

Quality Assurance Project Plan for Southwest Branch Rancocas *Escherichia coli* Screening Program

Watershed Protection Project 2015-16

Quality Assurance Project Plan Approval

Name: Roland Wall, M.S.
Title: ANS, Principal Investigator
Signature: _____ Date _____

Name: Dr. Richard Horwitz
Title: ANS, Fisheries Principal Investigator
Signature: _____ Date _____

Name: Dr. David Velinsky
Title: ANS, Biogeochemistry Principal Investigator
Signature: _____ Date _____

Name: Dr. Don Charles
Title: ANS, Phycology Principal Investigator
Signature: _____ Date _____

Name: Dr. Jerry Mead
Title: ANS, Geomorphology Principal Investigator
Signature: _____ Date _____

Name: Dr. Stefanie Kroll
Title: ANS, Project Science Director
Signature: _____ Date _____

Name: David Keller, M.S.
Title: ANS, Field Manager
Signature: _____ Date _____

Name: Paula Zelanko, M.S.
Title: ANS, Biogeochemistry Laboratory Manager
Signature: _____ Date _____

Southwest Branch Rancocas Stream Monitoring Quality Assurance Project Plan

This document was prepared to meet Quality Assurance/Quality Control (QA/QC) requirements for The Association of NJ Environmental Commissions bacteria screening component of its Southwest Branch of the Rancocas Septic education project. It documents the standard operating procedures and quality control methods used in monitoring the project area streams. This QA/QC work plan is prepared using as reference the United States Environmental Protection Agency's (EPA) *US EPA Region 2 Guidance for the Development of Quality Assurance Project Plans for Environmental Monitoring Projects* (January 22, 2004) and the Academy of Natural Sciences & Drexel University Quality Assurance Project Plan guidelines.

Contact Information

Name	Program Title/Responsibility
Jody Carrara, ANJEC Coordinator (609)-319-7237	Program Manager
Jody Carrara, ANJEC Coordinator	QA Officer
Jody Carrara, ANJEC Coordinator Cheryl Reardon, ANJEC Coordinator	Field/Sampling Leader
Jennifer Coffey, ANJEC Executive Director Mendham Office: (973)-539-7547	

NJDEP Water Quality/Quality Assurance

Volunteer Monitoring Coordinator-

Signature: _____

Date: _____

Signature: _____

Date: _____

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Project Name: Southwest Branch Rancocas Stream Monitoring Plan/QAPP

Project Duration: Summer 2015-Fall 2016, continuing with volunteers

Project Coordinator: Jody Carrara/Association of New Jersey Environmental Commissions

Partners: Friends of the Black Run Preserve & Evesham Township Environmental Commission

Special Training: This project uses several partners to conduct stream sample collection. Grab sample training for ANJEC coordinator and volunteers will be provided by the Stony Brook-Millstone Watershed Association and the QAPP of the Academy of Natural Sciences/NJDEP will be followed.

Project Description:

ANJEC is educating residents in Evesham Township/Southwest Branch of the Rancocas about septic maintenance and methods to ensure water quality standards are met. Long term stream monitoring for *Escherichia coli*, water chemistry, temperature and stream flow at selected sites, approved by the Academy of Natural Sciences and the NJ Department of Environmental Protection, will help to establish a baseline and measure improvement in water quality as the project progresses. RNA Source tracking of E. coli in sampled “hot spots” will further the projects goals of reducing septic influence on water quality.

In 2014 background information was gathered on the Southwest Branch of the Rancocas and ANJEC met with project partners to explore the Black Run Preserve and environs. Stream monitoring for E coli levels in 2015 and 2016, and resulting data, will engage the municipal officials, residents and further their understanding of the extent and cause of stream degradation. Residents who are members of the Friends of the Black Run Preserve will be trained in stream monitoring according to this QAPP and assist in stream sampling.

Project Area:

The 142-km² Southwest Branch study basin drains parts of Burlington County and a small portion of Camden County. From west to east, the three major Southwest Branch tributaries are the Southwest Branch (including Sharps Run, Barton Run, and Black Run), Haynes Creek (including Kettle Run, Cedar Run, and several unnamed Haynes Creek tributaries), and Little Creek (including Bear Swamp River). Most of the forested land is located in the areas of the Black Run, Kettle Run, Cedar Run, and the headwater areas of Little Creek. A relatively small percentage of the study basin area is agricultural land. (Evesham Environmental Resource Inventory, DVRPC)

Background

Many studies have been conducted to ascertain the health of the Rancocas Creek and tributaries. Variations in water quality as related to land use are documented by Zampella 1994, Dow and Zampella 2000, Zampella et al, 2009. The Pinelands Commission initiated a Long-Term Environmental Monitoring Program and in 2003 supported a study of the Rancocas Basin: “The Southwest Branch study basin had the lowest overall ecological-ratings of the four study basins. The majority of Southwest Branch monitoring sites were characterized by elevated pH and specific conductance values. A comparison of historical data sets with data collected during the Commission’s survey suggests that pH has increased at some Southwest Branch sites during the past thirty years.

