Citizen Volunteer Scientist Participation in Monitoring Stormwater Discharges in NH Seacoast Municipalities

Chapter 2

MANUAL for Project-Specific: TRAINING PROCEDURES, FIELD SAMPLING, SAMPLE PROCESSING AND ANALYTICAL METHODS

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Chapter 2

MANUAL for Project-Specific: TRAINING PROCEDURES, FIELD SAMPLING, SAMPLE PROCESSING AND ANALYTICAL METHODS

INTRODUCTION

This manual contains project-specific procedures for training volunteers, field sampling, sample storage, sample processing and analytical methods. As the project progressed, printed instructions for many of the tasks involved in the monitoring were revised as volunteers became more familiar with how meters worked and how to collect samples. The initial versions used during training, and the final revised versions of these instructions are included in this manual.

The project began with a training session for volunteers. Two weeks later volunteers were involved in field site inspections on consecutive days, when each team visited all potential sampling sites to inspect the pipe outfall and see if there was flowing discharge and whether the site was safely accessible for sampling. The first sample dates began the next week, starting with a thorough in-field training for all team members on safety, how to use the meters, detection kits and sample collection procedures. Volunteers were actively involved thereafter in all tasks, including sample collection, field measurements, sample storage and processing, field QA/QC procedures, site characterization and data recording. Only a few volunteers became involved with laboratory sample processing at the Jackson Estuarine Laboratory.

TRAINING PROCEDURE

A training workshop was scheduled prior to the beginning of the sampling schedule. The training was held at the UNH Jackson Estuarine Laboratory (JEL). A total of 22 volunteers were trained that day, and the Project PI was joined in supervising and training volunteers by Dari Ward, the UNH Marine Docents coordinator, Ted Walsh from NHDES VRAP program, Jean Eno from WRWC, and James Houle and Mindy Bubier from the UNH Stormwater Center. Volunteers were briefed on the purpose of the project and trained in sampling methods, field safety considerations, site and weather condition characterization and documentation, meter calibration and field measurements, and sample processing in the lab. Volunteers were also trained each time they went out into the field for sampling, until they knew how to conduct the different tasks involved in the project, and even thereafter as new conditions and problems arose.

The following seven pages are the agenda and training protocols for the March 7, 2012 training workshop.

CRV Training Session
STORMWATER MONITORING

March 7, 2012

Jackson Estuarine Laboratory

NH Sea Grant & JEL	Steve Jones & Dari Ward
UNH Stormwater Center	James Houle & Mindy Bubier,
NHDES VRAP Program	Ted Walsh

TRAINING SCHEDULE

9:00 Introductions, handouts & review of schedule
9:05 Presentation on stormwater problems in the New Hampshire Seacoast
9:10 Introduction to NHDES VRAP projects
Introduction to UNHSC Stormwater Center Dover Project
Review of Exeter/Greenland Stormwater Project

9:30 Laboratory review of field instruments, calibration and analysis kits
YSI 85, turbidity & pH meters; GPS
Total chlorine kit

9:50 Field demonstrations
Safety
Dry & wet weather
Instrument and kit use
Site description, conditions and data recording, flow rate

10:15 Laboratory sample processing & QA
End of day instrument checks
Bacterial indicators
Other lab analysis parameters
10:25 Wrap up

CRV: PROJECT ORGANIZING

10:30-11 organize into teams!

2 each for Exeter, Greenland & Dover
leaders and contacts
Schedule sampling dates for Greenland & Exeter
schedule follow up meeting for Dover project details
field kits

Review of Exeter/Greenland Stormwater Project

Background
- MS4 requirements
- Parameters (required and potential) and water quality standards
- Storm sewer map

Sites and required measurements
- Prioritized drains and affected receiving waters
- Frequency of sampling: repetition, new sites
- Parameters to be measured, baseline and potential

Tasks for volunteers
- Initial site visit & characterization
- Sampling preparation
- Sampling
- Analysis
- Data management
- Outreach

Questions and comments

CRV ProgramStormwater Monitoring Handouts

Procedures, Supplies & Equipment

Lab preparation

Check weather, time of low tide, and determine antecedent rainfall (previous 48 h)
Label sampling bottles, include QA sample bottles
Calibrate instruments: YSI meters, pH meter, turbidity meter
Maps, directions, order of site visits
Meeting place and TIME!, contact information, cell phones

