APPENDIX F

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN (QAPP) Version 1.0

FOR

AMERICAN RECOVERY AND REINVESTMENT ACT
Connecticut River Water Quality Monitoring Project 2009-13/ARRA 604

EPA RFA # 10099

Pioneer Valley Planning Commission

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MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

April 27, 2010

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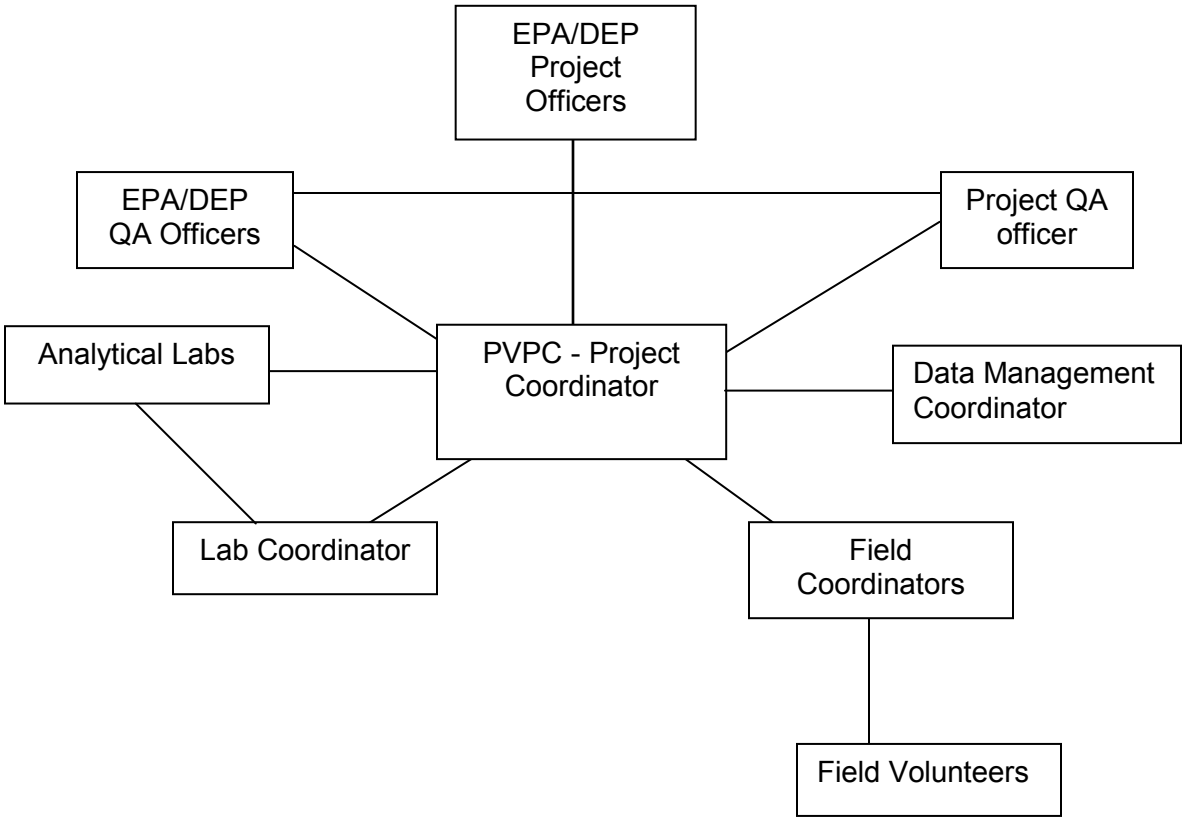
Table 1: Key Project Personnel

Name(s)	Project Title	Description of Responsibilities
Anne Capra, PVPC	Project Coordinator	Oversee all aspects of project that incorporate the monitoring program including: fiscal management, project objectives, reporting, data use, program changes, etc. Coordinate scheduling of sampling events. Produce monitoring reports. Produce or oversee outreach efforts.
MaryJo Moubry Feuerbach, US EPA	EPA Project Officer	Oversee grant administration and ensure reporting requirements are met.
Gary Gonyea, Mass DEP	DEP Project Officer	Oversee grant administration and ensure reporting requirements are met.
Patty Gambarini, PVPC	Project QA Officer	Run QA/QC program, ensure that all elements of the project follow QA procedures in the QAPP. Observe volunteers, review and maintain copies of data sheets and QC records, review draft reports, conduct program review in concert with Project Coordinator, recommend program changes if needed to ensure compliance with program goals and quality objectives.
Jerry Schoen, WRRC	Training, QAPP Coordinator	Volunteer recruitment and training. Develop QAPP.
Anne Capra	Lab Coordinator	Make arrangements with labs used to perform analyses according to QAPP; Ensure correct procedures are used, holding times are met, and adequate documentation is provided.
Anne Capra (southern reach) Andrea Donlon (northern reach)	Field Coordinator	Responsible for training and supervising volunteers in field work; ensures field forms are properly filled out, samples and forms are transported to laboratories as needed; and performs QC checks to make sure procedures are followed or corrected as needed (in collaboration with project QC officer).
Anne Capra	Data Management Coordinator	Maintain program data systems, perform/oversee data entry, check entries for accuracy against field and lab forms.
TBD	Volunteers	Conduct sampling, transport samples to lab. Assist as requested in data entry, outreach efforts.
John Smaldone	EPA QA Officer	Review QAPP, read QA reports, confer with program QA officer on quality control issues that arise during the course of a monitoring program.

Name(s)	Project Title	Description of Responsibilities
Richard Chase, MassDEP	DEP QA Officer	Review QAPP, read QA reports, confer with program QA officer on quality control issues that arise during the course of a monitoring program.
Andrea Donlon	CRWC lab director	Conduct bacteria field and QC sample analyses, report results to Project Coordinator, prepare sample containers for field samplers.
Val Partyka 534-2222	United Water lab director (for city of Holyoke)	Conduct bacteria field and QC sample analyses, report results to Project Coordinator, prepare sample containers for field samplers.

Figure 1: Project Organization



5. Problem Definition / Background

Problem Statement

The Connecticut River has been described as “our Boston Harbor”, because the river still has significant water quality problems, particularly combined sewer overflows (CSOs), which prevent the river from achieving federal and State Class B fishable/swimmable water quality standards in some segments. Similar to Boston Harbor, cleanup costs are very high (e.g. estimated at $325 million for CSOs in Springfield, Chicopee, and Holyoke Massachusetts alone), but the benefits of cleaner water will be also be enormous due to the popularity of the river for recreation and riverfront economic development. According to the USGS, bacteria levels in the Connecticut River are among the highest found in southern New England rivers. From the Holyoke Dam south to Connecticut, water quality standards are not supported (for primary contact), due to pathogens and suspended solids, primarily from urban runoff and combined sewer overflows. This is an environmental justice issue, as many low-income residents in the Holyoke-Springfield reach use the river for fishing and swimming.

The Connecticut River is not meeting Class B, fishable/swimmable standards in many urbanized areas, due to elevated bacterial levels from CSOs and urban stormwater. Limited information is available to the public on whether the river is safe for water-based recreation at any given location or time. Water quality sampling recently undertaken by the firm of Metcalf and Eddy for the Connecticut River Clean-up Committee in the Holyoke-Springfield, MA reach of the river showed geometric mean e-coli bacteria levels during wet weather events of 7480 colony forming units in Holyoke, 1800 in Chicopee and 1267 in Springfield, well above the water quality upper limit of 126 colonies/100ml indicating impaired river water and failure to meet water quality standards for recreational uses. Sampling conducted in 2008 and 2009 for the Rapid Response Water Quality Monitoring and Public Awareness project of the Connecticut River Tri-State Targeted Watershed Initiative(TWI) revealed wet weather geometric means of 134 E. coli colonines/100ml in wet weather vs. 32 colonies in dry weather for the northern Massachusetts reach (Northfield to Hatfield) and 377 colonies in wet weather vs. 86 colonies in dry weather for the southern Massachusetts reach (South Hadley to Longmeadow). These numbers compare to geometric means of 88 colonies (wet weather) and 24 colonies (dry weather) generated by monitoring conducted in the Vermont/New Hampshire river reaches for the TWI. See “Rapid Response Water Quality Monitoring and Public Awareness Final Report” (UMass WRRC 2010) for details.

A consortium of organizations, led by the Pioneer Valley Planning Commission, applied for and received a 604B Water Quality Management and Planning grant in 2009. The 604B project will continue the TWI volunteer based bacteria monitoring program in the Connecticut River watershed in Franklin, Hampshire and Hampden Counties. The project involves the collection of on-going monitoring of bacteria levels along the main stem of the river, new collection of baseline bacteria data on tributaries suspected to be sources of bacteria but for which little or no data exists to document the problem, and will perform new monitoring and field reconnaissance at specific locations for bacteria source tracking. Data collected will be shared with the public, DEP, municipal officials, and other stakeholders

through posting the data to an established web site targeting recreational river users as well as outreach through local media and forum outlets.

Watershed Background

The Connecticut River is New England's longest river, running 410 miles from the Canadian border through New Hampshire, Vermont, Massachusetts and Connecticut to Long Island Sound. The Connecticut River has been designated an American Heritage River. The watershed encompasses 11,260 square miles, with 148 tributaries, including 38 major rivers and numerous lakes and ponds. In its first 271 miles, the Connecticut River forms the New Hampshire – Vermont border. The watershed encompasses a full third (33 percent, 93 towns) of New Hampshire's land mass, and even more (41 percent, 114 towns) of Vermont. Fifty-three communities in these states claim the Connecticut River as a boundary.

Long a migration corridor for commerce, waterfowl, and culture, the river remains a living thread that binds together the people of both these states in one valley. Twenty four major tributaries and countless smaller ones drain a third of New Hampshire and two-fifths of Vermont, through the bed of a former glacial lake whose mark remains on the landscape to this day. Citizens of the Connecticut River Valley are well aware of the asset they now enjoy. The Connecticut commands respect when it releases its ice in the spring, when it floods after a storm, and when it turns turbines day after day to produce electricity for millions of people. Fertilizing its floodplain over thousands of years, the river's valley is home to some of the richest agricultural soils on the continent. Its waters, woods, and wetlands provide nationally recognized fish and wildlife habitat, including anadromous shad, Atlantic salmon and endangered shortnose sturgeon. It draws people to fish and canoe, and to explore the historic heritage of its nearby villages.

The Connecticut River valley is home to about 2 million residents, and about 84 % live in or near urban areas such as Holyoke and Springfield, Massachusetts. The watershed also includes New England's most productive farmlands, a vital waterfowl migration route along the Atlantic flyway, and habitat for fish.

Water Quality History

According to the MA DEP *Connecticut River Watershed 2003 Water Quality Assessment Report*, the status of the *Primary* and *Secondary Contact Recreational Uses* in the Connecticut River Basin are as follows:

Primary Contact Use Summary – Rivers	***Secondary Contact Use Summary – Rivers***
58.6 river miles impaired	166.7 river miles supported
116.6 river miles supported	8.5 river miles impaired
90.1 river miles not assessed	90.1 river miles not assessed

According to the "Massachusetts Year 2008 Integrated List of Waters" the following categories and water bodies/reaches are listed in the project study area in Massachusetts:

Category 3:" No uses assessed": Mill River Headwaters, outlet Factory Hollow Pond, Amherst to inlet Lake Warner, Hadley. 5.2 miles

Category 4c "Impairment not caused by a pollutant":
Lake Warner Hadley; Nutrients, Organic enrichment/Low DO, Noxious aquatic plants, Turbidity, Exotic species.

Category 5: "Waters requiring a TMDL":
Connecticut River

- Segment MA34-01. New Hampshire/Vermont/Massachusetts state line to Route 10 bridge, Northfield. 3.5 miles; Priority organics, Flow alteration, Other habitat alterations
- Segment MA34-02. Route 10 bridge, Northfield to Turners Falls Dam, Gill/Montague. 11.3 miles; Priority organics, Flow alteration, Other habitat alterations
- Segment MA34-03Turners Falls Dam, Gil/Montague to confluence with Deerfield River, Greenfield/Montague/Deerfield. 3.6 miles. Priority organics, Flow alteration, Suspended solids
- Segment MA34-04Confluence with Deerfield River, Greenfield/Montague/Deerfield to Holyoke Dam, Holyoke/South Hadley. 34.1 miles. Priority organics, Pathogens
- Segment MA34-05Holyoke Dam, Holyoke/South Hadley to Connecticut state line, Longmeadow/Agawam. 15.4 miles. Priority organics, Pathogens, Suspended solids

The *Primary* and *Secondary Contact Recreational Use*s are assessed for several segments in the Connecticut River Basin in the 2003 report. Multiple combined sewer overflows (CSOs) currently discharge to the Connecticut River between the Holyoke Dam, Holyoke/South Hadley and the Connecticut state line, Longmeadow/Agawam. The large volume and number of CSOs contributing pathogens in untreated combined sewage to this segment of the Connecticut River impairs the *Primary Contact Recreational Use* for the entire 15.9 miles.