Disturbance-indicator plants and other non-Pinelands plant species dominated the vegetation of most Southwest Branch sites. Although biogeography may be partly responsible for these patterns, non-Pinelands vegetation was associated with altered water quality. Nonnative fish species and bullfrogs were also found at most Southwest Branch survey sites. The presence of bullfrogs at Taunton Lake, where they were generally absent thirty years ago, suggests that a dramatic change in conditions at this lake occurred over the last three decades.”

(THE RANCOCAS CREEK BASIN: A REPORT TO THE PINELANDS COMMISSION ON THE STATUS OF SELECTED AQUATIC AND WETLAND RESOURCES, R. Zampella et al, 2003

N. J. A. C. 7:9B, NEW JERSEY SURFACE WATER QUALITY STANDARDS (E. coli)

Statutory Authority: N.J.S.A. 58:10A-1 et seq., 58:11A-1 et seq., and 13:1D-1 et seq.

Re-adopted: November 16, 2009 (41 N.J.R. 4735(a))

Last Amended – April 4, 2011 (43 N.J.R. 833(a))

ii. Primary Contact Recreation:

(1) Enterococci levels shall not exceed a geometric mean of 35/100 ml, or a single sample maximum of 104/100 ml.

(2) E. Coli levels shall not exceed a geometric mean of 126/100 ml or a single sample maximum of 235/100 ml.

iii. Secondary Contact Recreation:

(1) Fecal coliform levels shall not exceed a geometric mean of 770/100 ml.

(2) Fecal coliform levels shall not exceed a geometric mean of 1500/100ml.

2. Dissolved oxygen (mg/L) i. Not less than 7.0 at any time;

**E. Coli parameters for all Fresh Waters in the state (FW2), unless a higher water quality standard is required*

WATER QUALITY MONITORING/NJDEP

The determination of whether or not water quality is sufficient to meet an assessment unit’s designated use(s) is based on testing results from various water quality monitoring networks.

Across the state, NJDEP primarily relies on two water quality monitoring networks: the **Ambient**

Stream Monitoring Network (ASMN) and the **Ambient Biomonitoring Network (AMNET)**. NJDEP runs the ASMN network in cooperation with the U.S. Geological Survey (USGS). This network contains 115 stations that monitor for nutrients (i.e. phosphorous and nitrogen), bacteria, dissolved oxygen, metals, sediments, chemical, and other parameters. AMNET, which is administered solely by NJDEP, evaluates the health of aquatic life as a biological indicator of water quality. This network includes 820 monitoring stations located throughout the state. Each station is sampled once every five years. The first round of sampling for all stations took place between 1992 and 1996 and a second round occurred between 1997 and 2001. A third round of sampling took place between 2002 and 2006. (DVRPC ERI)

Ambient Biomonitoring Network

There are four AMNET stations in Evesham, which are sampled every 5 years. See **Table 14** below. NJDEP most recently sampled the Evesham sites in August 2006. Each AMNET site was tested for the diversity of the aquatic communities at that site – specifically, the benthic macroinvertebrates (bottom-dwelling insects, worms, mollusks, and crustaceans that are large enough to be seen by the naked eye). The numbers and types of species present are directly related to water quality. As the pollution level increases, more sensitive species disappear first, followed by others. As these species “drop out,” the diversity of the community drops as well. Benthic macroinvertebrate sampling is simple and inexpensive, and offers a holistic indication of overall water quality. Sites can be classified as either non-impaired, moderately impaired, or severely impaired for aquatic life support.

Samples were taken in Evesham in July and August 2006. The NJDEP revised the classification system for this round of AMNET samples. The new system divided the state into three geographical areas: High Gradient (above the Fall Line), Low Gradient (Coastal Plain excluding Pinelands), and Pinelands (the boundary of the Pinelands National Reserve plus a 5 kilometer buffer). The new classification system has several benefits. It takes into account that macroinvertebrate communities in New Jersey were shown to have statistically significant differences by geographic region. Additionally, it recognizes that Pinelands streams have low pH and conductivity, which do not resemble high quality streams in other portions of the state. For example, tea-colored streams in other areas might be an indication of poor water quality, but in the Pinelands this is simply reflective of the high iron content of the soil, as well as the tannins released by some forms of vegetation, such as cedars. Finally, the Pinelands Macroinvertebrate Index (PMI) has a finer resolution because it grades on a scale of excellent, good, fair and poor.

