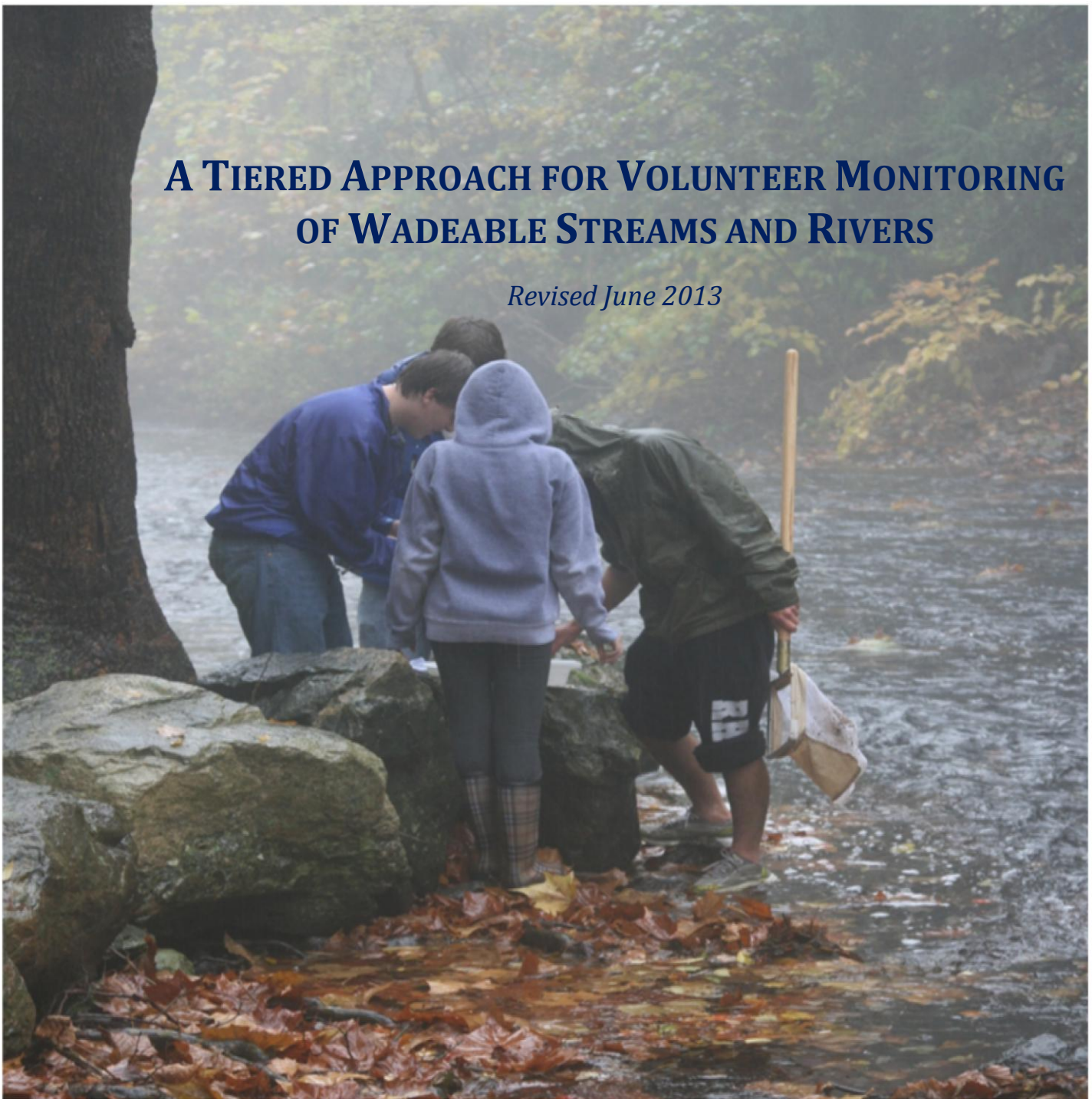
A Tiered Approach for Volunteer Monitoring of Wadeable Streams and Rivers

Revised June 2013



State of Connecticut
Department of Energy and Environmental Protection
Bureau of Water Protection & Land Reuse

A TIERED APPROACH FOR VOLUNTEER MONITORING OF WADEABLE STREAMS AND RIVERS

Revised June 2013

TABLE OF CONTENTS

Acknowledgements

This document is a revision of an earlier document authored by Michael Beauchene (CT DEEP) and published in June 2000 under the title, "A Tiered Approach for Citizen-Based Monitoring of Wadeable Stream and Rivers."

Preferred Citation

Connecticut Department of Energy and Environmental Protection. 2013. A Tiered Approach for Volunteer Monitoring of Wadeable Streams and Rivers. Connecticut Department of Energy and Environmental Protection. Hartford, CT 06106.

Photo Credits

All photographs contained in this report were taken by CT DEEP Bureau of Water Protection and Land Reuse, Monitoring and Assessment program staff unless otherwise noted.

For Additional Information Contact:

Meghan Ruta
Volunteer Monitoring Coordinator
Bureau of Water Protection and Land Reuse
Connecticut Department of Energy and Environmental Protection
79 Elm Street, Hartford, CT 06106-5127
(860) 424-3061
Meghan.Ruta@ct.gov

Purpose

There are many different water quality related resources available to support volunteer monitoring organizations, including numerous manuals, web sites, equipment, and analysis techniques. Unfortunately, water quality data generated using many of these methods may not be acceptable for use by the Department of Energy and Environmental Protection (DEEP).

The purpose of this document is to provide guidance to volunteer monitoring organizations that intend to collect and submit water quality information for inland surface water resources to the DEEP Bureau of Water Protection and Land Reuse, Monitoring and Assessment Program.

The tiered approach outlined in this document is intended to encourage participation by volunteers having a wide range of expertise, skills, and interest levels. It has been specifically developed by the DEEP to insure optimal generation and use of volunteer data.

Introduction

Water Quality Monitoring and Assessment in Connecticut

The Clean Water Act (CWA) is the primary federal law that protects our nation's surface waters, including lakes, rivers, wetlands, estuaries and ocean waters. The Connecticut Water Quality Standards (CT DEP 2011) form the foundation of Connecticut's water management programs as required by Section 303(c) of the federal Clean Water Act. The Water Quality Standards articulate State policies regarding designated uses and related classifications of Connecticut's water resources, addressing both surface and ground waters, and the standards and criteria necessary to support such designated uses.

Section 305(b) of the Clean Water Act requires each State to also monitor, assess and report on the quality of its waters relative to the attainment of designated uses established by the state's water quality standards. Each year, staff assigned to the CTDEEP ambient water quality monitoring and assessment program, conduct various monitoring activities to assess whether the State's rivers and streams are meeting the designated uses and criteria for their assigned water quality classifications. The State's Comprehensive Ambient Water Quality Monitoring Strategy (CT DEP, 2005) incorporates a combination of targeted and probabilistic water sampling designs. Sampling includes annual evaluations of reference sites, focused physical, chemical and/or biological monitoring, and follow-up to reported problems.

When making water quality assessments, DEEP assigns each designated use of a waterbody a level of support (i.e., fully supporting, not supporting, insufficient information, or not assessed). The level of support characterizes whether or not the water is suitable for the given use at the time of the assessment. The level of use attainment (i.e. support) is assigned based upon available water quality data and other reliable information; the final list of waterbodies that were assessed, as well as their corresponding assessments, is commonly referred to as the 305(b) list.

Section 303(d) of the CWA requires each state to also compile a subset of the waterbodies on the 305(b) list, identifying those waters that were monitored and determined to not be presently meeting water quality standards. This list of impaired waterbodies, commonly referred to as the 303(d) list, is prioritized for management action. The 305(b) and 303(d) lists are brought together in the Integrated Water Quality Report (IWQR), which is submitted to the United States Environmental Protection Agency (US EPA) every two years for review and, in the case of waters listed on the 303(d) list, US EPA approval.