CT River segment	Primary Contact use	Secondary Contact use
MA34-01	Support*	Support*
MA34-02	Support*	Support*
MA34-03	Not assessed	Not assessed
MA34-04	Support	Support
MA34-05	Impaired	Support
Barton Cove	Not assessed	Not assessed

* - indicates segment use is on "alert" status for reasons specified in the water quality assessment description for that segment.

The University of Massachusetts Water Resources Research Center (WRRC), working in collaboration with TWI partners Pioneer Valley Planning Commission (PVPC), Franklin Regional Council Of Governments (FRCOG), and The Connecticut River Joint Commissions (CRJC), designed and conducted a water quality study that involved sampling 16 sites (drawn from a list of 26 sites) twice a week in two urbanized reaches of the river in Massachusetts, Chicopee to Holyoke and Turners Falls to Greenfield; and one rural reach in Vermont, White River to Hartland, during the high-use summer recreation months of 2008 and 2009 (UMass WRRC 2010). All sites sampled are

considered to receive a high degree of use for swimming, boating, fishing and other river recreation. Samples were analyzed at four local wastewater treatment plants.

The TWI study focused only on potential health impacts related to possible disease bearing organisms. The study did not attempt to examine other issues such as nutrient loadings, toxic substances, or other potential problems. The study found that sites in the northern Massachusetts reaches exceeded the Massachusetts single sample primary contact limit of 235 E. coli colonies/100ml in 32% of wet weather samples and 6% of dry weather samples; in the southern Massachusetts reach, the limit was exceeded in 37% of wet weather samples and 13% of dry weather samples.

This project aims to continue the TWI work and also expand sampling to some tributaries of the Connecticut River that have known or suspected bacteria problems.

Intended data users

Stakeholders for this project include residents, visitors to, and recreational users of the Connecticut River Watershed; municipalities, and state, regional and federal environmental agencies. The data produced in this study will be shared with stakeholders, to aid them in making personal decisions on safe use of the river for recreational purposes; understanding causes and effects of weather, land use and other human activities on water quality; and developing management strategies for preservation/restoration of watershed health. All data that are reported will be compared with Massachusetts surface water quality standards for as applicable (e.g. bacteria data compared with criteria for recreational use).

Intended data uses include:

- To produce data of known and documented quality, in support of state monitoring programs, state water body health assessments (305(b)), Total Maximum Daily Load (TMDL) programs, municipal infrastructure improvements as appropriate, to collect baseline information for waters that are currently not assessed, and to advise local-level decision makers and educate the public on the condition of local waters and habitats.
- Identify sources of bacteria;
- Notify appropriate authorities of the suspected sources(s);
- Recommend appropriate action (e.g. further source tracking work, source removal, immediate clean up) to initiate remediation;
- Document bacteria source tracking conducted within the targeted sub-watersheds.
- Provide recreational river users with water quality bacteria contamination levels for their safety.
- Public education and outreach. By training and engaging volunteers in monitoring, they develop a better understanding of the importance of water resources and are in a better position to encourage their fellow citizens to take an active role in the preservation and restoration of their local water bodies and watersheds.

6. Project Tasks / Description

Objectives:
There are numerous small tributaries to the Connecticut River that are not being monitored by DEP, but are likely sources of bacteria loading. This proposed project is meant to complement DEP's monitoring program by conducting source tracking on water's not monitored by DEP but suspected to be likely contributing sources to the impairment due to their urbanized watersheds or identified parcels with highly threatening land uses.

This monitoring program is intended to:

- Advance improvement of the water quality of rivers and streams in the Connecticut River Watershed that are impaired due to bacterial contamination. Steps towards achieving this goal will be made by locating sources of bacteria contamination within targeted sub-watersheds and recommending appropriate action to initiate remediation.
- Contribute to ongoing and future assessments of whether bacterial contamination impairs the river's ability to support primary and secondary contact recreation.
- Convey this information to local, state and federal agencies and to river users through 'rapid response' analysis and communication.

This project defines 3 tiers of monitoring sites. Tier 1 sites include 9 sites along the main stem of the Connecticut River in Franklin, Hampshire and Hampden Counties, essentially the border with Vermont to the border with Connecticut. These are the same sites recently sampled in the EPA Targeted Watershed Initiative monitoring program.. Tier 2 sites are defined as those selected for initial screening via bacteria sampling. Tier 3 sites are defined as Bacteria Source Tracking (BST) sites that are monitored because results from Tier 2 site sampling suggests contamination in the vicinity. These Tier 3 sites may either be those initially selected as Tier 2 sites, or they may be found at locations not previously identified in Table 6; they will thus be "new" sties to be added to Table 6. This means that some Tier 2 sites may "graduate" to Tier 3 status.

PVPC, CRWC and WRRC will collaborate to recruit, organize and train volunteers to conduct a water quality monitoring program involving *E. coli* and temperature sampling in two Massachusetts reaches of the Connecticut River, including tributaries to be samples. For purposes of this QAPP, reaches are defined by the organizations that are overseeing sampling efforts. These are roughly, but not uniformly delineated by geography, and for convenience's sake, are referred to as the northern and southern reaches:

Southern reach:

All Tier 2 and 3 sites in the Mill River (Hadley), Fort River, Manhan River, Stony Brook, Buttery Brook, Willamansett Brook, Scantic River, and Mill River (Springfield). Sampling is coordinated by PVPC. In addition, PVPC will coordinate sampling of all Tier 1 sites on the main stem of the Connecticut River.

Northern Reach:

All Tier 2 and 3 sites in the Mill River (Northampton), Connecticut River in the vicinity of Barton Cove, Maple Brook, Bloody Brook, Sugarloaf Brook, and unnamed stream near Elwell Island, Northampton. Sampling is coordinated by CRWC.

Figures 2-4 show location of *E. coli sampling sites.* Figure 2 contains some of the northern sites; figure 3 contains both northern and southern sites; figure 4 contains the remainder of the southern sites.

Sampling activities will occur from late May (i.e. Memorial Day weekend) through October 2010 , and from late May through June 2011. Sampling sites are broken out into three tiers: Tier 1, Tier 2, and Tier 3 sites. Samples will be collected at Tier 1 sites one day per week for bacteria analysis. These sites are recreational access sites (boat ramps and marinas) on the river where primary and secondary contact with the river is highly probable. Monitoring these sites is important to provide data about bacteria levels on the main stem, which can be used over the long-term to assess the health of the Connecticut River relative to CSO abatement projects.

Tiers 2 and 3 monitoring sites will be on tributaries to the main stem that are suspected to be contributing bacteria loading to the main stem based on the land uses within the watershed and /or documented water quality impairments. These tributaries were identified based on the bacteria levels at the main stem sites, guidance from the project Advisory Committee and DEP (WERO and DWM) and also in part based upon the results of the 2009 bacteria monitoring under the current EPA funded TWI project and monitoring performed by DEP during the 2009 season. Most of the Tier 2 tributary sites are water bodies where little or no data about bacteria has been collected in the past and thus baseline bacteria data is of great importance. Up to 30 Tier 2 sites on tributaries along the entire main stem of the Connecticut River in Massachusetts will be monitored at least three times per site, no less than one week apart in time per site, over a 6 month period for bacteria “screening level” sampling. Tier 3 monitoring sites will be identified specifically for bacteria source tracking along those Tier 2 tributaries where bacteria screening results indicate bacteria levels in excess of secondary contact standards for *E. coli*. Tier 3 monitoring sites may include pipe discharges or in-stream grab samples. Up to 20 Tier 3 monitoring sites will be sampled once or more per month for six months.

See Table 6 for a list of candidate Tier 2 and Tier 3 tributary sites.

All Tier 1 samples will be analyzed for e. coli bacteria at the municipal wastewater treatment plant lab in Holyoke (operated by Suez/United Water); all Tier 2 and 3 sites will be analyzed at CRWC’s lab in Greenfield. CRWC’s lab will analyze up to 500 samples for E. coli using the Colilert system, from Standard Methods 9223B. Holyoke’s lab will analyze up to 700 samples for E. coli utilizing EPA SOP 1603 for membrane filtration.

Participating laboratories will send electronic copies of sampling results to WRRC immediately upon completion of sample analyses. WRRC will post draft water quality data on the project web site within one day of completion of laboratory analyses.

Optical brightener testing is a way of determining whether or not laundry detergents are entering a water body-either through a direct discharge or after traveling through the ground from a septic system that may be functioning poorly. Optical brightener testing can be used as a screening tool to separate areas with elevated bacterial counts due to inputs from human sources (septic systems or cross connections) as opposed to

domestic animals, pastured animals or wildlife. Human from animal waste sources can be screened using OB by deploying the test pads in storm drains or small feeder streams.

Besides laundry detergents some other materials may also cause positive results. These include metal particles, bleached materials, cotton dust, or paper products. It is important that the unbleached cotton pads are not exposed to these contaminants via aerial deposition or by physical contact-such as placing the pad down on paper, particularly if either is wet, which allows the optical brighteners to leach out.

Optical Brighteners: dry weather flows at piped outfalls may be field screened for optical brighteners (OBs). A tentative list is provided in table 6.1, but specific sites are to be determined via prior field inspection, and during Tier 3 sampling. Optical brightener sampling will occur at least once per site selected.

PVPC will coordinate communication between all program participants and will oversee quality control operations.

Table 2: Anticipated Schedule.

Activities occur in 2010 and 2011 except where indicated.

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Develop draft QAPP (2010 only)	X	X	X	X								
Finalize QAPP (2010 only)			X	X								
Site Selection	X	X	X	X								
Recruit volunteers			X	X	X							
Equipment inventory, purchase, inspection, and testing			X	X	X					X		
Field training and database-related training session(s)				X	X							
Coordinate/planning with analytical laboratories*		X	X	X	X	X	X	X	X	X		
Conduct Sampling *					X	X	X	X	X	X		
Data entry*					X	X	X	X	X	X		
Data review and validation*					X	X	X	X	X	X	X	X
Outreach (post data, project info on web site, etc.)*	X	X	X	X	X	X	X	X	X	X	X	X
Field audit(s)*					X	X	X	X	X	X		
Lab audit(s)*					X	X	X	X	X	X		
Draft report (2010)										X	X	X
Final report (2011)							X	X				
Data uploads to website *					X	X	X	X	X	X	X	X

* 2011 activities end in June

7. Measurement Quality Objectives

The quality objectives for the data collected under this QAPP are to produce data of sufficient quality to be acceptable by intended data users listed in section 5. Quality objectives are discussed for precision, accuracy, representativeness, completeness, and comparability.

Table 3: Measurement Quality Goals

Unless otherwise specified, samples are taken from water column.

Parameter	Units	Accuracy	Precision	Min. Detect. Limit	Expected Range
Optical Brighteners	Qualitative: negative positive, inconclusive	Weakly positive (inconclusive) or non-detect results for blank control pads	Duplicate results within 1 qualitative unit.	NA	Negative through positive
Temperature	^{0}C	$\pm$0.5 in comparison to NIST-traceable thermometer	$\pm$ 1	NA	0 – 35
E. coli	CFUs/ 100 ml for EPA 1603 MPN/ 100 mls (Colilert method)	Blanks and negatives show no colonies, positives show colonies	30% Relative Percent Difference for log 10 transformed duplicate data	0 for United Water (EPA 1603 modification): 1 MPN for CRWC (Colilert)	0 – 100,000
Location by coordinates (GPS)	degrees and decimal minutes (NAD 1983)	+/- 50 feet	Repeated readings, record during maximum satellite coverage	1 foot	NA

See section 14 for a discussion of how accuracy and precision goals are evaluated.

Table 4: Representativeness

Sampling site descriptions are given in section 10.

Indicator	Sample Site considerations	Rationale	Sample schedule
Optical Brighteners	Dry weather flows at piped outfalls	These locations and conditions optimal for detecting presence of human-source flows (i.e. septic systems or cross connections)	To be determined. At least once at each site selected for monitoring.
E. coli, temperature	Access/recreation locations, above and below suspected contamination sources, tributary mouths	Heavily used & previously monitored sites, high degree of water contact expected (Tier 1); locate pollution sources (Tiers 2 and 3)	Tier 1: 1/week, May – Oct. Tier 2: 2/mnth May – Oct. Tier 3: 1/mnth May – Oct. (May – June 2011 for all tiers).

Representativeness of the samples collected is considered in 3 ways: site selection, timing and frequency of sample collection.