AMNET Biological Assessment Score- 2006

Site ID Station Name Score	Waterbody	Impairment
---------------------------------------	------------------	-------------------

AN0162 Elmwood Rd Next to S T P	Southwest Br Rancocas Ck.....	29.71
AN0167 Hopewell Rd Out of Marlton Lk	Kettle Run.....	42.09
AN0165 Braddock Mill Rd UNT(Unnamed Tributary)	Black Run.....	58.17
AN0164 Kettle Run Rd Pipe	Black Run.....	76.61

Source: NJDEP, Bureau of Freshwater and Biological Monitoring

Pinelands Macroinvertebrate Index (PMI) Score Biological Assessment

<34 Poor <56-34 Fair <63-56 Good ≥63 Excellent

The pollutant of concern for these TMDLs is pathogens, the presence of which is indicated by elevated concentrations of fecal coliform and E. coli bacteria.

Evesham NJPDES Permits

Source: NJDEP, DVRPC

Permits for wastewater treatment and discharge, and the facility locations, are important for analyzing water sample test data and the implications. Our project focuses on septic system areas of Evesham Township, however the location of sewer treatment plants is essential to understanding the full picture.

Facility Name	Effective Start Date	Expiration Date	Discharge Category
Status Street Address			
NJ0024031 ELMWOOD STP 260 N ELMWOOD RD	6/11/07	5/31/2012	Wastewater Beneficial Reuse
NJ0024040 WOODSTREAM STP BRANDYWINE DR	11/1/2008	10/31/2013	Sanitary Wastewater
NJG0089842 SUNOCO #4-6284 RT 70 & OLDMARLTON PIKE	1/1/2009	12/31/2013	General Permit GW PetroProd
NJG0110108 OWENS-CORNING KETTLE RUN RD	6/1/2007	5/31/2012	Basic Industrial StormwaterGP
NJG0153451 EVESHAM TWP 984 TUCKERTON RD	9/1/2005	2/28/2009	Tier A Municipal Stormwater
NJG0166014 WOODSTREAM STP BRANDYWINE DR	10/1/2006	5/31/2011	Wastewater Beneficial Reuse
NJG0172278MONROE OFFICE PK 150 EVESBOROMEDFORD RD.	10/1/2008	9/30/2012	Dental Facilities (GP)

SELECTED WATER QUALITY MONITORING SITES

The following sites, not located in Evesham's Sewer Service Area, will be monitored according to Academy of Natural Sciences Drexel University/NJDEP QAPP. These sites were chosen to ascertain the efficacy of septic management in the watershed area. Stream data and lab results will be collected in a log book and shared with the municipal partners, Kirkwood-Cohansey Cluster partners, NJDEP and entered into the ANSDU computer data bank.

This project will monitor the amount of E. coli in the selected streams, with the ambition of identifying the species responsible for elevated counts in the future, as conditions at the monitoring sites become better known. Specific stream locations were chosen by location outside of the sewer service area and also for their distance from roadways and immediate storm water runoff.

Black Run

Address to Black Run Preserve Parking: 400 Kettle Run Road, Evesham, NJ

Lat: 39.844561N

Long: 74.897185W

GPS: TBD

Location: Follow Kettle Run Road entrance to the Black Run Preserve Trail, follow trail to the right through the Black Run Preserve to the first bridge

Habitat: Deciduous wetland and upland forest: Black Gum-*Nyssa sylvatica*, Black Willow-*Salix nigra*, Red Maple-*Acer rubrum*

Bartons Run

Address of bridge: 133 Taunton Lake Road, Marlton, NJ

Lat: 39.866322N

Long: 74.892025W

GPS: TBD

~133 Taunton Lake Road- at Bridge

lawns, deciduous forest Habitat TBD

Dutch Road/ Barton Branch

Address: (approximate at bridge)239 Dutch Road, Marlton, NJ

Lat: 39.859572N

Long: 74.905346W

GPS: Residential lawn

Dutch road, second bridge, septic, horses Habitat TBD

A well-documented area/landmark/location has been mapped for easy replication of the same sampling spot over the span of many years.

Please see the Appendix for map of sites

MONITORING TIMETABLE

E. coli monitoring and visual assessments are conducted in the months of May, June/July and August with 5 samples collected per site per month. Two samples will be collected on one day and one sample on the other 3 days of the month. Samples are collected on the first Monday of the month, weather permitting, first clear day thereafter. Lab test results and streamside assessment sheet data will be submitted to ANSDU database in Excel format the month following sample collection.

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Volunteer Training	As needed											
Bacteria Sampling					X	X	x	X				
Data Reporting							X		X			

MEASUREMENT QUALITY OBJECTIVES

The following table illustrates the precision, accuracy, and measurement range for the monitoring program's temperature measurements and sample collection.