Field equipment

Field gloves and eye protection
Hand sanitizer
Clipboards and pens
Label tape and markers
Data sheets: Field data sheet & Site description data sheet
Cooler and ice packs
Field meters and kits
Kimwipes
Sample bottles: Bacteria (sterile); Nutrients (acid washed); Ions: Cl^-, K^+ Other
Flow measurement: stop watch, large and small plastic graduated cylinders, tape measure

Field sampling protocol

Safety first!
Observe and record site conditions, evidence of flow and contamination source
Label all sample bottles with: SITE, DATE, TIME, ANALYTE, INITIALS OF SAMPLER

Use gloves and eye protection
Direct sampling: collect sample from outfall flow directly into sample containers
Indirect sampling: collect sample into large bucket, by scoop to bucket, bucket on rope
If appropriate, sample downstream first and work upstream to minimize disturbance
Collect water samples first
Clean outer surface of bottles before storing in cooler for transport to lab
Decontamination procedure for sampling device

Pool sampling: collect samples below discharge and upstream if appropriate

Store samples in cooler with ice packs

Read instruments: place DO probe into sample bucket immediately and allow stabilization
Collect small sample for chlorine (and potentially surfactant) kit analysis
Collect small samples and read pH and turbidity
Record all data onto field data sheet

Use of YSI DO meters/probes

A: CALIBRATING OPTICAL YSI DO PROBE
-Moisten sponge in the cal/transport sleeve with enough DI water to moisten it and install probe.
-Turn on power and wait 5 minutes
-Press Calibration ("Cal") then highlight "DO" and press "ENTER"
-Highlight "DO%" and press "ENTER"
-Once DO and Temp are stable (~30 sec) highlight "Accept Calibration" and press "ENTER"
-If taking reading on brackish (salty) water, enter salinity value in "Probe" menu.

MEASURING DO WITH OPTICAL YSI PROBE
-Insert probe into sample and move probe enough to release air bubbles
-Wait ~25-35 sec for reading to stabilize
-Record DO% then DO concentration readings

B: CALIBRATING YSI 85 DO METER
-Acclimate probe to water temperature conditions where sampling will take place (in water)
-After 10-15 minutes or length of time necessary for acclimation, remove probe from water
-Moisten clean cotton towel with water to be tested several times until towel at same temperature
-Wring out towel and wrap probe in towel
-Press both arrows simultaneously, hit ENTER, then once DO% reading stabilized, hit ENTER

MEASURING DO WITH YSI 85 METER
-Dip probe into water and 'tea bag' probe to keep prevent DO consumption affected reading
-Record DO% reading when it stabilizes
-Immediately switch MODE and record DO concentration reading

Use of turbidity meter → *Ted Walsh procedure*

Use of ph meter → *to be determined*

LABORATORY PROCESSING

Supplies
Lab notebook
Definite parameter analyses
    Bacteria
    Nutrients: Total-N and ammonia-N
    Chloride
(Potential)
    Potassium
    Chlorophyll a
    Optical brighteners, BOD, total suspended solids
Filtration funnel and filtrate collection flask
Filters, graduated cylinders, forceps, alcohol burner, Al foil

**Label all sample bottles with:
    DATE, SITE, TIME OF SAMPLE, ANALYTE, INITIALS OF SAMPLER
Store samples as required: frozen, refrigerated

Procedure

Bacteria:
    Shake bottle 20x
    Measure appropriate volume (TBD) of sample into graduated cylinder
    Sterilize forceps by dipping end into alcohol then flaming the end
    Place sterile membrane filter onto sterile filter tower, gridded side up, with sterile forceps
    Pour measured volume of sample into filter tower and turn on vacuum pump
    When sample is filtered, turn off pump and remove filter by grabbing unexposed edge with sterile forceps and rolling filter onto the surface of the agar media surface in the petri dish

    Continue with different volumes, then different samples
    When all samples are filtered, place Petri dishes of the different media into the correct incubator

    Clean glass and plastic ware, dispose of wastes

SITE INSPECTION

Prior to initiating sample collection and water quality monitoring, a meeting was held in each town to describe the project goals and objectives, go over field procedures and organize the volunteers. The team then visited the proposed study sites to inspect the pipe outfalls to see if there was flowing discharge and whether the site was accessible for sampling. Safety hazards were also noted, including poison ivy, slippery conditions, traffic, mosquitoes/ticks, and any other condition that would justify extra care. Sites were accepted or rejected and a final sampling plan was formulated. This initial site inspection took place just as winter ended and, as expected, conditions changed at study sites as insects emerged and plants like poison ivy grew.