The Connecticut Consolidated Assessment and Listing Methodology (CT CALM) describes the procedure used by the DEEP to assess the quality of the State's waters relative to attainment of Connecticut Water Quality Standards (CT WQS). (The CT CALM is included as Chapter 1 in the biennial IWQR reports.) The CT CALM serves to document the protocols used by DEEP to assess water quality data.

Although the DEEP relies primarily on data collected as part of our Ambient Monitoring and Assessment Program, data from other state and federal agencies, local governments, drinking water utilities, volunteer organizations, and academic sources are solicited and may be considered when making assessments. The CT CALM therefore also establishes minimum standards for data acceptability in order to insure that only credible data are used to perform the assessments.

A simple workflow diagram of the major steps in Connecticut's water quality monitoring and assessment process is presented in Figure 1. During step 1 data are collected and evaluated, in step 2 the data are compared to water quality standards and each river segment is assigned a level of support for each designated use. Finally, in step 3 the water quality assessments are reported to the public via the IWQR to Congress. The cycle is ongoing and repeats itself biennially.

The Importance of Volunteer Monitoring Data

The process of monitoring and assessing the State's rivers and streams is not a small task. There are over 5,830 miles of stream and river in the State of Connecticut; a distance roughly equivalent to the length of US-Mexico and US-Canada borders - combined!

Historically, DEEP monitoring activities were only able to focus on roughly 10% of the total stream miles (primarily on major rivers or streams having treated point source discharges). The introduction of a rotating basin strategy increased the number of rivers and stream monitored to approximately 20%. Targeted sites are now prioritized by major watershed and focus on the most significant resources, selected reference sites, and in response to nuisance complaints or concerns regarding pollution impacts.

DEEP ambient monitoring also includes a set of randomly selected sites capable of supporting probabilistic monitoring. This enables the state to monitor 100% of second through 4th order wadeable streams in Connecticut and to make a statewide determination of what percentage of rivers and streams are meeting water quality requirements.

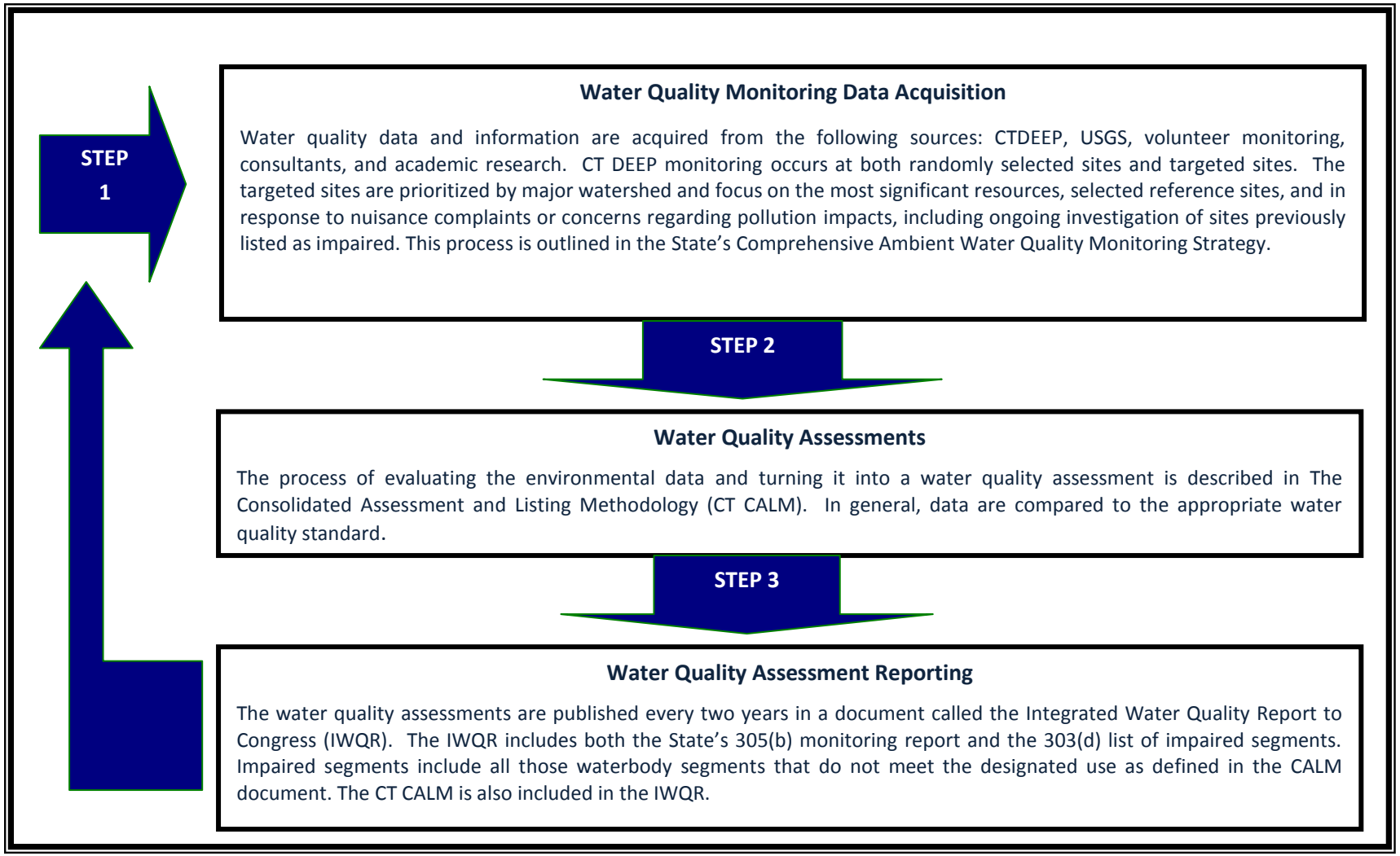


Figure 1. A generalized workflow for water quality assessments performed by the CT DEEP

.

Despite expanded monitoring activities and the introduction of probabilistic monitoring, there are still a large number of waterbodies, particularly smaller, first-order streams, with little or no water quality information. Consequently, data from sources other than the DEEP's own Ambient Monitoring and Assessment Program are solicited and may be considered to make water quality assessments. High quality, usable data submitted by volunteer monitoring organizations are among those external data considered. To ensure that your volunteer monitoring group's data are accepted for consideration by DEEP, follow the enclosed data submission guidelines.

The contribution of Connecticut's volunteer monitoring programs to the State's water quality monitoring and assessment efforts is incredibly valuable. Between 2006 and 2010, for example, the State's River Bioassessment by Volunteers (RBV) volunteer water quality monitoring program provided the State with information from 267 different stream sites (Figure 2). Eighty-three of these sites (31%) had at least four different types of the "Most Wanted" organisms; at these 83 locations DEEP was able to provide an assessment for aquatic life as "Full Support" for the IWQR. Without these volunteer data, water quality conditions would remain unassessed at these locations.

DEEP considers information for assessments up to November 1 prior to the year when the IWQR is due to US EPA. Data and information submitted after November 1st will be considered for the next IWQR reporting cycle.

Data quality is evaluated for use in assessments using the three-tiered system described in this document.

Data that meets DEEP's minimum data acceptability standards will be considered during the biennial assessment process.

Volunteers participate in the Tier 2 River Bioassessment by Volunteers (RBV) monitoring program.