Site selection process involves:

- Tier 1: identifying representative locations where humans are most likely to come into contact with the water for recreational purposes (i.e. as they are putting in and taking out boats from the Connecticut River), and therefore of conditions that are most likely to present health concerns. These sites were first selected for inclusion in the TWI monitoring program.
- Tiers 2 and 3: bracketing suspect bacterial pollution sources. In cases where there are no initial known/suspected sources, site selection is done by identifying access points (e.g. road crossings, recreation access) spaced throughout a tributary watershed, starting from accessible sites closest to the stream mouth and working upstream.
- Optical Brighteners: PVPC and CRWC staff review locations of known piped outfalls (or those discovered during E. coli monitoring activities), determine which to target for Optical Brightener monitoring. A tentative initial list is found in table 6.1.

Timing of sample collection took several factors into account. Memorial Day through Labor Day is considered the period of highest recreational use of the Connecticut River. For Tier 1 sampling, one sample per week over the course of the project will produce up to 30 or more samples per site. It is anticipated that this will produce both wet and dry weather samples. For tier 2 and 3 sampling, dry weather sampling is preferred, because bacteria sources are easier to identify in these conditions: there is less chance of dilution by storm flows, or of contamination by diffuse nonpoint sources. Tier 2 and 3 sites may be sampled as few as 2 or 3 times per site; upper limit of samples per site to be determined by BPJ of CRWC and PVPC staff. If high bacteria counts are found at a given site, this site is flagged as an impact site. In such cases, subsequent sampling may occur at sites further upstream, in order to better locate the source of contamination. If a site does not initially display high bacteria counts, it will be sampled at least twice more to confirm that low readings were not anomalous.

Comparability
The comparability of the data collected will be insured by using known protocols and documenting methods, sampling sites, sampling times and dates so that future surveys can produce comparable data by following similar procedures. Comparability of analysis results from the two different analysis methods and laboratories used (see section 6 above and 10 and 14 below) will be evaluated by splitting field samples and sending them to the two different laboratories for analysis as described in section 14.

Completeness
Completeness is the amount of valid data obtained compared to the amount of data planned.

At least 80% of the anticipated number of samples in each tributary will be collected, analyzed and determined to meet data quality objectives for the project to be considered fully successful.

A report detailing the number of anticipated samples, number of valid results, and percent completion (number of valid samples/number of anticipated samples) will be produced.

8. Training Requirements / Certification

Optical Brightener sampling will be conducted by PVPC and/or CRWC staff. Staff will be self-trained, using SOPs adapted from MassDEP's Optical Brightener SOP (CN 58.0) and the Optical Brightener Handbook published by Eight Towns and the Bay as guides. Jerry Schoen of the Massachusetts WRRC will train volunteers in bacteria sample collection techniques. Mr. Schoen has more than a dozen years experience training volunteer water quality monitors in these techniques. One training session each will be held in May 2010 and again in May 2011 in the southern and northern reaches, for a total of 4 training sessions. Specific locations to be determined for the Turners Falls / Sunderland area and the Springfield/Chicopee Holyoke area. PVPC and CRWC staff will attend the trainings held in the reach each coordinates.

Volunteers will be trained on sampling method, sample handling and transport, documentation (i.e. completing field sheets and chain of custody forms) and in project communication methods (e.g. how /where to obtain information on sampling schedules, rules for notifying project coordinators of planned/unplanned absence from sampling responsibilities etc.) Any volunteers involved in data entry will receive individual or group training on a schedule to be determined.

If any new volunteers join program after the training sessions occur, PVPC and CRWC will train these individuals, according to the respective reach the volunteer(s) agree to monitor. Records of training dates and who received training will be kept at the MassWWP office. Records will contain the following information: subject matter (i.e. what type of monitoring and procedures are covered), training course title, type of training materials, date and agenda, name and qualification of trainers, and names of participants trained. Sample training records are found in the appendices.

9. Documentation and Records

Field data sheets for water quality monitoring will be completely filled out on site and signed by the volunteers taking the samples at the time of the sampling event. This sheet will include the date and time the sample was collected, the site location number, the names of the volunteer samplers, current and previous weather conditions, water conditions, and water quality data collected at the site. Sample field sheets are found in the appendices.

Sample labels will be put on all sample containers and will include the site name, date, time, location, type of sample, and sampler's name. Labels for sample bottles are shown in the appendices.

Chain of custody (COC) forms will accompany samples from collection sites to laboratories. COC forms will be signed by collectors and all individuals who gain custody of the samples until they arrive at the lab. Information will agree with the label information on the sample bottles. Information such as the ID number, date, time, type of sample, and samplers will be included on the chain of custody form. COC form is shown in the appendices.

Project Coordinator fills out QC-Site reconciliation sheet and gives to field samplers prior to sampling events. This may be done on a weekly to monthly basis. Field samplers conduct QC activity as noted on the form (i.e. create a trip blank or take field duplicate at assigned site); label sample bottle and enter sample ID in field form according to QC labeling scheme. If departure from QC reconciliation sheet occurs, this must be noted in the comment area of the field sampling form and in the comment area of the QC reconciliation sheet. If this occurs, the field sampler must relay this information to the Project Coordinator via email (failing that, by phone) on the day sampling occurs.

Project Coordinator or Data Coordinator will use QC – site reconciliation data to document QC when lab results are received from each laboratory.

The data from these sheets will be entered into an Excel database. Original data sheets and the excel files will be stored in the PVPC office for no less than five years.

Data will be organized and entered into STORET. Data sheets will contain information necessary to allow data entry personnel to complete all required STORET fields. See section 19 for further information.

Project staff and volunteers may take digital photographs to assist in documentation of sampling site locations, outfalls or dry weather flows of interest, other visible signs of pollution, and other noteworthy phenomena encountered during conduct of this project. Digital photos will be stored on the PVPC computer in appropriately named folders (e.g. identifying sampling sites or a "visible pollution photos" folder). Some photos may be posted on project web site as part of outreach activities.

Miscellaneous records for instrument checks, calibrations, and maintenance will be kept in a logbook.

Training records for all volunteers involved in the project and materials used in the training will be kept.

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Table 5: Data Sheets, Labels, Laboratory and Voucher Forms

Documentation Type	**Form Name**	**How Used?**	**Example in Appendix?**
Sample Collection Records	Bacteria Field sheet	By volunteer samplers to record activities, conditions in field; identify sample.	Yes
	Optical Brightener Field Sheet	By volunteer samplers to record activities, conditions in field; identify sample.	Yes
QC field sample ID	QC - site reconciliation sheet	Project Coordinator and field samplers use to document type (blank or field duplicate) of QC sample and, if duplicate, which site receives duplicate sampling. Labs do not see this form.	Yes
Chain of Custody	COC form	By samplers, individuals transporting samples to lab, lab personnel receiving samples to document sample has been handled/transported in accordance with SOPs.	Yes
Laboratory Records	Analysis report – United Water (Holyoke) laboratory	Record analysis results, document lab activities.	Yes
	Analysis report – CRWC Laboratory	Record analysis results, document lab activities.	Yes
Training Records	Training Record Form	Document training activities, receipt of training by volunteers.	Yes
Photo documentation	NA	Photos are used as supporting documentation for site locations, visible signs of pollution, other noteworthy phenomena that may be encountered during the course of this project.	No

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10. Sampling Process Design

Sampling Safety. Personal safety will be a primary consideration in all activities, including selection of sampling sites and dates, and training programs. Safety procedures will include, but not be limited to:

- No sampling shall occur when personal safety is thought to be compromised.
- The Project / Field Coordinator will consult online weather forecasts in each sampling area before each sampling event to decide whether adverse weather or other conditions pose a threat to safety of field volunteers, and will cancel/postpone sampling when necessary.
- Samplers will wear life vests when sampling from boats or wading in waters under difficult conditions.
- Samplers will wear proper clothing to protect against the elements as applicable, especially footwear and raingear.

Sampling Design Considerations

PVPC will coordinate volunteers who will collect Tier 2 and 3 water quality samples at all sites in the southern reach. These include all tier 2 and 3 sites in the Mill River (Hadley), Fort River, Manhan River, Stony Brook, Buttery Brook, Willamansett Brook, Scantic River, and Mill River (Springfield). In addition, PVPC will oversee sampling of all Tier 1 sites on the main stem of the Connecticut River. CRWC will coordinate volunteers sampling of Tier 2 and 3 sites in the northern reach, on Connecticut River in the vicinity of Barton Cove, Maple Brook, Bloody Brook, Sugarloaf Brook, Mill River (Northampton), and an unnamed stream near Elwell Island, Northampton. Samples will be collected during the high-use summer recreation months (May-October). PVPC and CRWC staff will participate directly in some sampling of Tier 2 and 3 sites. Samples will be collected once per week on the 9 Tier 1 sites. These sites have been identified by PVPC, CRWC and WRRC staff based on water quality and site use history as discussed in section 6. Tier 1 sites are all located on the main stem of the Connecticut River. See Table 6.

PVPC, CRWC and WRRC staff selected tributary streams for Tier 2 and 3 monitoring based on water quality and site use history as discussed in section 6.

Two to four sites from each tributary will serve as the initial sites to be sampled. These are Tier 2 sites. The specific initial sites will be determined prior to the start of sampling in 2010. It is critical for BST to accurately record station locations using detailed descriptions and GPS readings ; often BST site locations differ by only 10-20 feet (e.g., up/down of outfall). General criteria for selecting these are that they are approximately evenly geographically distributed along a tributary, with one site near the mouth, one near headwaters, and at least one approximately mid way between; alternatively, if a tributary possesses sub-tributaries of interest, initial sites may be near the mouths of these tributaries. Subsequent sampling sites will be selected based on the results of sampling at the initial sites, according to the bracketing/ source detection strategy outlined in section 6, pages 12 and 13 and further discussed in the paragraph immediately following this one. These are Tier 3 sites.

Sampling for Tier 2 and 3 sites will occur once or twice per week on dry weather days. The schedule for each week will be established by PVPC and CRWC, considering weather and availability of the CRWC laboratory. For purposes of this project, dry weather is defined as no more than 0.1" rain during the 48 hours previous to sample collection. All Tier 2 will be sampled at least 3 times. Tier 3 sites will be determined based on Tier 2 results, and will be sampled at least once per month for 6 months. Individual sites will not be sampled any closer in time than one week apart. PVPC and CRWC will review results and make a determination as to whether monitoring should continue at a site, be shifted to a new site, or be resumed at a previously sampled site if results warrant. Given that the project objective is to locate bacteria sources, and given a limited budget, efficient use of resources is important. Sites that indicate high bacterial levels on a minimum of 3 consecutive dry sample events will be considered impact sites, and may be replaced by sites further upstream in an attempt to more closely bracket the pollution source. The determination of what constitutes "high bacteria levels" will be made by CRWC and PVPC staff based on best professional judgment and comparison with historical data and/or with other sites on the same stream. An initial general reference level of 1000MPN will be used as a definition of high levels, but this is subject to change as results are obtained and compared. The determination will be made in part on a site's bacterial levels relative to nearby sites. If, for instance, a site registers 500MPN and adjacent sites do not exceed 50 MPN, the site in question would be considered an impact site. Sites with low levels of bacteria will be monitored for at least 3 dates before a decision is made to move to another site. The general strategy for source detection is to begin with fairly uniformly geographically distributed sites within a watershed. Sampling and iterative site selection will proceed on a "control vs. impact" strategy. A site that produces low bacteria levels is considered a control site. Any site that produces high bacteria levels is considered an impact site. Sampling proceeds as described above (i.e. minimum 3 samples per site) with new sites selected to attain widespread geographic coverage, until an impact site is discovered. At that point, new impact and control sites are selected by moving the control site downstream closer the impact site, and/or the impact site upstream closer to the control site. This is done in conjunction with land use analysis conducted via map, driving or walking through watershed to identify visually any potential pollution sources. Project staff in consultation with volunteers will by this iterative process move impact and control sites closer together until a source is located, or until project staff concludes that no further determination is possible using the resources and practices available for this project. The objective is to collect 10 samples per event from Tiers 2 and 3 collectively, subject to practical considerations (i.e. availability of volunteers, staff time at CRWC laboratory).

Tier 1 samples will be analyzed for e. coli bacteria at the municipal wastewater treatment plant lab in Holyoke (operated by Suez/United Water); all Tier 2 and 3 samples will be analyzed at CRWC's lab in Greenfield. CRWC's lab will analyze samples for E. coli using the Colilert system. Holyoke's lab will analyze samples for E. coli utilizing EPA SOP 1603 for membrane filtration. We recognize that these are different methods. However, both are EPA approved. These are the methods that the participating labs currently use. The limited resources available to this project do not allow us to pay either lab (or another lab) to obtain the equipment, supplies and training necessary to adopt another method. Except for the quality control exercises described below, the samples used to identify bacteria sources will only go the CRWC lab, while Tier 1 samples will only go to the Holyoke lab. Thus, the answer to each study question (i.e. for Tier 1 sites, does the river support contact recreation at this site; for Tier 2 and 3 sites, where are the

pollution sources in this tributary) will rely on samples analyzed with a single method. Although these two methods have been found to be comparable in the scientific literature, we will conduct quality control exercises (described in section 14) by splitting samples collected at individual sites and sending them to both labs for comparison.