The final sites represented a variety of types of pipes in different settings in both towns. The pipe condition, pipe and site characteristics, and pictures of the pipes and sites were recorded during these initial site inspections and the information used as a reference during ensuing visits.

FIELD SAMPLING

To enable the Project PI to be present at each sample event, volunteers were assembled into two teams, one for each town. There were seventeen volunteers that participated in monitoring in Exeter, and eleven in Greenland. Volunteers included CRV Program volunteers from around the Seacoast region, and local volunteers. The sampling schedule in the two towns was on consecutive days every two weeks (Table 1). In Greenland, the team was able to sample from all seven sites on each sample date. In Exeter, sites were separated into two groups of six, one on the east and one on the west side of town, and the two groups of sites were sampled every other sample date.

LOCATION	DATE/DAY	ACTIVITY
JEL	March 7, 2012	Training workshop
Greenland town office and sampling sites	March 20, 2012	Project introduction, meter use dry run and site inspections
Exeter town office and sampling sites	March 21, 2012	Project introduction, meter use dry run and site inspections
Greenland town office parking lot and sampling sites	March 27, 2012	Sample collection and water quality monitoring
Exeter municipal parking lot and sampling sites-east side	March 28, 2012	Sample collection and water quality monitoring
Greenland town office parking lot and sampling sites	April 10, 2012	Sample collection and water quality monitoring
Exeter municipal parking lot and sampling sites-west side	April 11, 2012	Sample collection and water quality monitoring
Greenland town office parking lot and sampling sites	April 24, 2012	Sample collection and water quality monitoring
Exeter municipal parking lot and sampling sites-east side	April 25, 2012	Sample collection and water quality monitoring
Greenland town office parking lot and sampling sites	May 8, 2012	Sample collection and water quality monitoring
Exeter municipal parking lot and sampling sites-west side	May 9, 2012	Sample collection and water quality monitoring
Greenland town office parking lot and sampling sites	May 22, 2012	Sample collection and water quality monitoring
Exeter municipal parking lot and sampling sites-east side	May 23, 2012	Sample collection and water quality monitoring
Greenland town office parking lot and sampling sites	June 5, 2012	Sample collection and water quality monitoring
Exeter municipal parking lot and sampling sites-west side	June 6, 2012	Sample collection and water quality monitoring

Table 1. Training and sampling schedule.

The first step prior to leaving the lab was to use the Checklist to make sure all equipment and other materials were brought to the field sites.

Stormwater Drain Monitoring

Field Checklist

Dissolved oxygen meters: YSI 85 **&** Pro ODO
pH meter
Turbidity meter
Chlorine kit

Sample bottles: bacteria, nutrients, chloride
Sample bucket
Sample bottle cooler with blue ice
Chlorine analysis wastewater bottle

Data and site characterization sheets
Instruction sheets for DO, pH, chlorine and turbidity meters
Clipboard, pen

Label tape, Sharpie marker

Tool box

Gloves, Hand sanitizer spray bottle, eye protection
Extra batteries
Watch
Camera
Deionized water bottles
Kimwipes
Tape measure
Cotton Towel
Cooler temperature bottle

The sampling teams met prior to going out in the field at a designated site in each town. The Greenland team met every other Tuesday at 1:00 PM in the Greenland Town Office parking lot. The Exeter team met every other Wednesday at 1:00 PM in the municipal parking lot behind the Town Hall. The timing of low tide was important for some sites in Exeter, as three storm drains were inundated at high tide, or even just after low tide. The order of sampling at the set of sites for the day was determined, sample bottles were labeled and the team traveled together to the first site. The volunteers carpooled to minimize the number of cars parked at each site.