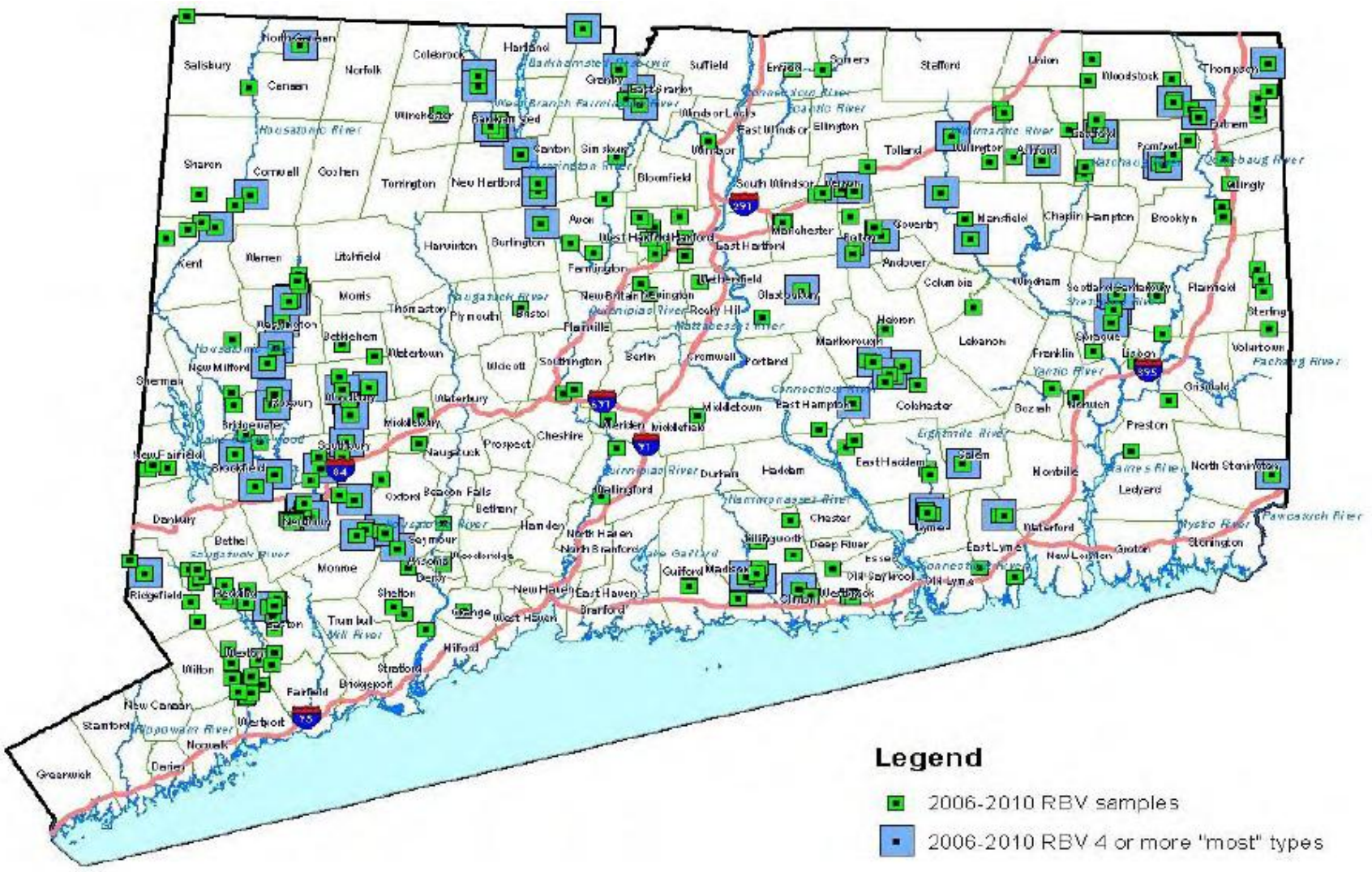


Figure 2. Locations of the 267 River Bioassessment by Volunteers (RBV) samples collected between 2006 and 2010. The large blue squares represent samples with 4 or more "most wanted" organism types present in the sample; at these 83 locations DEEP was able to provide an assessment for aquatic life as "Full Support" for the IWQR.

Tiered Approach to Volunteer Monitoring Overview

Volunteer monitoring continues to attract interested citizens in Connecticut. More than twenty volunteer monitoring groups collect and contribute water quality information on more than 100 sites annually to CT DEEP. While each volunteer monitoring organization is unique, the majority can be described as small groups of dedicated participants funded through a very limited budget (if at all). Their monitoring activities typically focus on water quality, intending to educate a variety of audiences and themselves about the physical, chemical, and biological condition of a waterbody. Data is often submitted to state and local officials in order to provide information about baseline conditions, screen for water quality issues, assess potential nonpoint source pollution, and provide information for watershed planning.

Since 1999, DEEP has promoted a three-tiered approach to volunteer monitoring (Table 1). The tiered approach provides volunteer monitoring groups with standard guidance regarding data collection and submission, encourages participation at a variety of levels of effort, and prioritizes the type of data most useful for the ambient monitoring program, in order to successfully augment current DEEP monitoring.

Tier 1 monitoring programs include independent observational monitoring efforts. Tier 1 data typically consist of digital photos or written descriptions of observations. These data are particularly helpful as a record of an episodic event; however they are not likely to provide sufficient information to formalize an assessment. (They can serve as important supporting information, however, if other data exists for the waterbody.)

Tier 2 monitoring programs include the efforts of those groups that participate in one of two DEEP-coordinated volunteer stream monitoring networks: the River Bioassessment by Volunteers (RBV) program and the Volunteer Stream Temperature Monitoring Network. Volunteers participating in these Tier 2 programs collect biological and thermal data under the supervision of the DEEP Bureau of Water Protection and Land Reuse. Tier 2 monitoring efforts typically require greater overall effort and training than Tier 1 efforts. Tier 2 data do not involve development of a Quality Assurance Project Plan (QAPP) as DEEP already maintains an overall QAPP for these programs; local programs that are trained by DEEP to participate in one of these monitoring networks (RBV or Stream Temperature) are covered under the DEEP QAPP. Although in some instances RBV data may be directly utilized to formalize assessments for high quality waters, most Tier 2 data are not likely to be enough information to formalize an assessment alone. Tier 2 data do however provide strong supporting information when other data exists for waterbody.

Tier 3 monitoring programs include waterbody-specific intensive monitoring or research programs, typically developed to address a specific water quality concern. *For DEEP to consider data produced by Tier 3 programs, a formal monitoring plan and associated Quality Assurance Project Plan (QAPP) must be approved by DEEP prior to the implementation of the monitoring program.* (In some cases EPA approval of the monitoring plan and QAPP is also

Table 1. Key Attributes of the CT DEEP Three Tier Volunteer Monitoring System									
		Program Type	Time Investment	Program Cost	Expertise Required	Training Requirements	Best Uses	Information Collected	Limitations
Tier	1	Independent Observational Monitoring Programs	Minor but Persistent	Low to Moderate	Low	Low: Little or no formal training	• Monitor episodic events (e.g., sewage overflow, poor erosion control, illegal discharges, withdrawals, or dumping) • Document baseline channel conditions	• Digital photos • GPS location • Written (e-mail) or verbal (phone call) description of activities	May require multiple small efforts to sufficiently document episode. May be better handled at the local level
	2	DEEP-Coordinated Stream Monitoring Networks	Minor to Moderate (Typically one day per year.)	Low to Moderate	Low to Moderate	Moderate: Formal group training by DEEP is required prior to monitoring	• Screen for very high quality streams/rivers • Monitor stream temperature	• Macroinvertebrate community data • Seasonal or annual temperature data • Site photographs	Seasonal monitoring programs
	3	Waterbody-Specific Intensive Monitoring Plans	Significant (Extensive planning; monitor several days per week or month; seasonal or year round)	Moderate to High	High	High: Requires adherence to a DEEP-approved Quality Assurance Project Plan (QAPP)	• Watershed-based plan support • Source-tracking impairments • TMDL assistance	• Indicator bacteria levels • Nutrient levels • Metal levels • Flow conditions (gauge data)	Program coordinator required May require EPA-approval of QAPP

required.) Tier 3 monitoring efforts are more labor intensive and more costly than Tier 1and Tier 2 efforts, and require significant technical expertise to successfully execute. Tier 3 QAPPs include laboratory tests and techniques to be used, standard operating procedures for field work, data quality objectives, and a plan for data management and analysis. Chemistry results are required to be provided from a state-certified laboratory, and taxonomic identifications must be conducted by a taxonomist with sufficient experience to provide reliable taxonomic identifications. Project objectives are expected to be consistent with DEEP's use of data for waterbody assessment purposes. Because of the rigor with which Tier 3 monitoring activities are planned and implemented, Tier 3 data may be used to directly support water quality assessments.