Optical Brightener sampling: PVPC and CRWC staff will review sampling data and communications with DEP and/or municipal officials to determine if piped outfalls exist where dry weather flows occur. Staff will develop a schedule to sample these locations at least once for presence of optical brighteners, to determine if evidence of detergents on sample pads indicates human sources (e.g. septic system discharges or cross connections). Specific site locations to be determined, sampling will occur during dry weather. A tentative list is found in table 6.1.

Project Coordinator (PVPC staff) will contact CRWC and United Water lab each week to reconfirm sampling schedule for that week and tentative schedule for following week; to determine if each all parties possess adequate supplies of paperwork (e.g. field sheets, labels), sampling equipment/supplies; and that overall system is running smoothly. PVPC will receive data reports from lab, event reports from Field Coordinators after each event. PVPC will communicate as necessary with United Water and CRWC to resolve any problems encountered in a timely manner.

PVPC and CRWC staff will coordinate and oversee sample event preparations in their respective reaches: activities of field samplers, sample transport to laboratories, pre-and post- sampling communication with laboratories. PVPC and CRWC will contact field volunteers each week to establish sample/site schedules, ensure that volunteers (and backups) are ready for each site to be sampled, and that they have all necessary supplies (e.g. coolers, sample containers, ice packs). PVPC and CRWC will generate brief event reports detailing any problems encountered. These will be collected by PVPC after each sample event.

Laboratories will communicate with Field Coordinators in each reach after each sampling event to ensure that samples are delivered to lab in acceptable condition; will analyze samples within required holding times and conduct quality control exercises as described in section 14; will submit analysis results (including QC data) to Project Coordinator via email immediately upon completion of analysis.

Field volunteers will communicate with Field Coordinators each week/sampling event to confirm their participation (or that approved backup has been arranged), which sites are to be sampled, delivery times to labs, and that needed supplies are in hand etc. Volunteers will collect samples at predetermined sites, dates and times, will complete field data and chain of custody forms, will deliver samples to labs, and will deliver paperwork to lab or Field Coordinators as stipulated in sampling plan.

Sampling site list.
Tier 1:
PVPC, CRWC, and WRRC have selected nine water quality sampling sites along the main stem of the Connecticut River as Tier 1 sites, to be sampled once per week. See Table 6.

Tiers 2 and 3:
PVPC, CRWC, and WRRC have selected the following Connecticut River tributaries to focus on. Candidate sites are shown in Table 6.

Site numbering convention: for Tier 1 sites: use same names as those used in TWI sampling program. For Tier 2 and 3 sites: river/stream initials + town (at stream mouth) initials + sequential number. Example: Site MRH1: MR = Mill River; H = Hadley 1 = number of site. Site numbers ascend going south to north. If any sites are added between 2 adjoining sites (e.g. between MRH1 and MRH2), will use a decimal numbering system, using number half way between the two existing sites. E.g. MRH1.5.

Maps of sampling sites may be seen in figures 2-5. Due to the extensive geographic region being sampled, *E. coli* sites are displayed across three maps. Figure 2 shows most of the northern reach sites. Figure 3 includes some of the Mill River Hadley sites, which are considered northern reach sites, and some of the southern reach sites. Figure 4 shows the remainder of the southern reach sites.

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Table 6: Sampling Sites

Site ID	Site Location	Lat	Long	Notes
Tier 1 Sites. Connecticut River. For consistency's sake, site numbers are the same as those used in the Targeted Watershed Initiative sampling program. Sites are listed below south to north. Naming convention refers to state initials and lab conducting analysis in TWI program.				
MAH1	Pioneer Valley Yacht Club, Agawam	42.063513	-72.59329	Boat launch site.
MAH2	Pynchon Point Park, Springfield	42.0833	-72.585449	
MAC1	North End Bridge/Bassett Marina Boat Launch, Springfield	42.1100833	-72.612883	Continuation of monitoring for high E. coli counts at this location and begin upstream source tracking.
MAC2	Davitt Bridge / Granby Rd, Chicopee	42.1504	-72.6069167	Boat launch site. High bacteria counts in TWI sampling.
MAC3	Medina St. Boat Ramp, Chicopee	42.1100833	-72.6253833	Boat launch site. High bacteria counts in TWI sampling.
MAH3	Jones Ferry, Holyoke	42.172379	-72.629898	
MAC4	Berchulski Fisherman Access, South Hadley	42.1945333	-72.59985	Boat launch site. High bacteria counts in TWI sampling.
MAH4	Brunelle's Marina, South Hadley	42.1945333	-72.5996333	Boat launch site.
MAG4	Barton Cove, Gill	42.6015667	-72.5315	River recreation site. High bacteria counts in TWI sampling.
	Storm drain outfalls to be identified in the field			
Tier 2, 3 sites: sampling coordinated by PVPC.				
Fort River, Hadley and Amherst.				
FRH1	Route 47 bridge, Hadley	42.332672	-72.578636	E. coli 240 colonies/100ml 9/3/09, 1500 colonies/100ml 9/9/08, MA DEP
FRH2	Tributary at Moody Bridge Road crossing, west	42.332894	-72.570777	First tributary crossing Moody Bridge Road closest to Bay Road
FRH3	Tributary at Moody Bridge Road crossing, east	42.339813	-72.556641	Tributary crossing Moody Bridge Road near South Maple Street
FRH4	Tributary crossing at Mill Valley Road	42.348866	-72.567433	

FRH5	South Maple Street, Hadley	42.341327	-72.550244	Main stem, next upstream road crossing. Several adjoining tributaries in between Fort 1 and Fort 2 that may need to be sampled.
FRH6	West Street (Rte 116) crossing, Amherst	42.355580	-72.520913	Hickory Ridge Golf Course and agriculture fields in between Fort 2 and Fort 3
FRH7	Bike Path Bridge/Mill Lane and South East Street, Amherst	42.357819	-72.504658	E. coli 460 colonies/100ml 9.9.08, MA DEP
FRH8	Hop Brook at Station Road Crossing, Amherst	42.341972	-72.493527	Major tributary coming from the south
FRH9	Pelham Road, Amherst	42.364227	-72.489891	Origination of Fort River from Hawley Brook, Adams Brook, Heatherstone Brook, Amethyst Brook
Mill River, Hadley and Amherst				
MRH1	Mouth	42.383385	-72.586842	
MRH2	Mill Site Road	42.386286	-72.550385	Near N. Maple St. No other known impacts until it reaches L. Warner
MRH3	N. Hadley Road Horse Farm	42.384511	-72.546587	This drains the Hadley Farm, would provide comparison with main stem of Mill R. coming from UM campus and N. Amherst. However, in high water, there might be some water backing up from main stem, potentially invalidating comparison
MRH4	N. Maple St. Hadley Road Horse Farm - alternate	42.382133	-72.546319	This drains the Hadley Farm, would provide comparison with main stem of Mill R. coming from UM campus and N. Amherst. Avoids high water problem of MRH3. Longer walk – about 100 yds from road. Same location as downstream nutrient site for TWI. , there might be some water backing up from main stem, potentially invalidating comparison
MRH5	N. Hadley Road Main stem Mill River	42.385065	-72.545965	Good comparison with MRH5 (or MRH4).
MRH6	Rt. 116 Horse Farm upstream	42.379137	-72.542574	Immediately upstream of Horse farm. Same location as upstream TWI nutrient site.
If necessary, additional sites may be added on the branch of the Mill that originates in the vicinity of Route 9 on the Amherst/Hadley line.				

MRH8	UMass parking lot Mill River	42.391999	-72.538835	This might prove useful to compare vs. small branch coming out of Campus Pond, Amherst center. Access may be difficult here; check for fencing.
MRH9	UMass parking lot, Campus Pond outlet	42.39127	-72.536899	Possibly useful comparison of Mill R. Vs. campus pond stream.
MRH10	Fearing St, Mill R. Amherst Center branch	42.382634	-72.523174	Last spot before stream goes underground. Collects Amherst center runoff. This would Bracket UMass campus with site MRH9
MRH11	Meadow St, Mill R. "northwest"	42.408027	,-72.539656	Captures a branch of Mill R. coming from NW, Hadley/Sunderland. Compare with site MRH12
MRH12	Meadow St, Mill R. east	42.408684	-72.538605	Just a few yards from site MRH11; this drains the Mill River from Shutesbury down, just before confluence with Mill R. NW (site MRH11).
MRH13	Mill R. Recreation area. Mill River	42.411504	-72.527887	Just below Puffers Pond, N. Amherst
MRH14	State St, Cushman Brook	42.415833	-72.514095	Above Puffers Pond. Mill River is named Cushman Brook above Puffers. For consistency's sake, naming convention continues from downstream sites.
MHR15	Teewaddle Hill, Cushman Bk. trib	42.43642	-72.492862	A branch of Cushman Bk. In N. Amherst near Leverett line. Might be access permission issues.
MRH16	Teewaddle Hill, Cushman Brook	42.43623	-72.492342	Just a few yards from site MRH15. Main stem of Cushman Brook. Might be access permission issues.
MRH17	Cushman Road, Cushman Brook	42.438483	-72.482724	100-200 yards upstream of site MRH16. If access or other problems with MRH16, use this instead.
MRH18	Broad Hill Road Shutesbury . Cushman brook	42.447698	-72.464753	1+ miles upstream from site MRH17. use this and other upstream sites if problems are found at MRH17.
MRH19	Leverett Road Shutesbury. Cushman Brook	42.449579	-72.452205	Further up on Cushman Brook.
Manhan River, Easthampton				
MRE1	Fort Hill Road, Easthampton	42.284091	-72.640880	E. coli 300colonies/100ml 7/1/08, 940 9/9/09, MA DEP
MRE 2	O'Neill Street/Lovefield Street crossing	42.279761	-72.654266	

MRE3	Lower Mill Pond outfall at Ferry Street crossing	42.275797	-72.654725	
MRE4	Route 10 crossing and Mill Street	42.273838	-72.673013	
MRE5	Bassett's Brook at West Street	42.273344	-72.675411	
MRE6	Glendale Road crossing	42.266552	-72.691225	Upstream of Hannum Brook intersection (Northampton Landfill on this brook)
Stony Brook, South Hadley				
SBSH1	Ferry Street at Brunelle's Marina, before CT River	42.263138	-72.598919	
SBSH2	Rte 116 by Chapdelaine Furniture	42.248222	-72.580097	6/09-9/09 312-950 cfu/100ml E. coli, South Hadley DPW
SBSH3	Leaping Well Brook at Mosier Street	42.245022	-72.579327	
SBSH4	At Morgan Street, south of Lower Pond	42.252252	-72.573430	
SBSH5	Morgan Street, east of Edison Drive and west of Mary Lyon Drive	42.251216	-72.559294	
Buttery Brook, South Hadley				
BBSH1	Brainerd Street and Lathrop Street	42.238627	-72.593477	
BBSH2	Newton Street at Rte 202 interchange	42.223536	-72.589877	
Willamansett Brook, Chicopee				
WBH1	Upstream side of Yelle Street	42.191149	-72.598733	9/9/08 20,000CFU/100ml E. coli, MA DEP
WBH2	Route 33 and east end Robert's Pond	42.194480	-72.583547	
Scantic River, Hampden				
SRH1	Mill Road	42.048477	-72.453744	9/9/08 3600 cfu/100ml E. Coli, MA DEP
SRH2	Somers Road crossing, north of intersection with Mill Road	42.054766	-72.439141	
SRH3	West Brook at Main Street, next	42.063713	-72.418577	

	to Colonial Village			
SRH4	At Chapin Road and South Road intersection	42.063363	-72.413208	
SRH5	Big Brook at Main Street	42.064430	-72.408744	
SRH6	At Rock-A-Dundee Road	42.047369	-72.383108	
Mill River, Springfield				
between Johnny Appleseed Park (near Hancock Street/Rifle Street Intersection) and the Watershops Ponds Dam (Allen Street)				This segment formerly received the vast percentage of CSO/DWO into the Mill River (over 55 million gallons/year , activating over 80 times/year) from CSO #048 (Allen and Rifle Street). This CSO was abated to discharge 4 times or less per year (Actual frequency of discharges now under analysis). Bacteria analysis in this stream segment during dry weather and wet weather may help evaluating the effectiveness of the CSO 048 abatement.
MRS1	Allen Street and Rifle Street, south of Watershops Pond Dam	42.097019	-72.563788	
MRS2	Hancock Street and Rifle Street	42.094152	-72.567808	
Tier 2, 3 sites: sampling coordinated by CRWC.				
Barton Cove of Connecticut River, Gill and Montague				
CTRG1	Franklin County Boat Club docks, Gill side	42.607748	-72.543065	Use most downstream dock. CRWC has gotten permission to sample here in the past. Close to state boat ramp site with 350w, 2133, and 1133 cfu/100 mL during 2009 Targeted Watershed Initiative sampling season
CTRG2	Boat dock at FirstLight Barton Cove campground access road, Gill side	42.604369	-72.532665	
CTRG3	Unity Park furthest upstream end, Montague side	42.604406	-72.547336	Used for kayak demo day access point and swimming spot
CTRG4	Unity Park parking area, Montague side	42.606438	-72.549529	Swimming spot