Matrix	Parameter	Precision	Accuracy	MR*
Ambient Air	Temperature**	+20%	+0.5 °C	-5.0 to 50.0 °C
Water	Temperature**	+20%	+0.5 °C	-5.0 to 50.0 °C
Water	E. coli	Lab Certified		

* MR = Measurement Range

INTENDED USE OF DATA

ANJEC has the following program goals:

1. To characterize the water quality and E. coli counts in the Southwest Branch of the Rancocas
2. To involve citizens in observing, monitoring, recording, and reporting stream conditions;
3. To motivate the public and local decision-makers to initiate change in their use of the land and septic management that will enhance water quality; (Evesham Township & Medford Lakes)
4. To provide data to the Academy of Natural Sciences & New Jersey Department of Environmental Protection; and
5. To identify areas where there are significant bacteria problems and more intense/species specific monitoring of fecal coliform should be performed.

DOCUMENTATION & RECORDS

Each field data sheet must be completed on-site at the time sampling occurs. These sheets are used to record information on ecological conditions as well as any unusual occurrences found. A sample data sheet is included in Appendix A. Data sheets are returned to the project coordinator along with water samples for transport to lab. A log book of sampling dates, data and eventual lab results will be kept by the project coordinator. A chain-of-custody form, included in Appendix D, is completed when the sample is transferred from the volunteer(s) to the Project Coordinator and delivered to the lab. Water samples will be hand-carried to a New Jersey Certified Lab i.e. NJ Analytical by Jody Carrara or ANJEC designee.

WATER SAMPLE COLLECTION OVERVIEW

Water chemistry will be sampled during the summer season of 2016. The following sample identifiers/samples/parameters will be collected/recorded at all sampling sites:

1. Sampling site location: stream name, station number, specific location (distance upstream or downstream of bridge, road, town, or other landmark), and latitude/longitude at the downstream point of the study reach.
2. Collection date and time, names of collectors.
3. Site physical conditions: width, depth, current speed, substrate type, canopy cover
4. Water chemistry per YSI meter: Dissolved Oxygen (DO), pH, Conductivity, Temperature
5. Biological assemblages: visible when collecting a grab sample
6. Photographs taken up- and downstream of collecting site and photograph number(s) recorded. Water chemistry samples collected, and on-site data recorded, as listed in the ANSDU protocol

EQUIPMENT NEEDS

YSI Multiprobe 2030-/shipped from YSI
100 foot tape measure
3 pairs of knee high boots
Nitrile/latex gloves (3 streams, 13 volunteers) ~100 pairs of gloves
Stainless Ruler
field data book
permanent black ink pen
Deionized Water (for blank water test)
Large Zip Lock Bags
Disinfecting wipes
Mosquito repellent
Chest Waders

SAMPLE COLLECTION PROCEDURE

Water should be collected at the downstream portion of the study reach before anyone has entered the stream. If any portion of stream reach is disturbed, samples can be taken from the

top of the reach. A clean pair of latex or nitrile gloves must be put on at the beginning of each sample collection. All sterile collection equipment will be provided by the NJ State Certified Lab. One sample at each site, as well as blank and duplicate samples will be collected at the rate indicated below, and placed on ice for transport to lab. If conditions are encountered where the above method of sample collection is considered to be dangerous (e.g., during high flow events), a modified technique will be used which samples will be composited from subsamples taken at representative depths and locations along the stream transect. Three sites @ 1 sample per day, (2 samples (duplicate) per site on one day of the month to complete 5 sample per month schedule.) The first day of sampling season field staff will collect one field blank. Thereafter, each group of 15 samples per month will also contain one duplicate and one blank.

At the beginning of the project, and at the end of each sampling day, the YSI Multiprobe will be calibrated per manufacturer's directions as needed. Sterile collection bottles from the laboratory will be retrieved each day and returned after sample collection to the lab. Multiprobe and equipment will be cleaned, dried and then placed into new plastic Zip-Loc bags for storage.

Blank and Duplicate Collection: Two types of blanks will be collected during the project.

One equipment blank, containing Deionized Water, will be collected as well as one field blank on the first day of collecting during the summer:

- 1) Equipment Blank: Collected between sites on the same day at a rate of 1 blank per 10 samples. Rinse sampler three times with DIW, then rinse the inside of the sampler with DIW into the sample bottle enough times to eventually fill the bottle. Place cube on ice.
- 2) Field Blank: Collected at the beginning of the first field day. Rinse sampler three times with DIW, then rinse the inside of the sampler with DIW into the sample bottle enough times to eventually fill the bottle. Place cube on ice.
- 3) Duplicate: Collected at the same time as sample at a rate of 1 duplicate per 10 samples.