At the first sampling site, volunteers were first reminded of safety precautions. We discussed the presence of poison ivy, slippery conditions, traffic, mosquitoes/ticks, and any other condition that would justify extra care. We discussed who would be doing what tasks for the day so as to organize all volunteers present with having task(s) to do. Sample collectors and anyone else who handled sample bottles exposed to the pipe discharge wore latex gloves that were changed at each site. Volunteers used an alcohol-based hand sanitizer at each site. This was a critical step as several of the discharges contained high levels of fecal-borne bacteria.

Sample collection

The sample collection protocol was relatively unique for each site, so no instructions were written. The general approach was first to figure out the best approach to accessing the pipe outfall. The plant growth changed possible access paths at several sites as the season progressed. Once on site, the pipe was inspected to confirm there was flow and to figure out how to collect an accurate sample of the discharge. Some sites tended to accumulate organic debris at the mouth of or just below the pipe outfall, so for some pipes there was a need to clear out debris, then to take time to let flow re-occur and allow for settling or transport downstream of suspended solids.

Sampling involved either direct sampling, where sample bottles were filled directly from the discharge flow, or indirect sampling, where a primary sample collection container was used to fill sample bottles. This depended on the volume, accessibility of the discharge and depth of pooling below some outfalls. Care was taken to leave underlying sediment and organic matter undisturbed. Most pipes discharged water in a single flow, while others discharged flow in several different flows or as a lateral flow across a flat cement surface. Sampling was focused on the largest and most representative flow area, given the previously described conditions.

Field protocol instructions

Instructions for deciding on whether to sample, the approach to and progression of field tasks, sample collection and flow rate measurement, field measurements and procedures are

summarized in the following six pages, including copies of the manufacturer's instructions for the LaMotte turbidity meter and the chlorine detection kit.

Stormwater Monitoring Study-2012

Meeting Place Instructions:

Record Air temperature
Calibrate pH, DO (2) and turbidity meters
Plan sampling order and procedure

On-site Instructions:

*the crew will need to split **RESPONSIBILITIES***:

Site observation and characterization recorder
Sample collector
Instrument users
Analysis kit users
Data recording & Quality assurance/procedures

*Order of **TASKS**:*

Determine if water is flowing and if sampling is possible; **If YES:**

-Characterize site description & take photo (first time/if changed)
-Collect sample for chlorine, pH and turbidity
-Conduct chlorine, pH and turbidity measurements
-Label lab analysis bottles (bacteria, nutrients and chloride)
-Collect samples for bacteria, nutrients & chloride into bottles; immediately store bottles in cooler
-Collect sample in bucket or cut-off sample bottle for DO meter
-Measure DO, salinity, temperature & specific conductance
-Measure standards if appropriate (mid-sampling site)
-Collect duplicate sample as needed

Flow rate determination (where possible):

-Collect total flow of discharge into the sample bucket over a measured time.
-Measure the collected volume in a large graduated cylinder.
-Confirm flow rate variability by measuring at least three times.
-Clean all probes with deionized water prior to proper storage

CALIBRATING & USING YSI OPTICAL DO meter

CALIBRATING OPTICAL YSI DO PROBE
-Moisten sponge in the plastic, gray cal/transport sleeve with enough DI water to moisten it (dump out excess) and install probe.
-Turn on power and wait 5 minutes
-Press Calibration ("Cal") then highlight "DO" and press "ENTER"
-Highlight "DO%" and press "ENTER"
-Once DO and Temp are stable (~30 sec) highlight "Accept Calibration" and press "ENTER"
-If taking reading in brackish (salty) water, enter salinity value in "Probe" menu.

MEASURING DO WITH OPTICAL YSI PROBE
-Insert probe into sample and move probe enough to release air bubbles
-Wait ~25-35 sec for reading to stabilize
-Record DO% saturation & then DO concentration readings

CALIBRATING & USING YSI 85 DO meter

CALIBRATING YSI 85 DO METER
-Moisten clean cotton towel with water to be tested several times until towel at same temperature as water
-Wring out towel and wrap probe in towel
-Turn on meter and press MODE until it is reading % DO saturation
-Allow DO reading to stabilize (~5 min)
-Press both arrows simultaneously, hit ENTER, then once DO% reading stabilized, hit ENTER

MEASURING DO & OTHER PARAMETERS WITH YSI 85 METER
-Dip probe into water and 'swirl' probe to keep water flowing & prevent DO consumption
-Record DO% reading when it stabilizes
-Immediately switch MODE and record DO concentration reading