The tiered approach has encouraged greater cooperation between volunteer monitoring groups. This has allowed the State to streamline efforts and resources expended in support of such programs. Through the tiered approach the State has also been able to develop several state-wide monitoring programs that meet specific goals and objectives – both for DEEP and for the local volunteer groups.

When determining which tier of monitoring effort to pursue, a volunteer group should evaluate the expertise of its members, funding required, resources available, effort required, and the number of dedicated volunteers. Regardless of the tier level pursued, each group will contribute meaningful information to the DEEP - provided that DEEP's data collection and submission protocols are followed.

It is generally recommended that new volunteer monitoring groups begin with a Tier 1 volunteer monitoring program (e.g. an observational monitoring program) to ensure that they do not take on more than they can handle. As the group acquires resources, volunteers, and information, they may then decide to pursue monitoring activities that are more complex (e.g., participation in a Tier 2 program).

Tier 1: Independent Observational Monitoring

Observational monitoring is a low-technology effort that does not require extensive equipment resources. *However, to produce usable data for DEEP, Tier 1 volunteer monitors must pay strong attention to detail and carefully document all observations*. DEEP advocates the use of two specific Tier 1 monitoring programs: periodic visual observation and streamwalks.

Tier 1 Data Types:

- Digital photos or video footage
- Written descriptions of observations
- Streamwalk program reports

Tier 1 Data Utility:

- Support implementation or development of watershed-based plans
- Identification of potential water quality problems.
- Initiate timely inspection by regulatory personnel.
- Assist with prioritization of site selection for additional monitoring.
- Provide general or more frequent information from waterbodies not routinely monitored or monitored infrequently.
- Establishment of an inventory of stream channel condition for sections of a stream or streams not routinely monitored.

Volunteer Resource Requirements:

- Periodic visual observations require minimal training, equipment, and management, but strict adherence to detailed documentation procedures is necessary. A single individual

(or a small group) can collect this type of monitoring data with relatively limited effort and time.

- Streamwalk programs require relatively little training and time commitment for the individual volunteer, but require a committed coordinator from an organizing group. Several days to several weeks of effort may be need to plan the program, recruit and train volunteer, and summarize the results into a final report.

Periodic Visual Observation (Tier 1 Program)

Many current water quality issues are short-term episodic events. The successful resolution of these events is related to the length of time that passes prior to detection. Therefore, some of the most valuable monitoring data volunteers can submit involves regular, periodic visual observation of stream and near stream conditions.

Periodic visual observation involves regular, detailed documentation of stream conditions over a period of time at one more stations along a waterbody. The most useful periodic visual observation information will be detailed documentation of both normal and abnormal conditions.

Period visual observation is particularly well suited for volunteers that are interested in contributing monitoring information but are not affiliated with a larger volunteer monitoring organization. Individual volunteer monitors can readily observe and document (i.e., through photographs and written observation journals) stream condition at multiple locations during optimal time frames (e.g., during or following storm events, during summer low flow periods, etc.).

Detailed observational data can augment the DEEP's periodic physical, chemical, and biological data by providing day-to-day or week-to-week stream conditions. In doing so, volunteer monitors can also potentially expedite water quality improvements by immediately notifying local officials and DEEP (see box at right) of abnormal conditions, in order to initiate timely follow-up inspection by regulatory personnel. Ongoing period visual observation efforts can provide DEEP with a valuable long-term record of conditions at a given site.

Suspect a chemical spill, oil spill, or illegal discharge?

Oil/Chemical Spills
Call the DEEP Emergency Response line:
866-DEEP-SPIL
or 866-337-7745

Illegal Discharges
Contact the DEEP Water Enforcement group:
860-424-3018

Periodic Visual Observation Submission Requirements:

1. *When submitting photographs or video footage, a written description of the monitoring site location must be included*. The location description should including waterbody name, town, location description (e.g. nearest business, house address, road intersection, or telephone pole) and the date and time that the photograph was taken.

Inclusion of GPS location (latitude/longitude), or a map with the monitoring site location noted, is preferred.

2. *Volunteers should provide DEEP staff with a written account of their observations at the monitoring site.* The intention of photographs and videos may not be immediately apparent to the DEEP staff reviewing it. Volunteers should clearly state what submitted photos/videos are intended to show (e.g. concern over unusual water color, an oily sheen, possible trash dumping site, heavy erosion, etc.) and when the photographs were taken (e.g., date and time).
3. *When possible, digital file names should be renamed to include the stream name, location and dat*e (e.g. [StreamName]_[Town]_[Place]_[Date MMDDYY format]-[Photo#]). For example, "HopRiver_Andover_UpstreamHendeeRd_061312_Photo1.jpg"
4. *Provide your contact information (phone or email) so that we reach you if needed for questions.*

Tips for Conducting Periodic Visual Observation:

- *Never trespass to obtain information or monitoring data.* DEEP cannot use information or data that was obtained illegally.
- *If taking repeat photographs at the same location, use the same camera to the extent possible for each photo.*
- *If using a date/time stamp ensure it is set to the correct date and time!* Mislabeled photos may not be usable by DEEP staff.
- *Include a reference point in photos, such as a landscape feature that is unlikely to change over several years (e.g. a large boulder, tree, or building).* This will both help DEEP staff locate the site in the field as well as assist with comparing photographs taken on different dates.
- *Consider installing a photo station to allow for maximum comparability of long-term observations at a site*. Photo stations are simple, inexpensive constructions consisting of a post installed in the ground, with a small platform on top that contains guides for positioning your camera (see image at right). If properly constructed and maintained, a photo station will ensure that your camera is always positioned at the same height and angle when taking photographs.
- *Lighting can greatly affect photographs*. Be aware of the angle of light, cloud cover, background, shadows, and contrasts. Consider taking photos at the same time; mid-day if possible.
- *If possible include a label or sign within the photo itself to note the date, stream, and location of the photo.*
- *Use a systematic method, such as a photo-log book, to record*

An example photo station. (picturepost.unh.edu)

information about each photo. Include the general location (stream, city, etc.) of the site; photographer name(s); photo number; date; GPS coordinates; time (for each photograph); specific information about the subject of the photo; and a narrative description of photo location including proximity to and direction from notable landscape features like roads, fence lines, creeks, rocky outcrops, large trees, buildings, previous photo points, etc. – sufficient for future photographers who have never visited the project to locate the photo point.

The Connecticut Streamwalk Initiative (Tier 1 Program)

A streamwalk is a one-time, volunteer-based, comprehensive visual assessment of the physical conditions of instream and streamside characteristics of the streams within a local river basin. Streamwalks serve two purposes: resource evaluation through data collection and community involvement and education.

