{S}/\text{cm}$ standard, purchased from the probe manufacturer.

14 DATA MANAGEMENT

Each team will record their data in the field on data sheets. The teacher at each school will review each team's data sheet for obvious mistakes such as wrong units or values outside of range (See table above).

Within 5 school/working days of sampling, the students will input the data into a web based system for managing volunteer-collected water quality data run by the NJ Dept. of Environmental Protection (<http://www.nj.gov/dep/online/>). This system is used by numerous volunteer monitoring groups in New Jersey.

Copies of data sheets will be mailed or faxed to the project manager within 5 working days of sampling, where they will be stored as a backup record to the online data system. Every month, all data will be retrieved from the online data system, and stored as an electronic file on a PRI computer; this file will also serve as a backup.

Daily rainfall and min/max air temperature will also be recorded on a data sheet and entered on-line, within 2 weeks of data collection.

15 ASSESSMENTS/OVERSIGHT

Methods and data will be assessed throughout the project by the Project Manager (PM) and the QA Officer (QAO). The Project Manager will have monthly discussions with each participating teacher to learn about any problems and to develop a plan to solve the problem(s).

The Project Manager or the QA Officer will compare the results from each school's teams and compute precision for each variable. If a precision violates its data quality objective, the Project Manager will contact the teacher at the violating school to investigate the cause of the violation and develop, if needed, a corrective action, such as conducting more training for the teachers or the students, or replacing some reagents.

16 DATA REVIEW, VERIFICATION, VALIDATION AND USABILITY

As mentioned above, the supervising teacher at each school will **review** each team's data sheet for obvious mistakes or anomalies such as those caused by wrong units or values outside of range. The PM/QAO will further **review** the data sheets submitted by the sampling teams, looking for similar mistakes. If such mistakes are found, they will be flagged with a comment so stating. These values will be investigated further to attempt to determine whether they are an error or "real" results. If the former, the entry will be deleted from the data management system.

The student teams will **verify** their data in the field by checking a box for each variable on the data sheet indicating whether any problems were encountered in implementing the specified method. The data sheet will contain a field to describe the problem if one was encountered.

Using the online data management system, for each sampling foray, the PM/QAO will **validate** the data by first computing mean value for each variable; if a particular value's deviation from the mean is greater than acceptable precision listed in the table, then the entry will be deleted from the data management system.

If a precision violates its data quality objective, the PM will contact the teacher at the violating school to investigate the cause of the violation and develop, if needed, a corrective action, such as conducting more training for the teachers or the students, or replacing some reagents.

The data will then be **reconciled** with the data requirements. The PM will perform a data quality assessment to determine if it can be used for its intended purpose, which is primarily the education of the student monitors. If a data value was obtained using the specified method, falls within its acceptable range, and its precision (as compared to spatially and temporally collocated values) is acceptable, then the data value will be considered useable.

17 REPORTING, DOCUMENTS AND RECORDS

Each team will record their data in the field on data sheets. The teacher at each school will collect and save the data sheets in a 3-ring binder at least until the end of the year. The Passaic River Institute will be receiving copies of these data sheets within several days of sampling. We will save them in a 3-ring binder for at least 3 years.

The data will be entered into the NJDEP's web based system for managing volunteer-collected water quality data, where it will reside and be accessible indefinitely.

Shortly after the end of the project (by the end of 2008), PRI will produce a data summary report, and submit to USEPA.

18 REFERENCES

Izaak Walton League of America. undated. "Save Our Streams" Volunteer Trainer's Handbook. Izaak Walton League of America. 110 pp.