Hit MODE and read specific conductivity (μS), salinity (ppt) and temperature (°C)

CALIBRATING & USING pH METER

CALIBRATING pH METER

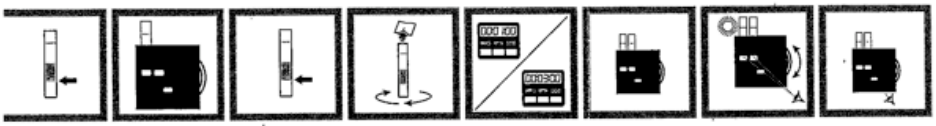
-Attach probe by screwing metal wire connector into side connection on meter
-Open meter and press **POWER/CAL** button on
-Pour pH 7.0 standard buffer solution into plastic cup
-Place end of probe into cup and swirl
-Press and hold the **CAL** key until the CAL display icon appears
-During calibration, CAL is shown on the display followed by SA (saved)
-The meter will display END and return to normal operation mode
-*Repeat with pH 4.0 standard buffer solution*
-Record the calibration slope (%) value that is displayed on screen

MEASURING pH

-Use the pH/mV button to select pH
-connect pH electrode to meter and place sensor end in the sample solution
-connect the temperature probe to meter and place into sample solution
-allow time for temperature probe to stabilize to sample temperature and read pH

CHLORINE

ree or total chlorine test procedure



. Fill a tube to the rst (5-mL) line ith sample.

2. Insert the tube into the left opening of the comparator.

3. Fill another tube to the first (5-mL) line with sample.

4. If testing free chlorine, add one DPD Free Chlorine Reagent Powder Pillow to the second tube. Swirl to mix.

If testing total chlorine, add one DPD Total Chlorine Reagent Powder Pillow to the second tube. Swirl to mix.

Note:*If testing free chlorine, complete the test and read the result within one minute of adding the reagent.*

Note:*If testing total chlorine, read the test result after three minutes but before six minutes after adding the reagent.*

5. Insert the second tube into the right opening of the comparator.

6. Hold the comparator so that daylight or a fluorescent light source is directly behind the tubes. Rotate the color disc until the colors in the front windows match. The best match might occur between two color segments.

7. Read the result in mg/L in the scale window. If the best match occurs between two color segments, determine the value halfway between the two printed numbers.

 For technical assistance or ordering information: visit www.hach.com, call 800-227-4224 or email techhelp@hach.com. Edition 2, October 2010

0-1 NTU TESTING GUIDE

» Calibrate meter with 1 NTU Standard.
» Select Options: NTU (EPA) or FNU (ISO), Formazin and Averaging/ 5 measurements.
» Use wall or USB adapter. Averaging option uses more power.
» Read manual before testing.
» To change Options refer to manual.
» For the most accurate results, follow the Tips.

CALIBRATION	
1.	Press ⏻ to turn meter on.
2.	Select **Measure**.
3.	Select **Turbidity – With Blank**.
4.	**Rinse** a tube three times with **0 NTU Standard** or turbidity-free water. **Fill** the tube to the line with 0 NTU Standard or turbidity-free water. **Cap** the tube. This is the BLANK.
	Tip: Use a clean, smudge-free, scratch-free tube. Do not use a tube or cap that was used for high turbidity standards.
5.	**Wipe** the tube thoroughly with a lint-free cloth.
	Tip: Surround the tube with a clean, lint-free cloth. Press the cloth around the tube. Rotate the tube three times in the cloth to assure that all areas of the tube have been wiped.
6.	Insert the tube into the chamber. Close lid. **Scan Blank**. Remove the tube.
	Tip: Align the index line on the tube with the index arrow on the meter. Tip: After scanning the blank, scan the blank again as a sample. It should read 0.00. If not, reblank the meter and scan the blank again. Repeat until it reads 0.00. A small negative number will be observed if the reading is slightly less than the reading used as the blank. This is expected due to minute variations between readings.
7.	**Empty** the tube. **Rinse** the same tube three times with the **1 NTU Standard**. **Fill** the tube to the line with 1 NTU Standard. **Cap** the tube.
	Tip: For the most accurate results, the same tube should be used for the Blank, 1 NTU Standard and the Sample to eliminate error caused by tube to tube variation. Tip: Fill the tube slowly, pouring down the inside wall of the tube to avoid introducing bubbles.
8.	**Wipe** the tube thoroughly with a lint-free cloth.
9.	Insert the tube into the chamber. Close the lid. **Scan Sample**.
	Tip: Scan the Sample three times, removing the tube from the chamber after each scan. The readings should be consistent. Use the last consistent reading to calibrate the meter.
10.	Press ▼. Select **CALIBRATE**.
11.	Press ▲ or ▼ to change the turbidity reading on the display to read **1.000**.
12.	Press ENTER to set calibration.
13.	Proceed to Analysis.