Maple Brook, Greenfield				
MBG1	Accessible location near where Maple Brook daylights, off Conway St.	42.587531	-72.612619	Maple Brook is underground except for a short section at mouth. This brook has a history of cross-connections and bacteria problems. Tier 2 will be at mouth. Tier 3 will involve consultation with Greenfield DPW to pull manhole covers.
Bloody Brook, Deerfield				
BBD1	Whately Rd. along N-S-running road segment	42.478334	-72.618996	960 cfu/100ml by DEP in 9/9/08. Bloody Brook crosses Whately Rd in two locations.
BBD2	Conway Street	42.482681	-72.615137	Branch of stream
BBD3	Routes 5 & 10	42.479972	-72.613091	
BBD4	Pleasant St. near North Main St.	42.481651	-72.605167	
BBD5	Capt. Lathrop Dr.	42.488248	-72.604735	
Sugarloaf Brook, Deerfield and Whately				
				Check to see if there is an accessible spot at Herlihy Park, Whately closer to mouth
SBW1	River Rd. N, Whately	42.465992	-72.592425	No previous data on this water body.
SBW2	Route 116, Deerfield	42.467238	-72.602341	
SBW3	Thayer St., Deerfield	42.472697	-72.610025	
SBW4	Sugarloaf St., NE side, Deerfield	42.476562	-72.607066	
SBW5	Graves St., Deerfield	42.477645	-72.603032	
Unnamed Stream near Elwell Island, Northampton				
USN1	Near bike trail bridge off Norwottuck parking lot	42.335645	-72.621547	Nothing known about this tributary which is mostly underground. Before they were laid off, DEP bacteria source tracking team recommended checking it out.
Mill River, Northampton				
MRN1	Clement Street bridge crossing	42.319154	-72.664981	DEP site 28B had 2,900 and 2,500 cfu/100 mL by DEP on 9/9/08 but was 12.1 on 4/27/09. Park at road site next to USGS gage. Sample downstream side of bridge.

MRN2	Bliss St. bridge crossing	42.329152	-72.675203	Park at end of Cross St. Sample at upstream side of bridge. Confirm DEP low count of 9.4 on 4/27/09. DEP site MRCTNH 7.0.
MRN3	Meadow St. bridge crossing	42.334194	-72.677477	Park at end of farm road at upstream side of bridge. Sample at upstream side of bridge. DEP low count 4/27/09.
MRN3.1	Meadow St. pipe outfall	42.334039	-72.677372	7,701 cfu/100 mL by DEP on 4/27/09. Pipe outfall immediately downstream of Meadow Street Bridge, left bank, park at farm road next to bridge.

Table 6 continued. Optical Brightener sampling sites. Tentative

Mill River, Springfield				
Between Johnny Appleseed Park (near Hancock Street/Rifle Street Intersection) and the Watershops Ponds Dam (Allen Street)				
MRS1	Allen Street and Rifle Street, south of Watershops Pond Dam	42.097019 OR: 42.09706111111112	-72.563788 Or: -72.56329166666666	Allen and Rifle Street, south of dam. Sample to be taken upstream of outfall. Lat/long coordinates are of outfall.
MRS2.5	Darwell and Locust Street	42.093183333333336	-72.5708027777778	Sample taken just downstream of outfall#2, which is on Orange Street, south bank of river, at Lat 42.093361111111115 Long -72.56979722222222
MRS3	Chstger and Rifle Street	42.09427777777778	-72.5664861111111	Just downstream of outfall at MRS1

Maple Brook, Greenfield				
MBG1	Mouth.	42.587531	-72.612619	Mouth.
MBG2	Corner of Arch and Chapman Streets	42.592355	-72.603892	DEP/Skalka OB site 15
MBG3	Garfield Street, near School Street	42.593747	-72.599893	DEP/Skalka OB site 14
MBG4	Off Maple Street near or at CVS parking lot	42.592897	-72.597161	DEP/Skalka OB site 12
MBG5	South Branch: Between North and High Streets	42.594026	-72.593898	north of Maple Street, vicinity of Baystate Medical offices parking lot, DEP/Skalka OB site 14
MBG6	North Branch: Sanderson Street	42.595481	-72.595691	Near back of Greenfield Jr. High School, DEP/Skalka OB site 10
MBG7	North Branch: Riddell Street	42.597995	-72.593505	DEP/Skalka OB site 8

Initial tentative list: All will be visited, assessed for practicality before decision to sample is made.

Figure 2. E. coli sampling sites. Partial list northern sites.

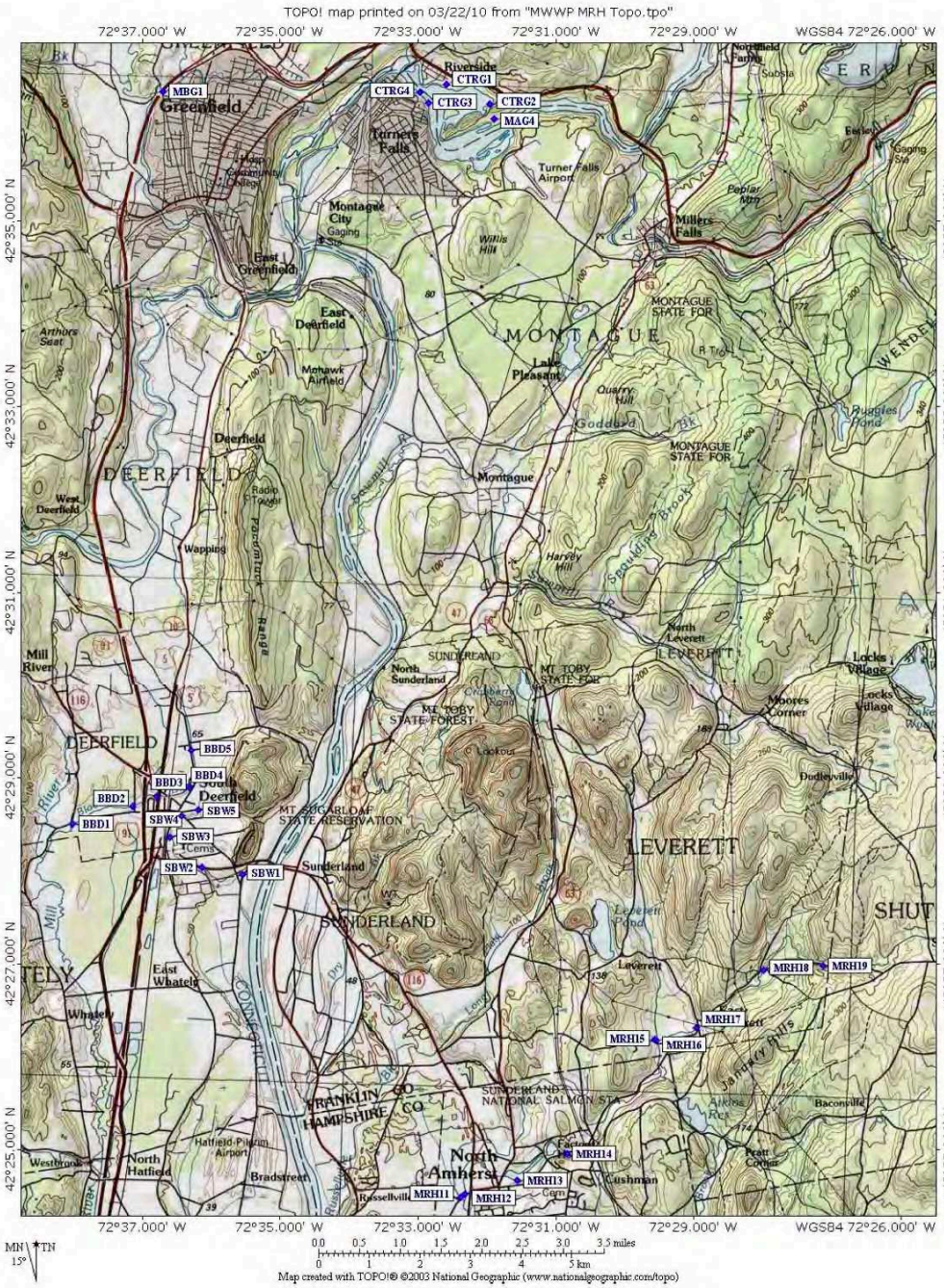

Figure 3. E. coli sampling sites. Partial list northern and southern sites.

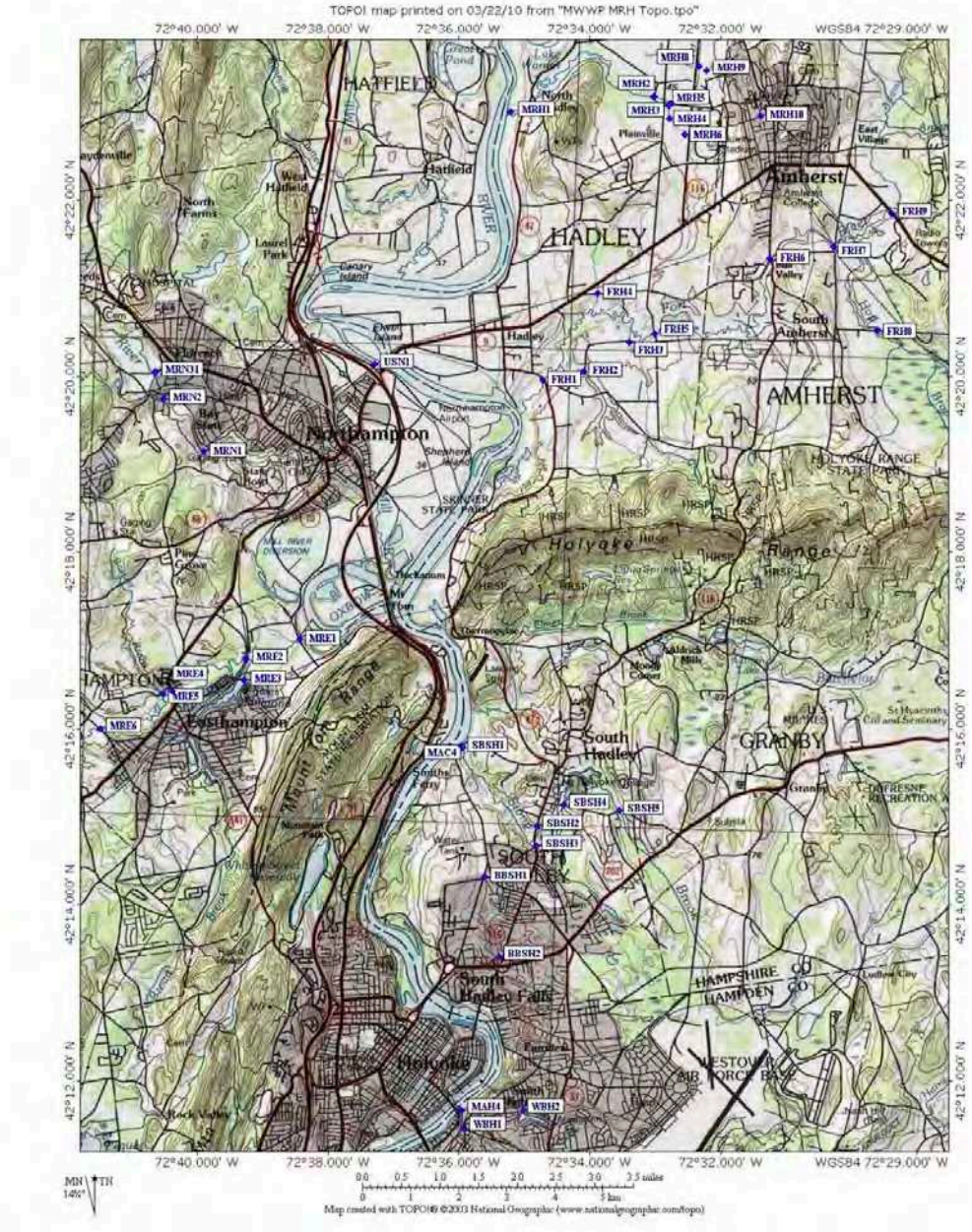

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Figure 4. E. coli sampling sites. Partial list southern sites.