Although there are many different versions of streamwalk and stream survey protocols available to volunteer monitoring groups, DEEP requests that groups interested in organizing a streamwalk utilize the methodology established by the USDA Natural Resources Conservation Service (NRCS). (See box at bottom right for contact information.)

The data gathered through the survey is a first step toward understanding the physical condition of a stream corridor. The goal is to provide information about the stream channel and surrounding land use. In addition, volunteers document "areas of concern", such as areas of extensive erosion and sedimentation, lack of adequate riparian (streamside) vegetation, or sources of direct discharges into the stream. Once areas of concern are identified, a community can plan and implement conservation measures to address the specific needs of their watershed.

Streamwalks also serve as an important community involvement and education opportunity. Surveying the river brings volunteers into direct contact with the resources around them and creates the opportunity for them to better understand how a river system works and the ways in which a river and a human community are connected.

NRCS Connecticut Streamwalk Initiative

To organize a streamwalk contact:

Seth Lerman,
NRCS Conservationist:
seth.lerman@ct.usda.gov
(203) 287-8038, Ext. 104

or

Todd Bobbowick,
NRCS Conservationist:
todd.bobowick@ct.usda.gov
(203) 287-8038, Ext. 103

Streamwalk guidebook and survey sheets are available online:
http://www.ct.nrcs.usda.gov/programs/communities/streamwalk_initiative.html

A streamwalk volunteer monitoring program requires relatively little commitment from individual volunteers but requires substantial commitment from the organizing group. The organizing group is responsible for delineating the survey segments; recruiting volunteers; coordinating and conducting training; analyzing the results and compiling a final report. For the volunteer, a single day of training as well as additional time (e.g. 1-2 days) to complete each assigned section of stream corridor is required. The total amount of time required to complete each survey will depend on the length of the survey reach, the difficulty of the terrain, and the amount of previous stream walking

experience of the volunteer. The total amount of time to organize the program and compile the results into a report will depend on the geographic scope of the report and the experience of the coordinator.

Streamwalk Program Information Submission Requirements:

1. *DEEP will accept and review streamwalk information as a compiled final report.* The most useful reports are those that are submitted as soon as possible upon completion of the Streamwalk, and that are directly linked to an existing watershed-based management plan.
2. *Report s should include photos that are clearly labeled to indicate when and where they were taken, and clear, written descriptions of volunteer observations, particularly any areas of concern observed.*

Tips for Developing a Streamwalk Program:

- *DEEP strongly encourages groups interested in conducting a streamwalk program to consult with the DEEP Watershed Management Program before implementing a streamwalk assessment*. Streamwalk programs that generate new information that supports an existing watershed-based plan or that helps better characterize a known impairment will be most useful to DEEP.
- Streamwalk programs are not required to develop a QAPP in order to submit data to DEEP. However, there is a model QAPP available from a previous streamwalk program than can be reviewed and utilized by interested monitoring groups; contact the Volunteer Monitoring Coordinator for a copy.
- *Streamwalk organizers should consider discussing their program and sharing results with their local municipality.* Many of the areas of concern that are observed during streamwalk programs are best addressed at the local level.

Tier 2: DEEP-Coordinated Monitoring Networks

DEEP currently coordinates two Tier 2 monitoring programs: the River Bioassessment by Volunteers (RBV) network and the Volunteer Stream Temperature Monitoring Network.

Tier 2 programs are comparable to Tier 1 programs in terms of time commitment, program cost, and the level of expertise expected of the volunteer. The volunteer training is typically slightly more extensive in Tier 2 programs, requiring recurring annual 1-day training. Data from Tier 2 programs is, in some cases, directly relied upon for making assessment decisions; more stringent quality assurance measures, as compared to Tier 1 programs, are therefore implemented for Tier 2 programs.

Tier 2 Data Types:

- RBV voucher specimens with datasheets
- In-stream temperature probe data
- Supporting site photographs

Students participating in the River Bioassessment by Volunteers (RBV) program use kicknets to collect macroinvertebrate samples from a river.

Tier 2 Data Utility:

- Use to screen for very high quality streams and rivers
- Provide additional information to support DEEP water quality assessments
- Provide information from streams not routinely monitored by the DEEP
- Prioritize site selection for additional monitoring
- Establish a record of the benthic community at a given stream location

Volunteer Resource Requirements:

- Participation in one of DEEP's Tier 2 monitoring programs requires a committed core group of volunteers (6 or more), including one individual that is willing to serve as the group's local program coordinator and main contact.
- The program coordinator will need to make a moderate time commitment to (1) recruit additional volunteer participants if needed, (2) coordinate a group training event, (3) select and scout potential monitoring sites, (4) organize monitoring field dates (if different from training), and (5) review and compile the final data and corresponding datasheets and site photographs for submission to the DEEP.
- A moderate commitment is required from volunteer participants. Volunteers must be able to commit to annual training approximately 2-4 hours long. Monitoring typically requires one team of 2-3 volunteers for each site to be monitored, with at least one volunteer per team having had prior experience with the monitoring protocol being utilized (i.e., RBV or stream temperature monitoring).

- Participation in both the RBV program and the Stream Temperature Network requires that volunteers obtain several pieces of equipment:
    - The RBV program requires volunteers have access to at least one kicknet per site as well as several pieces of additional field equipment (sorting trays, tweezers, magnifying glasses, sieves, etc.).
    - Participation in the Stream Temperature Monitoring network requires the purchase of at least one stream temperature probe (e.g. Onset HOBO or TidbiT data loggers), and additional materials to secure the probe at the stream site (e.g. heavy metal weight, zip ties, metal cable, PVC tubing, flagging, etc.)
    - In addition, the volunteer organization coordinating the local monitoring activities will need to provide a number of items, including copies of training materials and field datasheets, boots or waders, topographic maps, digital camera(s), and, if possible, a GPS unit.
    - Additional equipment may be required depending on the program. Some equipment may be available for short-term loan from the DEEP.

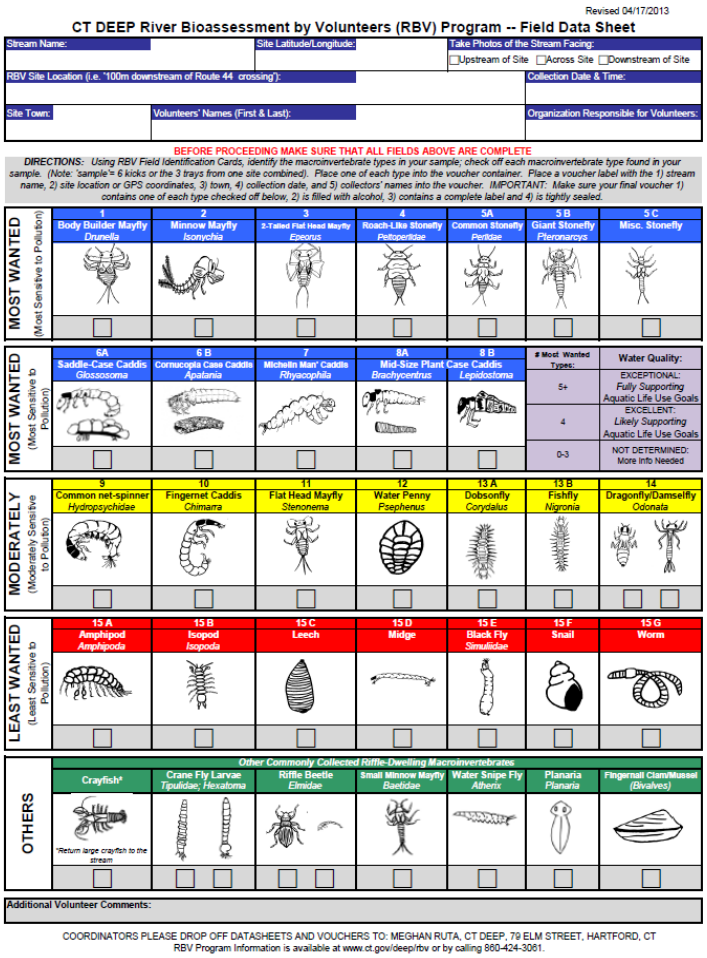
River Bioassessment by Volunteers (RBV) (Tier 2 Program)

The River Bioassessment by Volunteers (RBV) program, first piloted in 1999, is the longest-running volunteer stream monitoring program in Connecticut. Similar to DEEP's own benthic macroinvertebrate-based water quality monitoring efforts, RBV focuses on collecting macroinvertebrates (i.e., 'river bugs') from riffle habitat within a stream or river. However, instead of focusing on the entire macroinvertebrate community, RBV essentially is a scavenger hunt for a subset of macroinvertebrate 'types' that can be found.