Sample Preservation: Sterile laboratory bottles containing water samples must be kept at 4 degrees Celsius (± 2 degrees Celsius) after collection until received by the lab. The samples will be returned to the lab on the same day as collection.

Guidelines for measurement of physical/streamside chemical parameters (Tier 1)

Dissolved Oxygen: Measured with a YSI 6000DM or equivalent sensor *in situ* 1 m below water surface or just below the water surface in riffles.

pH: Measured with a YSI Multi Probe or equivalent sensor *in situ* 1 m below water surface or just below the water surface in riffles

Conductivity: Measured with a YSI Multi Probe or equivalent sensor *in situ* 1 m below water surface or just below the water surface in riffles.

Temperature: Measured with a YSI Multi Probe or equivalent sensor *in situ* 1 m below water surface or just below the water surface in riffles.

Speed of current: Where feasible, current speeds will be measured with a pre-calibrated current meter (e.g., Global Water Flow, Swoffer, Marsh-McBirney). All current meter calibration data will be recorded.

When pre-calibrated current meters are not available, or meaningful current speed measures cannot be obtained using a current meter (e.g. very shallow water), surface current speed will be measured by timing floating objects over a fixed distance. Portions of wooden tongue depressors or similar low profile floating objects will be timed over a distance of one or more meters, and converted to centimeters per second. Alternately, floating debris may be measured over a distance of one or more meters and converted to centimeters per second. Timing is done with a digital stopwatch accurate to 0.1 second. Speed of current measured in this way will be considered Tier 2.

Depth: Depth will be measured using a stainless steel rule. Measurements will be taken to estimate the undisturbed water surface (typically the downstream side of the rule), i.e., the increased depth on the upstream side of the rule will not be included. Accuracy will be to one cm.

http://www.state.nj.us/dep/wms/bwqsa/vm/docs/visual_manual_2011.pdf

Cluster groups will follow the New Jersey Department of Environmental Protection's "Stream Monitoring Manual" in accordance with the NJDEP Volunteer Monitoring Program, and will fill out and submit the manual's Visual Assessment section. Visual stream assessments will be conducted over a 100-meter long stream reach in order to estimate substrate composition, channel morphology, canopy and riparian zone cover. The entire length of the reach must be walked prior to filling out any of the assessment forms (which should be done after sampling any fish, macroinvertebrates or algae). For the intents and purposes of this project, the left and right banks of the stream will be determined by looking **downstream**, not upstream as the "Stream Monitoring Manual" indicates.

General Sheet. Site identification data, survey team, date, time of day and weather conditions. The assessment also entails estimates of water conditions (odor, turbidity, surface coating and stream flow) and descriptions of stream characteristics (woody debris, aquatic vegetation, algae, litter and structures). The General Assessment sheets also ask for notes on land use characteristics and general observations about flora and fauna at the site. Finally, a site sketch should be drawn which includes such information as stream flow, roads, sampling locations, and photo and GPS references.

Pipe & Drainage Ditch Sheet. Make note of any pipes within the reach, and describe its size, type, location, flow and the condition of the stream both at the pipe and downstream of it.

Stream Flow Worksheet. First measure the width and depth of random areas throughout a 20-foot length of the stream to determine an average width and depth, and then time how long it takes an object (such as a stick, leaf or ball) to float down the 20-foot stream section. These

measurements will then be used to calculate the area of the stream section in cubic feet, and then, the velocity (or flow) of the stream in cubic feet per second.

Literature Cited & Reviewed

Environmental Resource Inventory for the Township of Evesham, 2009. Delaware Valley Regional Planning Commission
<http://www.evesham-nj.org/pdf/ERI.pdf>

Dow, C. L. and R. A. Zampella. 2000. Specific conductance and pH as indicators of watershed disturbance in streams of the New Jersey Pinelands, USA. Environmental Management 26:437-445.

Zampella, R. A. 1994. Characterization of surface water quality along a watershed disturbance gradient. Water Resources Bulletin 30:605-611.

Zampella, R. A. and N. A. Procopio. 2009. Landscape patterns and water-quality relationships in New Jersey Pinelands streams. Pinelands Commission, New Lisbon, New Jersey, USA.

N. J. A. C. 7:9B

Surface Water Quality Standards

Statutory Authority: N.J.S.A. 58:10A-1 et seq., 58:11A-1 et seq., and 13:1D-1 et seq.