0-1 NTU TESTING GUIDE (continued)

ANALYSIS (following calibration procedure)	
1.	Press ⏻ to turn meter on.
	Tip: Meter should have been calibrated with 1.0 NTU Standard.
2.	Select **Measure**.
3.	Select **Turbidity – With Blank**.
4.	**Rinse** a tube three times with **0 NTU Standard** or turbidity-free water. **Fill** the tube to the line with 0 NTU Standard or turbidity-free water. **Cap** the tube. This is the BLANK.
	Tip: Use a clean, smudge-free, scratch-free tube. Do not use a tube or cap that was used for high turbidity standards.
5.	**Wipe** the tube thoroughly with a lint-free cloth.
	Tip: Surround the tube with a clean, lint-free cloth. Press the cloth around the tube. Rotate the tube three times in the cloth to assure that all areas of the tube have been wiped.
6.	Insert the tube into the chamber. Close lid. **Scan Blank**. Remove the tube.
	Tip: Align the index line on the tube with the index arrow on the meter. Tip: After scanning the blank, scan the blank again as a sample. It should read 0.00. If not, reblank the meter and scan the blank again. Repeat until it reads 0.00. A small negative number will be observed if the reading is slightly less than the reading used as the blank. This is expected due to minute variations between readings.
7.	**Empty** the tube. **Rinse** the same tube three times with the **Sample**. **Fill** the tube to the line with Sample. **Cap** the tube.
	Tip: For the most accurate results, the same tube should be used for the Blank, 1 NTU Standard and the Sample to eliminate error caused by tube to tube variation. Tip: Fill the tube slowly, pouring down the inside wall of the tube to avoid introducing bubbles.
8.	**Wipe** the tube thoroughly with a lint-free cloth.
9.	Insert the tube into the chamber. Close the lid. **Scan Sample**.
10.	**Record** the result.

LaMotte Exeter DPW

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Water Measurements & Analysis Kits

Parameter	Unit of Measure	Instrument	Nature of sample
Turbidity	NTU	LaMotte 2020e turbidity meter	Subsample from bucket
pH	pH units	"The Oyster" pH meter	Subsample from bucket
Chlorine	mg/L	Use kit instructions	Sample direct from pipe or subsample from bucket
Temperature	°Centigrade	YSI 85 or Pro ODO meter	In Sample bucket
Salinity	ppt	YSI 85 or Pro ODO meter	In Sample bucket
Specific conductivity	µS	YSI 85 or Pro ODO meter	In Sample bucket
Dissolved oxygen concentration	mg/L	YSI 85 or Pro ODO meter	
Dissolved oxygen saturation	% saturation	YSI 85 or Pro ODO meter	In Sample bucket

Water Sampling

Parameter	Sample Method	Storage
Dissolved & total nutrients	Direct sample from pipe flow or from sample bucket transferred to 1 L *acid-washed* Nalgene bottle	In cooler on ice
Bacteria	Direct sample from pipe flow or from sample bucket transferred to 1 L *sterile* Nalgene bottle	In cooler on ice
Chloride	Direct sample from pipe flow or from sample bucket transferred to 50 ml plastic bottle	In cooler on ice

For each sampling date, one individual would record time, weather conditions, site characteristics, and eventually would record measurement data. Site characteristics and weather conditions were recorded on one form, and data and QA/QC information recorded on another, as shown below.