Volunteers are trained by DEEP staff (or an approved Certified RBV Trainer) to collect a sample of the benthic macroinvertebrate community at a monitoring site. Volunteers work to identify and sort a limited group of specified macroinvertebrates. Each organism type on the provided list of RBV organisms is categorized as "most wanted," "moderately wanted," or "least wanted" depending on their known distribution in Connecticut's streams. "Most wanted" types are typically found only in Connecticut's most pristine streams, while those that are "least wanted" are commonly found in the most degraded waters.

Volunteers work together to sort and identify an RBV sample.

Training for first-time volunteers takes approximately 2-3 hours and includes a combination of classroom and field-based training. At the conclusion of training, volunteers are divided into teams of 2-3 volunteers and assigned one or more nearby sites to monitor.



Revised 04/17/2013

CT DEEP River Bioassessment by Volunteers (RBV) Program -- Field Data Sheet

Stream Name:	Site Latitude/Longitude:	Take Photos of the Stream Facing: ☐Upstream of Site ☐Across Site ☐Downstream of Site
RBV Site Location (i.e. "100m downstream of Route 44 crossing"):		Collection Date & Time:
Site Town:	Volunteers' Names (First & Last):	Organization Responsible for Volunteers:

BEFORE PROCEEDING MAKE SURE THAT ALL FIELDS ABOVE ARE COMPLETE

DIRECTIONS: Using RBV Field Identification Cards, identify the macroinvertebrate types in your sample; check off each macroinvertebrate type found in your sample. (Note: 'sample'= 6 kicks or the 3 trays from one site combined). Place one of each type into the voucher container. Place a voucher label with the 1) stream name, 2) site location or GPS coordinates, 3) town, 4) collection date, and 5) collectors' names into the voucher. IMPORTANT: Make sure your final voucher 1) contains one of each type checked off below, 2) is filled with alcohol, 3) contains a complete label and 4) is tightly sealed.

MOST WANTED (Most Sensitive to Pollution)

1	2	3	4	5A	5 B	5 C
Body Builder Mayfly *Drunella*	Minnow Mayfly *Isonychia*	2-Tailed Flat Head Mayfly *Epeorus*	Roach-Like Stonefly *Peltoperlidae*	Common Stonefly *Perlidae*	Giant Stonefly *Pteronarcys*	Misc. Stonefly

MOST WANTED (Most Sensitive to Pollution)

6A	6 B	7	8A	8 B	# Most Wanted Types:	Water Quality:
Saddle-Case Caddis *Glossosoma*	Cornucopia Case Caddis *Apatania*	Michelin Man' Caddis *Rhyacophila*	Mid-Size Plant Case Caddis *Brachycentrus*	Mid-Size Plant Case Caddis *Lepidostoma*	5+	EXCEPTIONAL: *Fully Supporting* Aquatic Life Use Goals
					4	EXCELLENT: *Likely Supporting* Aquatic Life Use Goals
					0-3	NOT DETERMINED: More Info Needed

MODERATELY (Moderately Sensitive to Pollution)

9	10	11	12	13 A	13 B	14
Common net-spinner *Hydropsychidae*	Fingernet Caddis *Chimarra*	Flat Head Mayfly *Stenonema*	Water Penny *Psephenus*	Dobsonfly *Corydalus*	Fishfly *Nigronia*	Dragonfly/Damselfly *Odonata*

LEAST WANTED (Least Sensitive to Pollution)

15 A	15 B	15 C	15 D	15 E	15 F	15 G
Amphipod *Amphipoda*	Isopod *Isopoda*	Leech	Midge	Black Fly *Simuliidae*	Snail	Worm

OTHERS

Other Commonly Collected Riffle-Dwelling Macroinvertebrates

Crayfish*	Crane Fly Larvae *Tipulidae; Hexatoma*	Riffle Beetle *Elmidae*	Small Minnow Mayfly *Baetidae*	Water Snipe Fly *Atherix*	Planaria *Planaria*	Fingernail Clam/Mussel *(Bivalves)*
*Return large crayfish to the stream						

Additional Volunteer Comments:

COORDINATORS PLEASE DROP OFF DATASHEETS AND VOUCHERS TO: MEGHAN RUTA, CT DEEP, 79 ELM STREET, HARTFORD, CT
RBV Program Information is available at www.ct.gov/deep/rbv or by calling 860-424-3061.

The River Bioassessment by Volunteers (RBV) Program datasheet.

Teams monitor their assigned site, following the RBV protocol, between September and November. The RBV monitoring protocol is completed streamside and takes approximately 2 hours per site. At the conclusion of the RBV monitoring effort, teams submit a completed data sheet and a labeled voucher collection for each site to their local group coordinator for eventual submission to DEEP. The voucher for each sampling site contains one of each macroinvertebrate type present at that site; the voucher is preserved with isopropyl or ethyl alcohol. Voucher contents are confirmed by DEEP staff and considered the official monitoring data for the site.

For those sites with 4 or more types of organisms in the 'Most Wanted' category present in the voucher collection, the location likely fully supports the State Biological Water Quality Criteria for aquatic life. The final decision to list the site as fully supporting, however, will be based upon a comparison of the results to additional available information and WPLR staff's familiarity with the site. Final assessment decisions (i.e. 'fully supporting') are reported by stream segment in the Integrated Water Quality Report to Congress (www.ct.gov/deep/iwqr).

RBV Program Training Requirements:

- All RBV volunteers must attend an annual training held by either DEEP staff or a Certified Local RBV Trainer. During the training volunteers are taught proper collection, sorting, identification, and voucher preparation and documentation techniques.
- RBV Volunteers that have participated in a Train-the-Trainer workshop and served as a group organizer for two or more years under DEEP supervision, are added to the list of Certified Local RBV Trainer. Certified Trainers are able to train new RBV volunteers and lead local RBV programs without direct DEEP staff supervision. To retain certification, trainers must remain active RBV volunteers and attend DEEP-led refresher Train-the-Trainer workshops periodically.

RBV Program Data Submission Requirements:

- *DEEP can only accept RBV data collected by volunteers who have been trained by DEEP staff or an approved local RBV program coordinator (i.e., DEEP certified RBV trainer).*
- The DEEP maintains a Quality Assurance Project Plan (QAPP) to ensure data generated by the River Bioassessment by Volunteers (RBV) program is high quality and usable for monitoring and assessment purposes. **All certified RBV trainers, local program coordinators, and volunteers are expected to abide by the data collection, preparation, and submission requirements outlined in the RBV QAPP**.
- *One datasheets must be submitted to DEEP for each site monitored*. Datasheets must be complete and legible.
- *One voucher must be prepared and submitted for each site monitored*. V*oucher must be preserved with ethyl or isopropyl alcohol and include a complete label, written in pencil*.
- *Digital photographs documenting the environmental conditions at the time of monitoring must be submitted for each site monitored*.