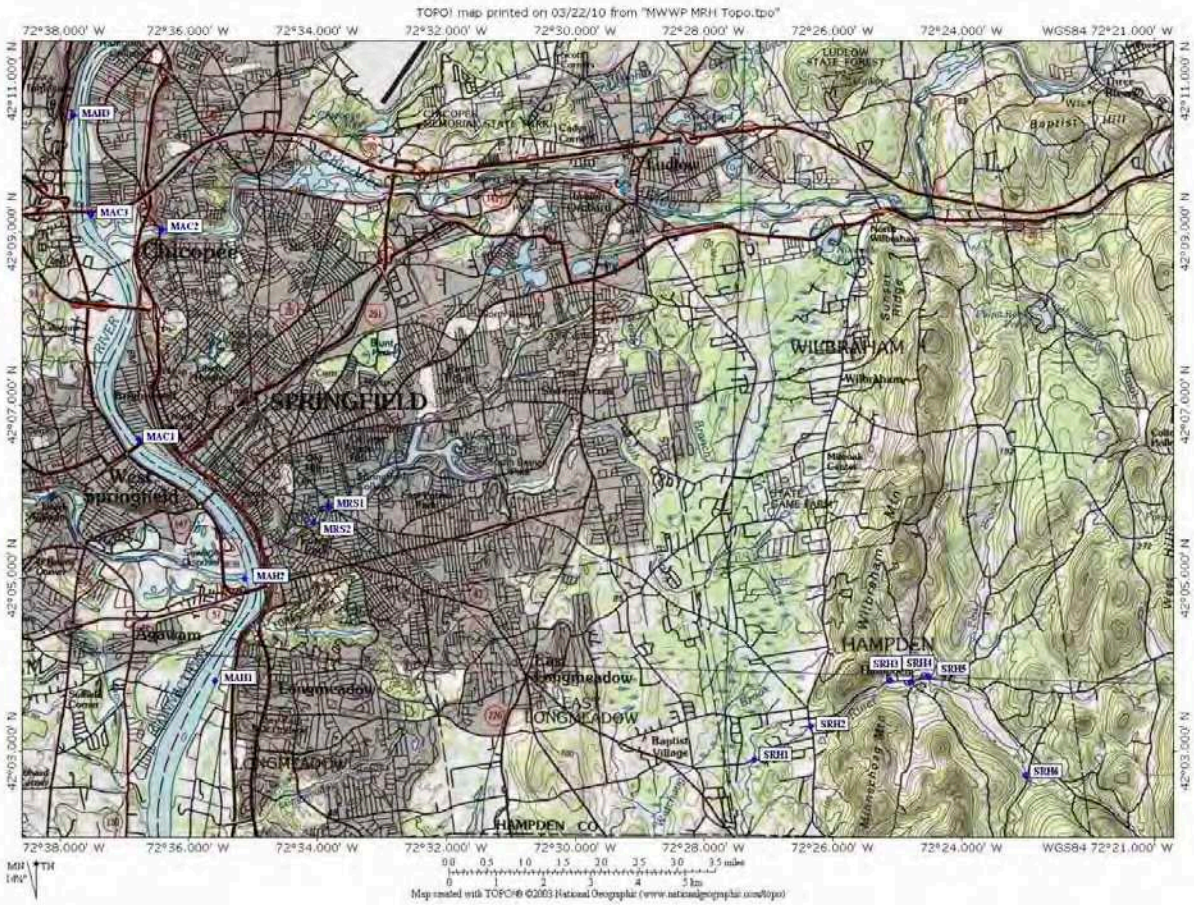

Figure 5. Optical Brighteners sampling sites - Greenfield: tentative.

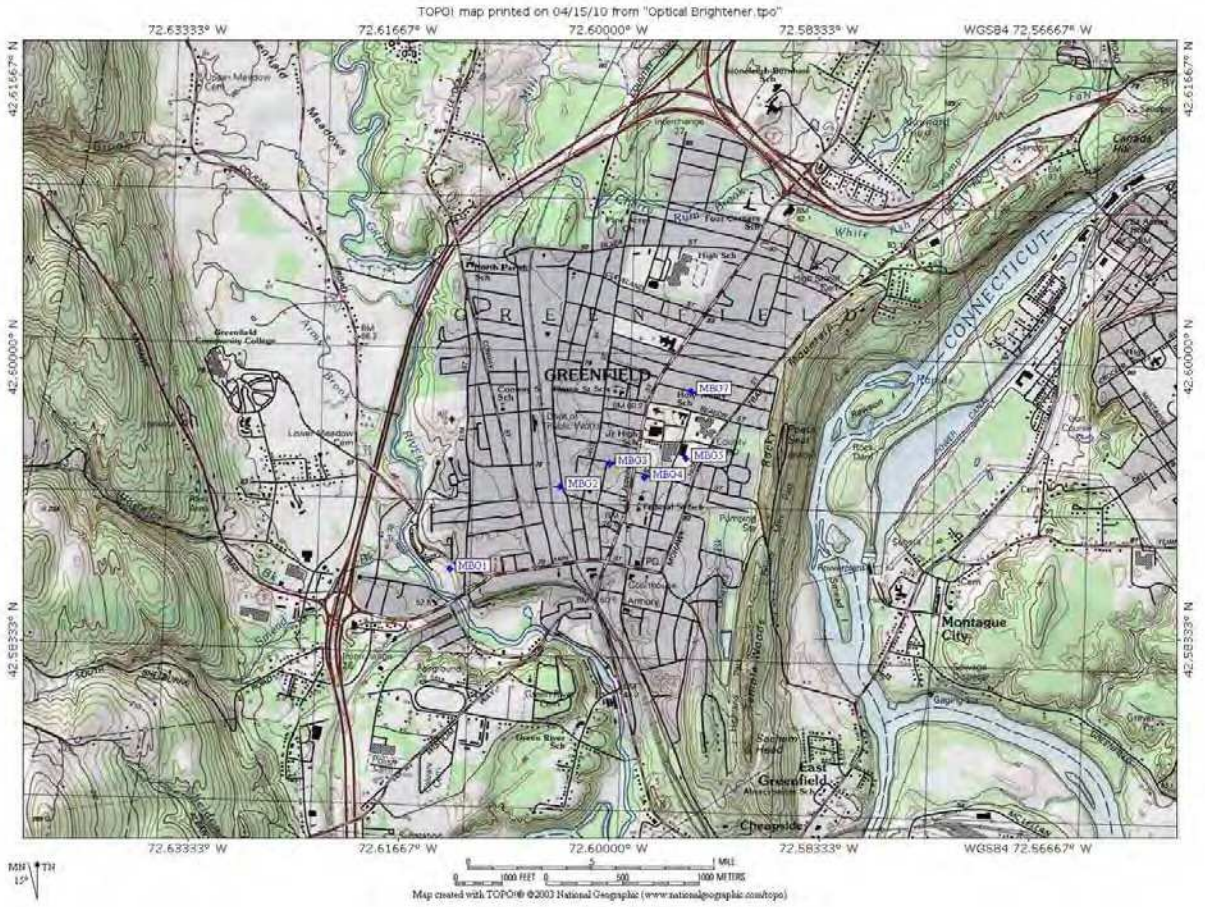

Figure 6. Optical Brighteners sampling sites - Springfield: tentative.

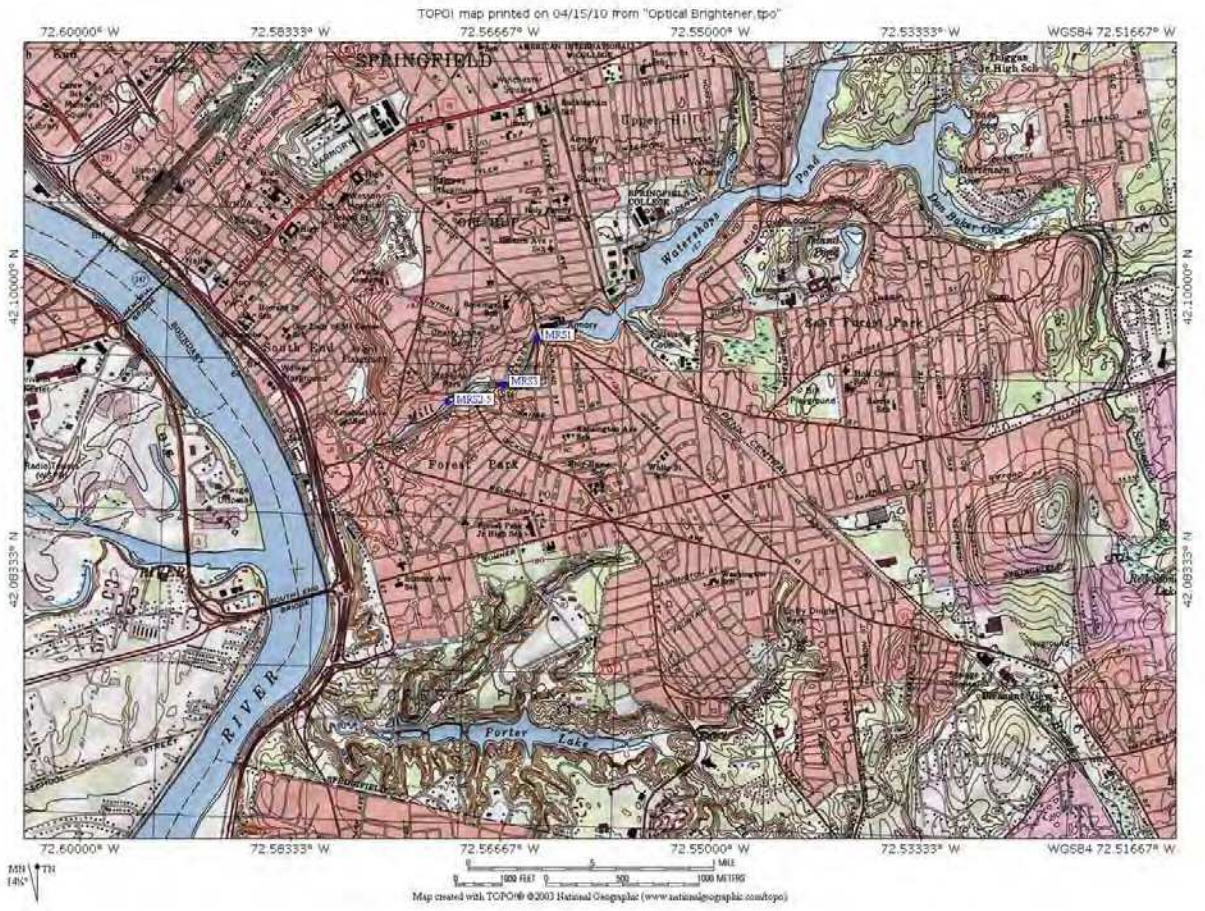

Table 7: Sampling Sites, rationale, frequency and duration

Survey type	Indicators	Sample locations	Site location rationale	Frequency, duration, special conditions	Total # of samples (each parameter), including QC[1]	Field Survey QC
Do river locations support contact recreation?	*E. coli*	See site list. Unless otherwise specified, within 20 feet of shore, at wadeable river access/recreation locations	Representative high-use recreation areas. Previously sampled in CT River TWI project.	1 per week between May and October;	500	One field duplicate per sample event
Bacterial source tracking	*E. coli*	See Table 6	Bracket potential sources	Minimum 3 dry weather samples per location. If high numbers found, or to continue using as control site, sampling may continue beyond that number. Dates to be selected between May and October	700	One or 2 field duplicate samples per sample event. (goal is 10% duplicates)
Bacterial source tracking	Optical brighteners	Piped outfalls. To be determined	Dry weather flows at outfalls may indicate human sources of bacteria.	At least once each selected site.	20	One duplicate per 10 samples: if <10, at least 1 duplicate.

Sample types, special considerations.
Optical Brighteners: to perform the test a hand sewn packet made from mosquito netting which contains an unbleached cotton pad is deployed for approximately 2-3 days. To increase the evaluation time, the pad is replaced with another that is deployed for another 2-3 days. If the pad is left out too long, the surface may be obliterated with dirt and definitive observations can not be made. The sampler should be deployed in water that is moving and is deep enough to cover the sampler. The needed depth can be obtained by shoveling out a trench for the brick. If sediments are disturbed, allow them to settle or float away before the sampler is deployed or the cotton pad will become fouled. The sampler should be placed so that the cotton pad is perpendicular to the current. See “Optical Brighteners SOP 604b CRWC 03-10-10.doc” in Appendix 1.