Re-adopted: November 16, 2009 (41 N.J.R. 4735(a))

Last Amended – April 4, 2011 (43 N.J.R. 833(a))

Pinelands Commission Comprehensive Management Plan- Specifically: PART VIII-WATER QUALITY

<http://www.state.nj.us/pinelands/cmp/CMP.pdf>

Pinelands Commission Proposed Amendment to the Comprehensive Management Plan-Power Point Evesham-Medford Conservation Plan

[http://www.state.nj.us/pinelands/landuse/recent/medeves/Black%20Run%20Presentation%20\(3.27.2015\)\(REVISED\).pdf](http://www.state.nj.us/pinelands/landuse/recent/medeves/Black%20Run%20Presentation%20(3.27.2015)(REVISED).pdf)

APPENDIX

A1

SW Rancocas Stream Monitoring

Submission ID _____

General Sheet

* Site Name/ID #: _____ * Watershed Management Area: _____

* Waterbody Name: _____ * County: _____

* Segment Identification

Beginning at Latitude/Longitude: _____

Estimate of Segment Length (aim for 100m): _____

* Survey Team: _____

* Time: _____ * Date: _____

* Today's Weather: Clear Partly Cloudy Overcast Light Rain Steady Rain Heavy Rain Snow Heavy Snow Melt

Air Temperature: _____

Water Temperature: _____

Water Depth: _____

Days since last rain: _____

Meter Readings: DO _____ Conductivity _____ pH _____

Water Conditions: Circle the term that fits best for each category.

Odor: _____ Normal Sewage Petroleum Chemical Anaerobic
(rotten eggs) Other

Turbidity: _____ Clear Slightly turbid Turbid

Surface Coating: _____ None Oily Foam Scum Other

Stream Flow: m/sec _____ Slow Moderate Swift Combination

Assessment Sheet Land Use Characteristics- check the features present within viewing distance of the water

Residential	Mines/Quarries	Poultry
Recreational	Construction	Commercial
Agricultural	Anglers	Roads
Industrial	Livestock Use	Trash/Litter
Houses	Odors (from facility)	Feedlot
Hiking Trails	Pipes, Drains	Evidence of Fire
Cropland	Golfing, Resorts	Bridges/Causeways
Industrial Plants	Orchards	Water Withdrawal
Maintained Lawns	Power Plants	Logging
Parks, Campgrounds	Dumping	Sewage Treatment
Pasture	Marinas	