Tips for Organizing a Successful RBV Program:

- *Contact the Volunteer Monitoring Coordinator prior to conducting your sampling event to ensure that the locations you intend to monitor are suitable for the RBV method* (QAPP requirement). The most valuable information will come from groups who are able to complete the process along a reach of river that is not routinely monitored by DEEP.
- *RBV is intended to screen for high quality waters; RBV is not suitable for use in most urban streams.* (If you would like to monitor an urban stream, discuss alternative monitoring options with the Volunteer Monitoring Coordinator.)
- *New volunteers must be trained by a local RBV coordinator (i.e. certified RBV trainer) or DEEP staff.* Volunteers must successfully participate in a supervised RBV program for two or more years before leading a new local RBV program.
- *Many groups train for a few years under the guidance of an experienced RBV organization to determine whether the RBV program is right for them.* If your organization is not sure whether it should invest in developing an RBV program for your volunteers, contact the Volunteer Monitoring Coordinator to be paired with an existing RBV program in your area.

Volunteer Stream Temperature Monitoring Network (Tier 2 Program)

A volunteer prepares a temperature data logger for deployment in a local stream. *(Photo courtesy of Candlewood Valley Trout Unlimited)*

The Volunteer Stream Temperature Monitoring Network is DEEP's newest volunteer monitoring program. Established in 2008 with support from the US EPA volunteer monitoring equipment loan program, the network includes a growing number of volunteer monitoring organizations across the state. Participants in the program are trained by DEEP staff to install a stream temperature data logger at local stream sites of interest each spring (April-May), in order to capture data during the critical summer low flow period (June-August). (Prior to being placed in the field the data loggers are programmed to record hourly stream temperature.) Loggers are retrieved by volunteers in the early fall (September-October) and returned to DEEP for download and data analysis. The data generated by the Volunteer Stream Temperature Monitoring Network volunteers are instrumental to DEEP's water quality standard development, fish habitat assessment, and potential stream habitat restoration efforts.

Stream Temperature Monitoring Training Requirements:

- First-time volunteers must contact DEEP to schedule a training and to discuss potential monitoring locations. Training will cover how to prepare the data logger for deployment, how to deploy the logger in a stream, and required documentation protocols.

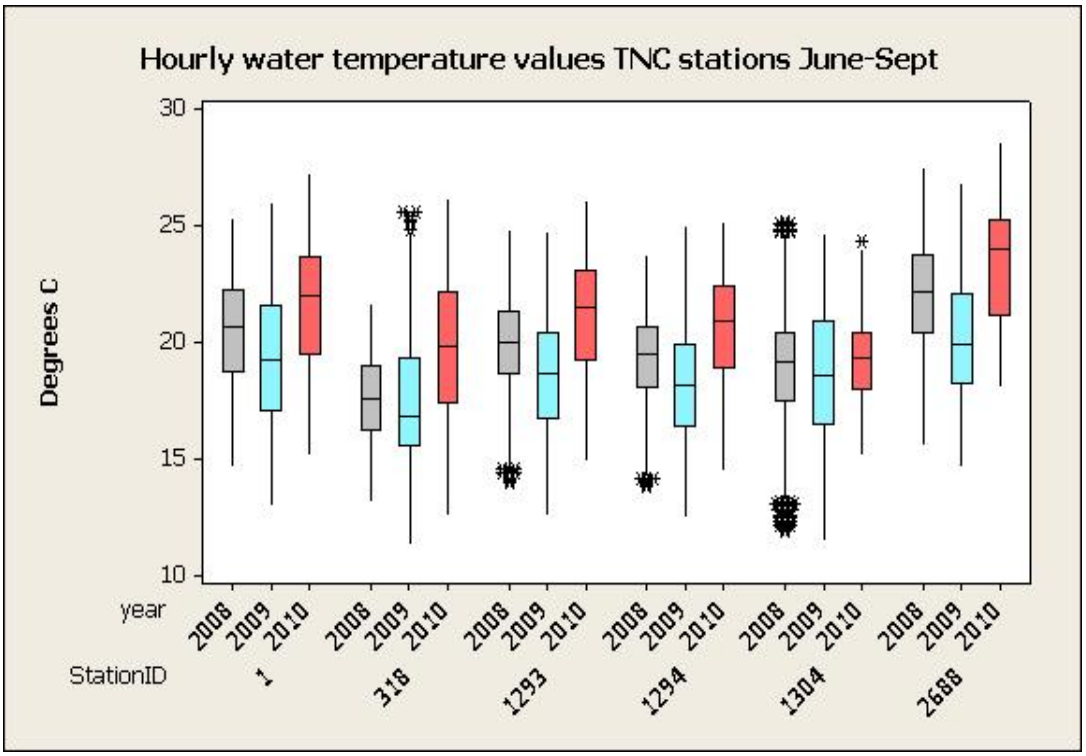
Stream Temperature Monitoring Data Submission Requirements:

- The DEEP maintains a Standard Operating Procedure (SOP) for the deployment of stream temperature data loggers in order to ensure data generated by the program is high quality and usable for monitoring and assessment purposes. **Volunteers are expected to abide by the data collection, preparation, and submission requirements outlined in the SOP.**
- *Data is to be submitted as hourly data in degrees Celsius.* (Loggers should be programmed to begin recording on an hour mark, e.g. 1:00, 2:00, 3:00, etc.) Data should be submitted to DEEP in both .xls and .hobo format. (Alternatively, volunteers can submit loggers directly to DEEP for download if volunteers do not have access to the necessary software to download the loggers.)
- *One datasheets must be submitted to DEEP for each site monitored*. Datasheets must be complete and legible.

- *Digital photographs documenting the location and environmental conditions at the time of logger deployment and retrieval must also be submitted for each site monitored.*
- *All data loggers must be quality checked before and after deployment; the quality check data files for each logger must be submitted to DEEP at the time of data and site photograph submission*. Quality check procedures and data submission requirements are documented in the DEEP SOP. (Volunteers unable to perform their own quality checks can coordinate with the DEEP Volunteer Monitoring Coordinator in order to have loggers quality checked by DEEP staff.)

Tips for Organizing a Successful Local Volunteer Stream Temperature Monitoring Program:

- Volunteers are encouraged to consult with the DEEP Volunteer Monitoring Coordinator prior to monitoring. DEEP maintains a network of more than 100 monitoring locations; coordination with DEEP staff will help avoid redundancy in monitoring and also help prevent volunteers from placing loggers in locations that are known to be difficult to monitor (e.g. those locations that are prone to heavy floods and equipment loss).



The Nature Conservancy at Devil's Den is a participant in the Volunteer Stream Temperature Monitoring Network. Between 2008-2010, TNC successfully monitored six locations, providing DEEP with valuable insight into summer stream temperature conditions at these sites.

Tier 3: Waterbody-Specific Intensive Monitoring Plans

DEEP staff conducts laboratory analysis.

Tier 3 programs include waterbody-specific intensive monitoring plans. Tier 3 programs are independently carried out by volunteer groups, and are significantly more costly and labor intensive than Tier 1 and Tier 2 programs. In addition, Tier 3 programs require that volunteer monitoring groups possess a significant amount of related scientific expertise and technical experience or, if not, that they work with a qualified contractor (e.g. laboratory).

For Tier 3 data to be accepted for use by DEEP, Tier 3 programs must be developed in consultation with DEEP staff. A volunteer group should expect to invest a substantial amount of time, effort, and, potentially money, to collect, process, and analyze sample data for a Tier 3 monitoring program. The involvement of a paid program coordinator is often required to successfully implement these programs.