E. coli. Grab sample at approximately 1 foot depth. All bacteria samples will be collected according to a schedule that allows them to be analyzed within required holding times, during normal operating hours for all participating laboratories.

11. Sampling Method Requirements

MassWWP sampling protocols will be used for all indicators except optical brighteners, as indicated below. Table 6 summarizes the key elements of the SOPs. Complete field sampling SOPs are provided in the appendices.

Table 8: Sample Collection Methods

Parameter	Equipment/ Sample Container	Minimum Sample Quantity	Sample Preservation	Maximum Holding Time	Source of Protocol
Temperature	Alcohol thermometer	N/A	N/A	N/A	MassWWP Standard Operating Procedure Rivers-1 for Temperature Revision 0
E. coli	Sterilized HDPE/PP/ glass; Polystyrene. New disposable sterilized plastic sample bottle for Colilert samples [1]; latex gloves.	120 ml	Chill to <6^{0}C in cooler w/ice	6 hours	MassWWP SOPs Rivers – 3. For Bacteria R.0 *(see appendix*)
Optical Brighteners	Handsewn unbleached cotton pad placed inside plastic covered netting attached to a weight	N/A	After retrieval pads are rinsed in sample water squeezed "dry" and then placed in a plastic bag , kept flat and away from potential contaminants. Kept in dark	3 days	CRWC Optical Brightener SOP – after DEP DWM OB SOP. CN: 58.0
GPS	GPS unit	NA	NA	NA	Manufacturers' instructions

1. Cl residual is not anticipated at any Tier 1 site, based on discussions with WWTP operators and others (e.g. agency personnel) during the CT River Tri State Watershed Initiative project.

Table 9: Field Sampling Considerations

Parameter(s)	Sampling Considerations
temperature	Inspection and post-checking of probes are critical to achieving accurate and precise measurements
Optical Brighteners	The sampler, which includes a weight (e.g. brick) and the sample holder should be deployed in water that is moving and is deep enough to cover the sampler. The needed depth can be obtained by shoveling out a trench for the brick. If you disturb the sediments, allow them to settle or float away before you deploy the sampler or the cotton pad will become fouled. The sampler should be placed so that the cotton pad is perpendicular to the current.
E. coli bacteria	Sterile (new-sealed or autoclaved-sealed) bottle required. Place upright, capped sample bottle under the surface of the water about six inches. Do not rinse bottle. Slowly uncap and let it fill to capacity under the water. With hands away from the bottle opening, bring the bottle up and out of the water, pour sufficient water to leave approximately 1/2 inch air space in the bottle. Cap bottle and tighten. Latex gloves should be worn when sampling in waters suspected of contamination.

When crews arrive at a sampling site, they will sample in the following order:
Bacteria survey: *E. coli*, temperature.

12. Sampling Handling and Custody Procedures

E. coli: Sample container labels will be attached to dry bottles, with the following information: Site ID#, sample type, date and time, preservation, name of sampler, project name (CT River 604b Monitoring Program).

Optical brighteners: After the sampler is retrieved the pads should be rinsed in the sample water squeezed “dry” and then placed in a plastic sandwich bag which keeps it flat and away from potential contaminants. The bag should be labeled on the outside with the collectors’ initials, the water body name, location and or station number, the dates the sampler was deployed and retrieved. A sample label is stapled to the pad when the pads are returned to the lab. The label has the station number, collector’s initials, dates deployed and retrieved. The sample pads should be kept in a storage container and returned to the CRWC lab. The pads do not have to be refrigerated but they should be kept out of the sun.

13. Analytical Methods Requirements

Standard Operating Procedures (SOPs) for analyses performed by each participating laboratory are included in the appendices.

Table 10: Analytical Methods

Parameter	Method #	Source of Method	MDL	Laboratory using method	Special Provisions
E. coli	United water laboratory 1603	EPA 1603 (Modified m-TEC)	1 CFU*	United Water	Sodium Thiosulfate used in all containers for collecting samples from areas suspected or confirmed of having a chlorine residual. If chlorinated, dechlorinate samples to prevent loss of bacteria in sample. Filter smaller volumes when samples are very turbid.
	Bacteria Colilert SOP 604b CRWC 03-11-10	Standard Methods 9223B	1 CFU*	CRWC	
Optical brighteners	Optical Brighteners SOP 604b CRWC 03-10-10	Adapted from DEP CN 58.0		CRWC	

* MDL may change based on sample dilution rates

14. Quality Control Requirements

Table 11: QC Tests

Instrument/ Parameter	Accuracy Checks	Precision Checks	Approx. % Field QC Samples (field duplicates)
Thermometer	Compare with certified thermometer (owned by UMass EAL) at beginning of season	Field duplicates	10%
Optical Brighteners	Blank Pads	Different personnel conduct side-by-side assessments, compare	10%
E. coli	Negative and positive plates	Field duplicates Lab duplicates	10-20%

E. coli field duplicates are taken sequentially.
Project Coordinator will make at least one trip in each reach (southern and northern Massachusetts) in each sampling season (i.e. 2010 and 2011) to accompany and observe volunteers as they collect samples and transport to lab. Project Coordinator will confer with agency and program QA officers to determine what steps to take if quality control samples reveal sampling or analysis problems.

To compare Colilert and EPA 1603 E. coli analysis methods, PVPC and CRWC staff will schedule 3 sampling days in May, prior to or at the beginning of the project sampling season, wherein duplicate samples will be taken from 3 sites, one replicate from each delivered to the United Water and CRWC labs, respectively, for analysis by the different methods. An attempt will be made to collect samples that contain low, moderate and high levels of bacteria, for comparison purposes. CRWC and PVPC will confer on which sites to be sampled for this purpose. Depending on practical considerations (e.g. time, travel distance), these may or may not be identical to those sampled in the program (e.g. Tier 1, 2 or 3 sites listed in Table 6). .Duplicate sampling procedure: when possible, 2 samplers will position themselves side by side in stream, facing upstream, wait for disturbance to settle, then collect samples at same time, with bottles close together during the sample collection. When only 1 sampler is available, sampler will wear latex gloves, hold both caps in one hand, both sample bottles in other hand, collect 2 samples together, then replace caps on bottles.

Optical Brightener field duplicates will be placed side by side in current.

15. Equipment Testing, Inspection, and Maintenance Requirements

Table 12: Equipment Testing, Inspection, and Maintenance Requirements

Equipment Type	Inspection Frequency	Type Inspection	Maintenance, Corrective Action
Autoclave (bacteria analysis)	Weekly	Inspect and clean as needed. Spore check is run with a batch to ensure the autoclave is reaching proper temperature and pressure	Clean, lubricate surfaces; maintain water surfaces according to user's manual.
Sample prep equipment (e.g., sealer for Colilert bacteria method)	Prior to each sampling	Visual inspection, clean, and maintain according to manufacturer's recommendations.	Spare sampler
Incubator (bacteria analysis)	Prior to each sampling	Check temperature with max/min electronic thermometer (traceable to NIST)	Spare batteries, electrolyte
Thermometer	Before each sampling date	Visual, breakage/ integrity of column.	Keep spares on hand.
UV Lamp for Optical Brightener analysis	Before each analysis session	Visual; turn on to check proper functioning.	Spare bulbs on hand.

All inspection results and description of any maintenance performed will be recorded in a maintenance logbook. Maintenance records will be reviewed and signed off monthly by the QA Officer.

16. Instrument Calibration and Frequency

Table 13: Equipment Calibration

Equipment Type	Calibration Frequency	Standard or Calibration Instrument Used
Thermometers	At beginning of sampling season	NIST thermometer at CRWC laboratory and putting thermometers in ice water and tepid water

All calibration activities will be logged in a project notebook.

17. Inspection and Acceptance Requirements for Supplies

Sample bottles will be provided by participating laboratories. Bacteria sampling bottles will be autoclaved by participating laboratories prior to collections. Bottles will not contain thiosulfate - it is not expected that chlorine will be present in the water sampled. Coolers and ice packs provided by PVPC.

Table 14: Supplies Inspection, Acceptance Procedures

Supplies	Inspection Frequency	Type of Inspection	Available Parts	Maintenance
reagents/ standards for use in coliform analysis (See U nited Water and CRWC laboratory SOPs for details)	Before each sampling date	Visual inspection of quantity and expiration date	Spare, fresh solutions	Storage according to manufacturer's recommendations, Annual replacement at beginning of sampling season
Latex gloves	Before each sample date	Visual inspection of quantity, integrity	Spares	
Bags (e.g., zip lock)	Before each sampling date	Visual inspection of quantity, integrity	Spares	Storage according to manufacturer's recommendations
Field and Lab sample sheets	Before each sampling date	Visual	Additional copies and pens	
Sample Bottles	Before each sampling date	Integrity, cleanness and seal for nutrient bottles, verified sterility of bacterial sample bottles, equipment or rinsate blank for reused bottles	One set of spare bottles	Clean after use
Cooler	Before each sampling date	Cleanness, Ice packs	NA	Clean after each use
Optical Brightener: rope, monofilament line, container baskets	Before each deployment	Visual inspection for integrity.	Spares	Clean after each use.

18. Data Acquisition Requirements

No data other than that collected by project participants under the auspices of this QAPP will be used, other than to consult NOAA weather web site as needed to confirm dry weather conditions for sampling dates for Tier 2 and 3 sites.

19. Data Management

Field samplers will record data on field sheets, review and initial them before leaving each sampling site. Any errors or problems will be noted on field sheets. Corrective actions needed will be discussed with Field/Project Coordinator if feasible; if communication with Field/Project Coordinator is not feasible, field sampler will determine what corrective action is needed and will undertake such action. Field samplers will make copies of field sheets and mail to Field/Project coordinator every 2 weeks.

Project Coordinator will issue QC-site reconciliation sheets to field samplers prior to field sampling events. This will occur on a weekly to monthly basis. Field samplers will check appropriate fields to confirm QC sampling has occurred as scheduled, or will document departure in both the field sampling forms and the QC-site reconciliation sheets. Field samplers will contact Project Coordinator on the day of sampling to explain any departure from the planned QC sampling activities.

As practical, Project/Field Coordinator will review sheets and confer with samplers on any needed corrective action.

Field samplers will fill out the chain-of-custody form for forwarding the processed samples to the laboratory. Each person who handles or transports samples will also sign the custody form upon receipt of the samples. Chain of custody forms will follow samples to the lab and back to Project Coordinator by mail or pickup on a bi-weekly or monthly basis.

Once laboratory analyses are complete, the laboratory personnel will email lab results to the Project Coordinator.

The Project Coordinator and/or Data Management Coordinator will enter raw field and lab data into the PVPC and CRWC computer systems; will then email results to WRRC. When field sheets are received by Data Management Coordinator, computer-entered data will be compared with field sheets for accuracy. Suspected errors will be discussed with field samplers; corrections will be made as necessary to data on project web site and in project database. Project Coordinator and/or Data Management Coordinator will use QC-Site reconciliation sheets and communications from field samplers to document QC results from each sampling event.

The Project Coordinator and/or Data Management Coordinator will adapt STORET data entry spreadsheets used in the TWI program for use in this program. These will define projects, stations, and results. At the end of each sampling season, after data have been reviewed to correct or discard inaccurate entries and data not complying with data quality objectives, Project Coordinator and/or Data Management Coordinator will enter results data into the STORET data spreadsheets and submit to EPA, either by entering directly into the EPA STORET database or by sending Excel spreadsheet to EPA Region I staff for upload to STORET.

Original data sheets will be stored in PVPC offices, Springfield. Disk back-ups and copies of the data sheets will be made and stored in a separate location at PVPC WRRC offices. Computer files of lab results from the CRWC lab will be stored on a shared drive that is backed up daily, weekly, and monthly. Daily backups are stored in the

office; weekly and monthly backups are stored off site. All paper field data sheets will be filed in a metal filing cabinet at the office in Greenfield.

Project staff and volunteers may take digital photographs to assist in documentation of sampling site locations, outfalls or dry weather flows of interest, other visible signs of pollution, and other noteworthy phenomena encountered during conduct of this project. Digital photos will be stored on the PVPC computer in appropriately named folders (e.g. identifying sampling sites or a "visible pollution photos" folder). Some photos may be posted on project web site as part of outreach activities.

Documentation of data recording and handling, including all problems and corrective actions, will be included in all preliminary and final written reports.

Examples of data forms and checklists are provided in Appendix 1.