Storm Drain Outfall Characteristics

Date _____ _____

Time _____ Recorder name:

Outfall ID# _____

Location _____ Photo taken? Yes No

Receiving waterbody _____

Directions _____

Owner/neighbor contact? No Yes Comments: _____

Weather Clear Cloudy Rainy

Precipitation in last 3 days? No Yes Inches _____

Pipe flow None Trickle Steady ≥ 1/4 pipe flow

Seepage flow None Trickle Steady

FLOW RATE _____ liters/second

Outfall Description

Pipe or Drain _____ _____ _____

Material Shape Height x Width

Submerged in water? No Partially Fully

Sediment condition Open 1/4 full 1/2 full 3/4 full plugged

Excavation for sampling? Yes No Describe: _____

Structure condition Excellent Good Fair Poor

Depth of water in pipe

Trash/Litter present? Yes No Describe: _____

Yard waste present? Yes No Describe: _____

Pet/other animal feces? Yes No Describe: _____

Odor?

Water quality Turbid Oily Foamy

Green or rusty slime? Green Rusty

General Comments

Stormwater Drain Monitoring: *FIELD MEASUREMENTS*

Date: _____ Start/End time: ___/_____ **Recorder:**

Volunteers present:

Station #	**Location**	**Time start**	**H20 Opt** °C	**Temp 85** °C	**Salinity** ppt	**Specific conductance** µS	**pH**	**Chlorine** mg/L	**Turbidity** NTU	**Dissolved Oxygen** Opt %	85 %	Opt mg	85 /L
Replicate													

QA/QC Meter Check

	pH		**Turbidity**			**Dissolved Oxygen** Opt %	85 %	Opt mg	85 /L
	7.0/4.0 standard	% slope	*DI H20 blank*	*1.0 standard*	10.0 standard				
Calibration									
Site #:									
End of day									

Field QA/QC procedures

All meters were calibrated just prior to use each sampling date according to manufacturer specifications. A useful, comprehensive guide to many of these procedures is available through the NHDES VRAP (NHVRAP 2011). Another QA/QC goal was to include replicate analyses at one site per sample date. Midway through the sampling, standards were re-checked on all meters to detect meter drift. Meters were also re-calibrated at this time if necessary. At the end of the day, meters were again checked for readings of standards to again check for drift. For laboratory analyses, duplicate samples were collected for every ten samples collected. Field and lab blanks with de-ionized were also included in the analysis.

SAMPLE STORAGE AND PROCESSING

The samples of water for laboratory analysis were stored in the field in coolers with blue ice. An extra sample bottle containing water was stored along with the samples and used to check water temperature when the cooler was returned to JEL. The water temperature in the cooler upon arrival ranged from 9 to 14°C. Samples were immediately stored on a walk-in 4°C room prior to processing for bacterial and nutrient analyses. Bacterial analyses required same-day processing while nutrient and chloride samples had holding times of 28 days (Table 2).

Parameter	Indicator	Lab/method	Container*	Preservation	Maximum holding time
E. coli	Sanitary wastewater	UNH-JEL	PA, G	<10°C, 0.008% Na_2S2O_3	6 hours
Total N	Sewage, animal waste, fertilizer	UNH-WQAL	P, FP, G	Freezing @ -20°C	28 days
Ammonia	Sanitary wastewater	UNH-WQAL	P, FP, G	Freezing @ -20°C	28 days
Chlorine, total residual	Potable water	Field kit	P, G	None required	15 minutes
Chloride	Road salt, sewage, estuarine water	NHDES lab	P, G	Refrigeration: 4°C	28 days
pH	Natural & polluted water	Meter	P, FP, G	Refrigeration: 4°C	14 days
Turbidity	Natural & runoff material	Meter	P, FP, G	Refrigeration: 4°C	48 hours
Dissolved oxygen	Oxygen demand	Meter	P, FP, G	None required	Immediate
Specific conductance	road salt, polluted water	Meter	P, FP, G	Refrigeration: 4°C	28 days
Salinity	Road salt, estuarine water	Meter	P, FP, G	Refrigeration: 4°C	28 days
Temperature	Many factors	Meter	P, FP, G	None required	Immediate

*P=polyethylene; G=glass; LDPE=low density polyethylene; FP=fluoropolymer (polytetrafluoroethylene (PTFE; Teflon®); PA=polypropylene or other autoclavable plastic

Table 2. Water quality parameters, sample bottle containers, preservation and maximum holding times for measurements and analyses conducted in this project.