For DEEP to utilize data generated by a Tier 3 program, a formalized monitoring plan and Quality Assurance Project Plan (QAPP) must be approved by DEEP *prior* to the start of monitoring. (If the project is funded with federal monies, EPA approval will also be required before monitoring commences.)

Tier 3 Data Types:

- Indicator bacteria levels
- Nutrient levels
- Metal levels
- Other water chemistry data (e.g. pH, conductivity, turbidity)
- Optical brightener monitoring analysis
- Streamflow gauge data

Tier 3 Data Utility:

- Monitoring implementation of watershed-based plans or to guide development of a new watershed-based plan
- To collect information to source-track known impairments
- To generate monitoring data to support of TMDL implementation or to track implementation progress

- To provide scientific information regarding a specific monitoring question for selected parameters.

Volunteer Resource Requirements:

- Tier 3 monitoring programs require an extensive commitment from volunteers, including multiple training sessions, sampling events, laboratory processing, and data analysis.
- These programs require the involvement of a dedicated project manager who possesses strong data management skills.
- Significant funding is often required to implement Tier 3 programs as access to scientific field and laboratory equipment, supplies, and personnel is typically required.

Tier 3 Data Submission Requirements:

- **Prior to commencing Tier 3 monitoring, a detailed monitoring plan and Quality Assurance Project Plan (QAPP) must be reviewed and approved by the DEEP.** (Approval may also be needed from EPA if the project is funded through a section 319 NPS grant or other sources of EPA funds). *DEEP cannot accept Tier 3 program data (e.g. water chemistry or bacteria monitoring programs) that were collected without an approved QAPP.*
- Tier 3 program results should be submitted as a final report which includes a summary of the monitoring effort and an analysis of the data generated. Interim reports or data submissions may be submitted for long-term projects. Volunteers should consult with the Volunteer Monitoring Coordinator prior to program implementation to discuss when and how data will be submitted.

Tips for Organizing a Successful Tier 3 Program:

- The most useful Tier 3 programs will be those that support implementation of an existing watershed-based plan or total maximum daily load (TMDL) analysis.
- Before attempting to develop a Tier 3 monitoring program, volunteer groups should be able to clearly articulate what they intend to monitor (i.e. what water quality parameters), where (i.e. specific sampling locations), when (i.e. sampling schedule), and, why (i.e. what is the question that the monitoring program is intended to answer).
- Data analysis should be covered within the Tier 3 monitoring program's implementation plan; if volunteers are not able to perform analysis within their group a contractor may need to be obtained to perform this service. While DEEP may choose to accept Tier 3 data (if collected under an approved QAPP), DEEP cannot commit to analyzing large volumes of volunteer monitoring data.
- DEEP strongly discourages groups from attempting to implement Tier 3 programs if members of the group do not already possess experience developing and implementing a water quality monitoring program.

Resources for Volunteer Stream Monitors

DEEP Volunteer Monitoring Coordinator

If your group would like DEEP to consider their monitoring data as part of the State's water quality assessment process, please contact the DEEP Volunteer Monitoring Coordinator prior to initiating your monitoring plan. The Coordinator will work with your group to insure that your monitoring plan will produce data that conforms to DEEP's volunteer monitoring data submission requirements.

New groups interested in participating in DEEP's three-tiered volunteer monitoring program should contact the Coordinator to discuss which volunteer monitoring option best matches your group's interest and skill level. The Coordinator is available to provide monitoring training and technical assistance to volunteer monitoring groups on a limited basis.

Contact Information:

Meghan Ruta
Volunteer Monitoring Coordinator
Bureau of Water Protection and Land Reuse
Connecticut Department of Energy and Environmental Protection
79 Elm Street, Hartford, CT 06106-5127
(860) 424-3061
meghan.ruta@ct.gov

StreamVolMon Listserv

Volunteer stream and river monitors are encouraged to subscribe to the DEEP-StreamVolMon Listserv. Listserv subscribers will receive email notifications of DEEP Volunteer Stream/River Monitoring Program announcements including new program updates, training opportunities, upcoming monitoring events, website updates, report releases, relevant grant and funding opportunities, and other information related to river and stream monitoring in Connecticut.

The listserv is intended to insure optimal generation and use of volunteer stream/river monitoring data by increasing awareness and understanding of DEEP's three-tiered volunteer monitoring. The listserv is also intended to help foster a stronger volunteer river and stream monitoring network in Connecticut by encouraging increased collaboration and resource sharing.

To subscribe to the Listserv:

- Send an email to imailsrv@list.state.ct.us
- Leave the subject line blank
- In the body of the message type: *Subscribe DEEP-StreamVolMon YourFirstName* YourLastName** (*Substitute your first and last name in the line above)

- NOTE: If you have an e-mail signature, header, and/or footer set up to be automatically included in emails, you will need to delete these before sending the subscribe request. (Subscribe emails must be completely blank with the exception of the required one line subscribe request noted above.)
- You will receive an e-mail confirmation that you have successfully subscribed to the listserv.

To unsubscribe from the Listserv:

- Send an e-mail to imailsrv@list.state.ct.us
- Leave the subject line blank
- In the body of the message type: *Unsubscribe DEEP-StreamVolMon YourFirstName* YourLastName** (*Substitute your first and last name in the line above)
- You will receive an e-mail confirmation that you have been removed from the listserv
- Note: requests to unsubscribe must be sent from the same email account used when subscribing to the email list. E-mail signatures, headers and footers must be removed prior to sending your unsubscribe request.

To submit content to the Listserv:

Requests to submit content (e.g. event announcements, monitoring questions, etc.) to the listserv can be submitted to the Volunteer Monitoring Coordinator by emailing Meghan.ruta@ct.gov.

To contact the Listserv administrator:

If you are having trouble subscribing or unsubscribing from the listserv, or if you have other listserv related questions, please contact the Volunteer Monitoring Coordinator by emailing Meghan.ruta@ct.gov.

Equipment Loan Program

The CTDEEP Volunteer Monitoring Program maintains an equipment loan program to support volunteer river and stream monitoring in Connecticut. Equipment availability is limited and is generally distributed on a first-come, first-served basis.

- RBV kits are available for short-term loan (i.e., two weeks or less) to groups who have participated in the RBV program for two consecutive years or more.
- HOBO stream temperature probes are available for annual loan to volunteer monitoring groups participating in the stream temperature monitoring network.
- Additional equipment and lab support may be available on a limited basis to groups participating in Tier 3 monitoring efforts. Contact the Volunteer Monitoring Coordinator to discuss your monitoring plan and equipment needs.

Due to high demand, volunteer monitoring groups are encouraged to reserve equipment with the Volunteer Monitoring Coordinator several weeks or more in advance of anticipated monitoring dates.

DEEP Website

Additional information about the CT DEEP Volunteer Monitoring Program, including materials related to both the River Bioassessment by Volunteers (RBV) program and the Connecticut Volunteer Stream Temperature Monitoring Network are available online at http://www.ct.gov/deep/streamvolmon.

Information regarding other program and activities of the DEEP Water Quality Monitoring and Assessment Program, as well as a link to all recent reports, can also be found online at: http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325616&depNav_GID=1654.

References

CT DEP. 2005. Connecticut Comprehensive Ambient Water Quality Monitoring Strategy. CT Dept. of Environmental Protection, Bureau of Water Management, Planning Division, Hartford, CT.

CT DEP. 2011. Water Quality Standards. CT Dept. of Environmental Protection, Bureau of Water Management, Planning Division, Hartford, CT. www.ct.gov/deep/lib/deep/water/water_quality_standards/wqs_final_adopted_2_25_11.pdf

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: Benthic macroinvertebrates and fish. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, D.C. EPA 440-4-89-001.