Table 15: Data Management, Review, Validation, Verification Process

Activity	By whom	Corrective action, if needed
Fill out, distribute QC-site reconciliation sheet to field samplers	Project Coordinator	Field samplers document departures from planned QC sampling, contacts Project Coordinator. Additional QC sampling scheduled as needed in future sampling events.
Check labels just prior to sampling, to ensure correct labeling of container.	Field sampler	Correct label or change container
At time of sampling, record data, sign field sheets and check off or comment on QC – site reconciliation sheets.	Field sampler	
Fill out, sign chain of custody (COC) forms for samples going to lab.	Field sampler	
Before submitting field sheets to field/Project Coordinator, check for reasonableness to expected range, completeness. Make copies of field sheets. Send field sheets to field/Project Coordinator every 2 weeks.	Field sampler	Flag suspect data.
Upon receipt of field sheets, recheck for reasonableness to expected range, completeness, accuracy, and legibility. Sign COC form.	Field/Project Coordinator	Confer with field sampler(s) on any questions/problems found.. Flag suspect data.
Upon receipt of samples and COC forms, check to see that forms correspond to number of samples, condition of samples as stated on COC forms. Sign COC forms. Copies of COC forms are made, sent to field/Project Coordinator.	Lab Coordinator, Field/Project Coordinator.	Confer with field/Project Coordinator. Contact field samplers as needed to locate missing samples, data records. In case of missing/spoiled samples or data records, authorize resembling as needed and feasible. If resampling is not feasible, flag all suspect data.
Upon completion of laboratory analyses, fill out lab sheets, including data on QC tests. Review for reasonableness to	Lab Coordinator.	Re-analyze if possible. If not, confer with Project Coordinator. Flag all suspect data.

Activity	By whom	Corrective action, if needed
expected range, completeness. Make copies of lab sheets. Send electronic copy of lab sheet to Project Coordinator.		
Upon receipt of electronic copy of lab sheets, review for completeness and legibility.	Monitoring/Data Mgt. Coordinator.	Confer with lab coordinator.
Upon completion of data entry, print out raw data. Compare with field/lab sheets for accuracy.	Data Management Coordinator or other volunteer. Data entry personnel may review their own work, but a different person than data entry person shall perform the final accuracy comparison.	Re-enter data.
Translate raw data printouts into preliminary data reports: run statistical analyses and/or prepare graphical summaries of data. Compare lab results with QC-site reconciliation sheets to document QC activities/results. Check for agreement with QC objectives stated in Tables 3 and 11 and for completeness.	Project Coordinator/Data Management Coordinator	Confer with QA Officer. Flag or discard suspect data.
Post data on project web site, email to cooperating organizations for use in their outreach activities.	Project Coordinator/Data Mgt. Coordinator	
In-season (at least once) and end of season review of collected data sets (individual sample runs and season-total compilations); review for completeness and agreement with QC objectives and DQOs.	Project Coordinator. TAC if applicable. Share with QA Officer.	Flag or discard suspect data. Decide upon any restrictions in use of data with respect to original data use goals. If mechanism is in place to ID suspect data, use footnotes to indicate such data and to describe data use restrictions.

20. Assessments and Response Actions

The progress and quality of the monitoring program will be continuously assessed to ensure that its objectives are being accomplished. The Project Coordinator will periodically check to see the following:

a. Monitoring is occurring as planned;
b. Sufficient written commentary and supporting photographs exist;
c. Sufficient volunteers are available;
d. Volunteers have been observed as they sample their sites - Project Coordinator will make at least one trip in each reach (Northern MA, Southern MA) as early as possible in each sampling season to accompany and observe volunteers as they collect samples and transport to lab. Project Coordinator will check that the Samplers are safe while monitoring, to observe and correct sampling practices, field data form entries and monitoring elements.
e. Samplers are collecting in accordance with project schedules;
f. Data sheets and custody control sheets are being properly completed and signed;
g. Data are properly interpreted;
h. Plans for dealing with adverse weather are in place;
i. Retraining or other corrective action is implemented at the first hint of non compliance with the QAPP or SOPs;
j. Labs are adhering to the requirements of their QAPP, in terms of work performed, accuracy, acceptable holding times, timely and understandable results and delivery process;
k. Data management is being handled properly, i.e. data are entered on a timely basis, is properly backed up, is easily accessed, and raw data are properly stored in a safe place;
l. Procedure for developing and reporting the results exists.

The Project Coordinator shall confer with the QA Officer as necessary to discuss any problems that occur and what corrective actions are needed to maintain program integrity. In addition, the Project Coordinator and QA Officer shall meet at the end of the sampling season, to review the draft report and discuss all aspects of the program and identify necessary program modifications for future sampling activities. Corrections may include retraining volunteers; rewriting sampling instructions; replacement of volunteers; alteration of sampling schedules, sites or methods; or other actions deemed necessary. All problems discovered and program modifications made shall be documented in the final version of the project report. If modifications require changes in the Quality Assurance Project Plan, these changes shall be submitted DEP and EPA for review.

If data are found to be consistently outside the Data Quality Objectives (see Section 7) the Project Coordinator, in consultation with project, DEP and EPA QA officers will review the program and correct problems as needed.

21. Reports

Data that have passed preliminary QC analysis as described in Table 19.1 will be posted on the project web site and emailed to the local press and to participating organizations that have agreed to post data at information kiosks and similar venues at their sites. A caveat will accompany these or any data released on a preliminary basis, explaining that

they are for review purposes only and subject to correction after completion of a full data review occurring at the end of the sampling season.

The Project Coordinator will write a year one and a final report, with assistance from the QA Officer. This will be sent to the QAPP distribution list. The final report will include (updated as necessary) any tables and graphs that were developed for initial data distribution efforts (i.e. the web site and media), and it will describe the program's goals, methods, quality control results, data interpretation, and recommendations. This report may also be used in public presentations.

The year one and final reports will include discussion of steps taken to assure data quality, findings on data quality, and decisions made on use, censor, or flagging of questionable data. Any data that are censored in reports will be either referred to in this discussion, or presented but noted as censored.

Any reports submitted to Massachusetts state agencies will generally conform to MassDEP guidelines CN 0.74 *Recommended Content of 3rd Party Data,* CN 0.78 *Data Deliverable Guidelines for Grant Projects* and /or other MassDEP guidance. MassDEP will be contacted prior to submission of raw data and final reports.

22. Data Review, Validation and Verification Requirements

The Project Coordinator will review field and laboratory data after each sampling run and take corrective actions as described in Table 19.1. At least once during the season, at end of the season and if questions arise, the Project Coordinator will share the data with the QA Officer to determine if the data appear to meet the objectives of the QAPP. Together, they will decide on any actions to take if problems are found.

23. Validation and Verification Methods

Data validation and verification will occur as described in Table 19.1, and will include checks on:

- Completion of all fields on data sheets; missing data sheets
- Completeness of sampling runs (e.g. number of sites visited/samples taken vs. number proposed, were all parameters sampled/analyzed)
- Completeness of QC checks (e.g. number and type of QC checks performed vs. number/type proposed)
- Accuracy and precision compared to data quality objectives
- Representativeness of samples and resulting data by examining survey metadata for unusual conditions and occurrences that may have affected the validity of results.

24. Reconciliation with Data Quality Objectives

At the conclusion of each sampling season, after all in-season quality control checks, assessment actions, validation and verification checks and corrective actions have been taken, the resulting data set will be compared with the program's data quality objectives (DQOs). This review will include, for each parameter, calculation of the following:

- Completeness goals: overall % of samples passing QC tests vs. number proposed in Section 7
- Percent of samples exceeding accuracy and precision limits
- Average departure from accuracy and precision targets.

After reviewing these calculations, and taking into consideration such factors as clusters of unacceptable data (e.g. whether certain parameters, sites, dates, volunteer teams etc. produced poor results), the Project Coordinator and Project QA Officer will evaluate overall program attainment.

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APPENDIX 1

Field and Laboratory Operating Procedures

- R-3 Bacteria Rev.0
- SOP United Water EPA 1603
- Bacteria Colilert SOP604b CRWC 03-11-10
- Optical Brighteners SOP 604b CRWC 03-10-10

APPENDIX 2

Sample bottle labels, data sheets, forms

Connecticut River 604B Monitoring Program

Pioneer Valley Planning Commission –60 Congress Street Springfield, MA 01104-3419 acapra@pvpc..org 413-781-6045

FIELD DATA SHEET – *E. coli monitoring*

DATE:_____ SAMPLER NAMES:_____

WEATHER OBSERVATIONS (check appropriate boxes):
Weather now: ❑Clear ❑Partly Cloudy ❑Overcast ❑Cloudy ❑Drizzle ❑Raining ❑Other:

Weather past two days:
_____

Was the rain ❑light, ❑moderate, or ❑heavy?

Site Name/ID	Sample ID	Time	Air °C	H_2O °C	H_20 Color	H_2O Odor

Color, odor codes:
Water color: clear; cloudy; muddy, **green, brown, tea** colored, **ir** = iridescent, **other** (describe):_____

Water odor: none, rotten **egg**, **gas**oline, **sewage, det**ergent, **fish**, **other** (describe):_____

Any floating debris?
(describe):_____

Comments:

Connecticut River 604B Monitoring Program

Pioneer Valley Planning Commission –60 Congress Street Springfield, MA 01104-3419
acapra@pvpc..org 413-781-6045

QC – Site reconciliation Sheet - E. coli sampling

Date	Sample ID	Corresponding site	QC Type	*Sampler*	*Comment*

Project Coordinator fills out columns 1 – 4 (Date through QC type).
Sampler fills out name, comment columns.
Date = date sample taken
Sample ID = lab initial plus "QC": i.e. AQC (Aquacheck), GQC (Greenfield), CQC (Chicopee), or HQC (Holyoke). If >1 QC samples are taken on the same day for the same laboratory , use numbering system (e.g. AQC1, AQC2) to differentiate. ***This Sample ID is also entered in Sample ID field of field sampling form.***
Corresponding site: enter site # if the QC is a duplicate. Otherwise enter "QC".
QC Type: D = Duplicate; B = blank.
Sampler: Enter Sampler name/initials
Comment: Enter check mark to indicate QC was taken as planned; otherwise note what occurred (e.g. duplicate may have been taken from a different site). May use back of sheet if additional space is needed. If QC sample was not taken as planned, field sampler must also enter comment in field sampling form to explain what occurred.

Connecticut River 604B Monitoring Program

Pioneer Valley Planning Commission –60 Congress Street Springfield, MA 01104-3419
acapra@pvpc..org 413-781-6045

Field Data Sheet - Optical Brightener sampling

SITE NAME:_____ SITE NUMBER: _____

DATE:_____ TIME:_____ Deploy___ or Retrieve ___ Sample.

VOLUNTEERS:_____

WEATHER OBSERVATIONS (check appropriate boxes):
Weather now: □Clear □Partly Cloudy □Overcast □Cloudy □Drizzle □Raining □Other:

Air Temperature: _____°C

Weather past two days:_____
If it has rained in past two days, estimate amount of precipitation:_____inches
Was the rain □light, □moderate, or □heavy?

WATER OBSERVATIONS (check appropriate boxes):
Water color: □clear □cloudy □muddy □green □brown □tea colored □iridescent

□other:_____

Water odor: □none □rotten egg □gasoline □ sewage □detergent □fishy

□other:_____

Any floating debris?
(describe):_____

STREAM USE OBSERVATIONS
Any human use of stream?

Describe:_____

Any Livestock or wildlife?

Describe:_____

Comments:

Connecticut River 604B Monitoring Program

Connecticut River Watershed Council – 15 Bank Row Greenfield, MA 01301
adonlon@ctriver.org (413) 772-2020

Lab Data Sheet – *E. coli* Bacteria

Laboratory: _____

Date: _____ Analyst: _____

Water Body: Connecticut River

E. Coli Sample Results

Sample ID & Replicate #	Volume ml	Count	Colonies/ 100 ml

Sample bottle label
For E. coli

Sample ID
_____

Site Location _____

Site No. _____ Sample Type:_____

am
Date: _____ Time: _____pm
mm/dd/yr

Preservation Method: _____

Sampler's Name _____

Optical Brighteners sample bag label - duplicate used to staple to pad when returned to laboratory

Optical Brightener Sample

Water Body _____

Site Location _____

Site No. _____

Date deployed: _____

Date retrieved: _____
mm/dd/yr

Sampler's Name _____

Chain of Custody Form
Connecticut River 604b Monitoring Program

Name of Lab:_____

Sampler's Signature:_____

Sample IDs	Site name/ number	Date, Time	Type	#Bottles	Analyses	Comment *(Initial all comments)*
					E. coli	

Relinquished by: Signature	Received by: Signature	Condition when received (i.e. warm, cool, frozen)	Date/Time
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Additional Comments:

Training record form

Specific Training Type & Description	Trainer(s)	Training Date(s)	Trainees	Location of Training Records
EXAMPLE: E. coli sampling	Project Coordinator.	TBD – within 3 weeks of start of annual sampling in May	Volunteers *to be named*	PVPC computer (electronic copy), office filing cabinet (paper copy)