Comments: _____

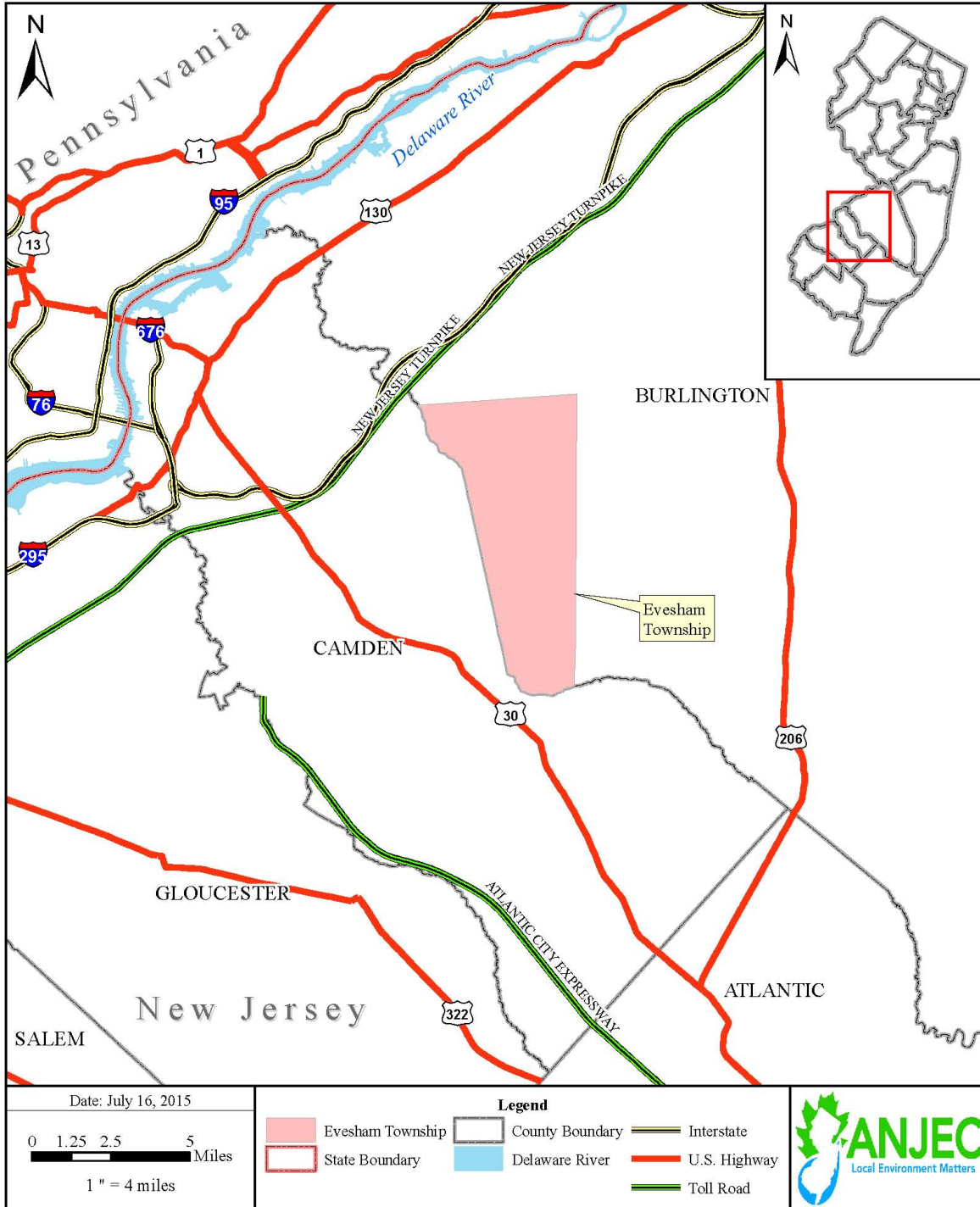
A2

Site Sketch: Include stream flow, roads, sampling locations, riffles, pools, runs, ditches, riprap, outfalls, photo and GPS reference #

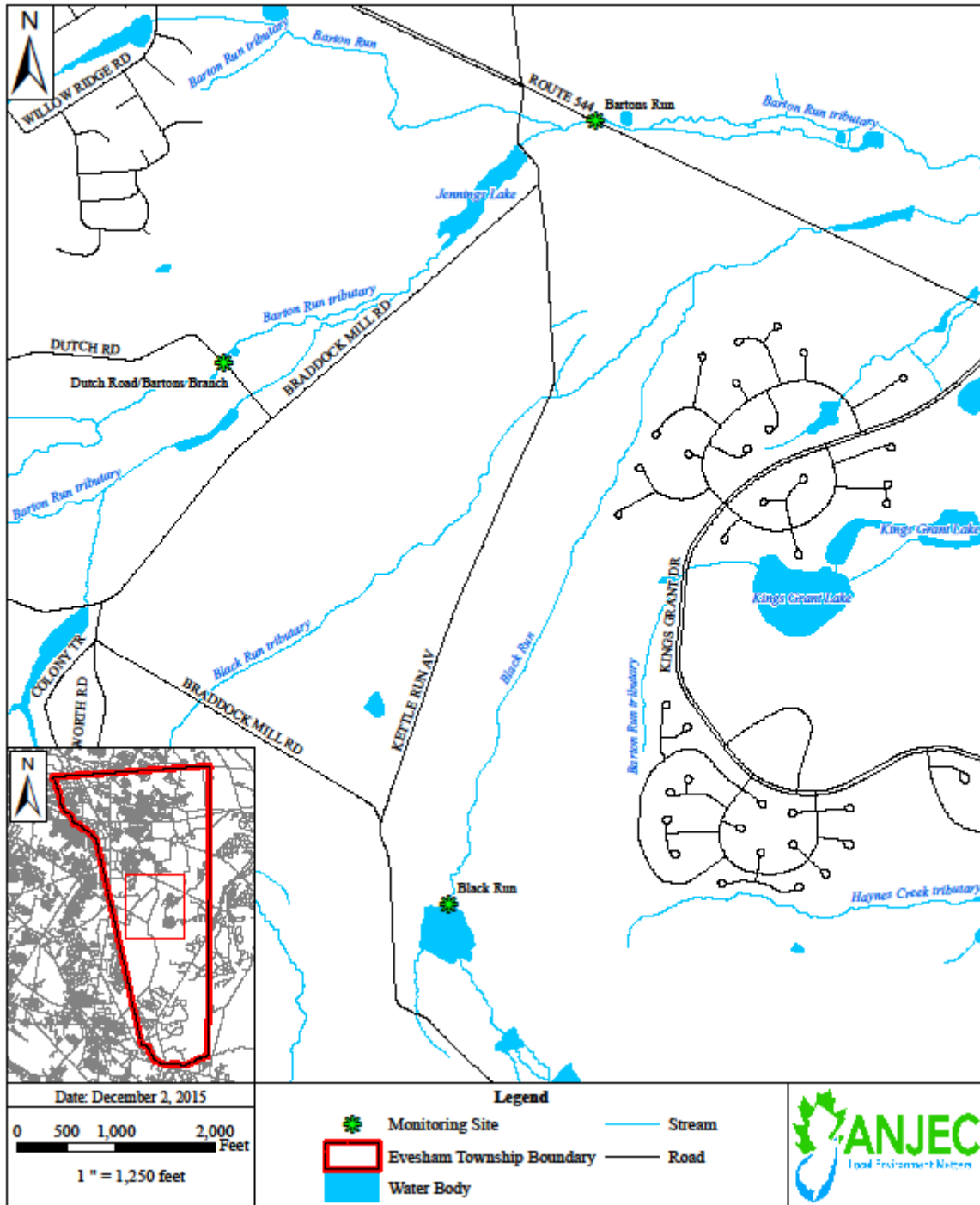
Site Sketch:

B

*Evesham Township, New Jersey
Location Map*

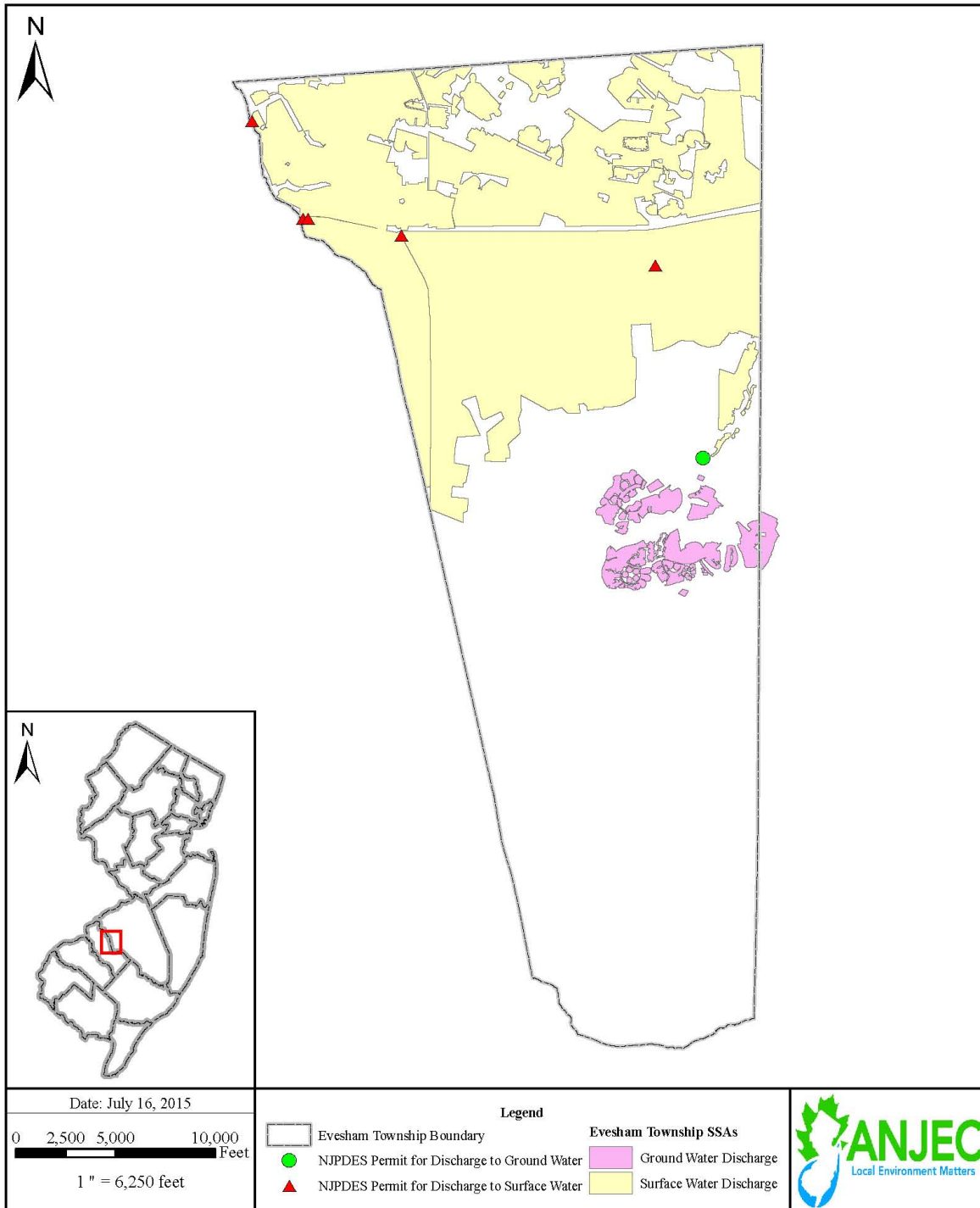


Evesham Township, New Jersey
Monitoring Sites with Streams & Water Bodies Map



D

*Evesham Township, New Jersey
Sewer Service Areas (SSAs) & NJPDES Permits Map*





Evesham Township, New Jersey
Monitoring Sites with Wetlands & Landscape Project Habitats Map