LABORATORY ANALYTICAL METHODS

Bacteria, chloride and nutrient concentrations in samples were measured using the standard protocols used at the UNH-JEL, NHDES and UNH-WQAL labs, respectively Samples collected for this study were processed at JEL for analysis (bacteria) the same day, or stored frozen (nutrients) or under refrigeration (chloride) for up to 28 days. . Detailed procedures for these analyses can be found in published protocols (Jones 2002, Jones and Bryant 2004, WQAL). Analysis and/or processing procedures used for samples in this study are described as follows:

Bacterial sample processing and analysis

Samples were collected for bacterial analyses (fecal coliforms, *E. coli*) in sterilized 1000 ml polypropylene bottles. Analyses were according to standard lab protocols (Jones 2002, Jones and Bryant 2004). Sample bottles were shaken 20 times and appropriate volumes were measured in sterile graduated cylinders or by pipettes. The filter volume depended on the number of target bacteria present in the sample, which is critical because there should be enough colonies to measure, but not too many to overcrowd the surface of growth media used to enumerate them. Relatively accurate sample volumes were chosen following the first two sample dates when several different volumes were filtered to ensure getting countable numbers of colonies on growth media, and in some cases this involved initial decimal dilution in sterile buffered peptone water prior to filtration.

The measured sample volume was transferred to a sterile filter tower with a sterile 0.45 µm pore size 47mm membrane filter, and filtered using a vacuum. Forceps were surface sterilized using flamed alcohol and used to transfer the filter to the surface of labeled mTEC growth media Petri plates. Once all samples were filtered, the mTEC plates were transferred to an incubator set at 44.5±0.2 °C and incubated for 22-24 h. All glass and plastic ware was properly rinsed and cleaned, and there was proper disposal of wastes. Bacterial concentrations were determined the next day by counting the number of yellow colonies (fecal coliforms) then re-counting remaining yellow colonies (*E. coli*) after transferring the membrane filter to the surface of a urea-soaked cellulose pad; non-*E. coli* colonies are often urease positive and turn to purple colonies while *E. coli* is urease negative and remains yellow. Positive cultures and blank (de-ionized water) filtrations were used as controls.

Fecal samples from local source species were collected on two dates a site in Greenland (dog feces) and at a site in Exeter (unknown species). Fecal samples were decimally diluted to 10^{-8}. Aliquots (2.5 milliliters (ml)) from the dilution tubes were filtered through membrane filters as described above for water samples.

Nutrient sample processing

Samples were collected for nutrient analysis in brown polyethylene 500 ml bottles. Sample volumes of approximately 100 ml were filtered through acid-washed (10% HCl) filter towers and 0.45 µm pore size 47 mm diameter membrane filters into an acid-washed 1000 ml filter flask. Separate filter towers and collection flasks were used for each sample. Filtered sample water was transferred from the filter flask into 60 ml square-bottom, acid-washed, and labeled high-density

polyethylene bottles for ammonium analysis. Separate square-bottom acid-washed 60 ml bottles were filled directly for total nitrogen analysis. Both sets of bottles were stored frozen at -20°C in a freezer until analyzed.

Both nutrient analyses were conducted at the UNH WQAL, according their updated "QAPP for the Water Quality Analysis Lab at the University of New Hampshire, Department of Natural Resources, Durham, NH." Ammonium was analyzed according to the USEPA Method 350.1 Revision 2.0 with a SmartChem discrete analyzer, The method involves an automated phenate detection of filtered water samples. The typical range is 0-1.0 mg N/L. The MDL is 0.005 mg N/L. Total nitrogen was analyzed according to the USGS Method I-4650-03 with a SmartChem discrete analyzer. This method involved alkaline persulfate digestion of unfiltered water samples followed by colorimetric measurement of nitrate and orthophosphate. The typical range is 0-10 mg N or P/L.

Chloride sample processing

Samples collected for chloride analysis were checked for tightly closed lids and proper labeling then stored at 4°C. The analytical method was what is used at the NHDES laboratory.

REFERENCES

Jones, S.H. 2002. QA Plan for the Jackson Estuarine Laboratory Microbiology Lab. USEPA approved: 2002.

Jones, S.H. and T. Bryant. 2004. Standard procedure for detection of total coliforms, fecal coliforms, *Escherichia coli* and enterococci from environmental samples. Jackson Estuarine Laboratory, University of New Hampshire, Durham, NH.

WQAL: http://www.wrrc.unh.edu/lab/lab.htm