Massachusetts Department of ENVIRONMENTAL PROTECTION

2008 DWM ENVIRONMENTAL MONITORING OVERVIEW

(CN 331.0)

Water quality monitoring, assessment and management activities of the MassDEP are sequentially performed in accordance with a rotating five-year watershed schedule. Surface waters are typically monitored during Year 2 of the cycle by the Division of Watershed Management's (DWM) Watershed Planning Section. The main programmatic objectives of the DWM related to surface water quality monitoring are to:

- Collect chemical, physical and biological data to assess the degree to which designated uses, such as aquatic life, primary and secondary contact recreation, fish consumption and aesthetics, are being met in waters of the Commonwealth;

- Collect chemical, physical and biological data to support analysis and development of implementation plans to reduce pollutant loads to waters of the Commonwealth;

- Screen fish in selected waterbodies for fish tissue contaminants (metals, PCBs and organochlorine pesticides) to provide for public health risk assessment;

- To the extent feasible, locate pollution sources and promote and facilitate timely correction;

- Over the long term, collect water quality data to enable the determination of trends in parameter concentrations and/or loads;

- Develop new or revised standards, which may require short-term research monitoring directed towards the establishment or revision of water quality policies and standards; and to

- Measure the effectiveness of water quality management projects or programs (such as the effectiveness of implementing TMDLs, Best Management Practices (BMP) for the control of nonpoint pollution, or a state-wide policy or permitting program).

Quality assurance is maintained for DWM's watershed monitoring program to ensure implementation of an effective and efficient sampling design, to meet programmatic goals and to provide data meeting specific data quality objectives. The U.S. Environmental Protection Agency (USEPA) has approved a comprehensive Quality Assurance Program Plan (QAPP) that applies to the generation and use of surface water quality data by DWM for a five-year period (2005 through 2009). This five-year *program* QAPP is annually supplemented by project-specific Sampling and Analysis Plans (SAPs), which provide detailed information regarding individual *project* organization, tasks, background, sampling design and non-direct measurements.

The DWM performed monitoring activities in 2008 primarily within the *Blackstone, Chicopee,*

Connecticut and Nashua watersheds. In consultation with appropriate agencies and organizations (e.g., USEPA, USGS, watershed associations, etc.) DWM monitoring coordinators reviewed historical data and information, examined GIS data layers, reviewed NPDES and water withdrawal permits, conducted reconnaissance and formulated individual watershed SAP's. While some of the DWM monitoring activities in 2008 were targeted at specific issues of concern, the majority of the monitoring in the "Year Two" watersheds was aimed at providing the necessary data and information to assess the extent to which water bodies are supporting their intended uses, as designated in the Massachusetts Surface Water Quality Standards. This information supports individual watershed assessments, which, in turn, inform the Massachusetts Integrated List of Waters submitted to the EPA in fulfillment of sections 305b (Summary of Water Quality) and 303d (List of Impaired Waters) of the Clean Water Act (CWA).

While the assessment monitoring described above is useful for determining the overall status of water quality conditions at the watershed scale, the data and information gained through those efforts are often insufficient for identifying with confidence the location and magnitude of the specific sources of pollution contributing to water quality impairment, and typically do not support follow-up actions aimed at restoring impaired waters. To address the need for this kind of data and information, the bacteria source tracking (BST) efforts of MassDEP's regional monitoring personnel were continued in 2008 with the goal of locating and eliminating sources of bacteria contamination to surface waters in their respective regions. These efforts are described in more detail later in this report.

Although the majority of DWM's monitoring efforts in 2008 were centered in the "Year 2" watersheds, a few miscellaneous projects were undertaken in watersheds apart from the rotating monitoring and assessment schedule. For example, the DWM performed fish toxics monitoring at seven sites in response to public requests. Other special investigations are summarized below in the section entitled "Additional Monitoring Activities".

More detail pertaining to the monitoring activities accomplished in 2008 is presented below for both the "Year Two" watersheds, as well as throughout the state.

BLACKSTONE

The 2008 surveys of the Blackstone River Watershed focused on obtaining information to meet the following objectives:

- Determine the water quality and biological health of rivers/streams within the watershed that were not assessed in the 2003 Water Quality Assessment Report and increase coverage to river/streams that have never before been assessed by conducting assessments based on chemical parameters and biological (fish, aquatic macroinvertebrates, bacteria) communities.

- Provide biological and habitat data to document the status of benthic communities over time (trend monitoring); provide biological, habitat, and dissolved oxygen, temperature, and chemical data to DWM's Environmental Monitoring and Assessment Program to be used in making *Aquatic Life* and *Aesthetics* use assessments required by Section 305(b) of the Clean Water Act; and provide data for other informational needs of Massachusetts regulatory agencies.

- Provide quality-assured *E. coli* data for the purpose of assessing *Primary* and *Secondary Contact Recreational* uses in rivers/streams.

- Provide quality-assured dissolved metals data for the purpose of assessing the aquatic life use in rivers/streams.

- Provide quality-assured data to DWM's Total Maximum Daily Load Program to assist with TMDL development.

- Provide quality assured water quality and dissolved oxygen data on historically sampled sites within the Blackstone River Watershed to support HSPF model development and calibration.

The specific sampling activities of the 2008 Blackstone River Watershed Year 2 Survey are listed below. A total of 72 river stations (including water quality, fish population, metals, unattended deployment, and biomonitoring) and one lake were sampled to address the above objectives. Monitoring stations are summarized in the table at the end of this section. Note that RBP III Assessment/Macroinvertebrate, periphyton, and, phytoplankton stations noted in the summary table are located within the same segment as the station, but adjusted to suitable sampling areas based on site conditions.

1) **Water Quality:** Water quality surveys were conducted a total of 7 times (weeks of April 28, May 26, June 23, July 7 [bacterial only], August 4, August 25, November 3 [6 sites – bacteria and turbidity only]). Water quality data were collected at 51 stations throughout the sampling season including 5 stations visited by CERO SMART program staff and 2 sites at the Upper Blackstone Water Pollution Abatement District (UBWPAD) facility in Millbury. Data included grab samples for total phosphorus, total nitrogen, ammonia nitrogen, total suspended solids, color, turbidity, hardness (only 10 sites), and *E. coli* bacteria (not at 2 UBWPAD sites). At 28 of these sites and the 2 UBWPAD sites additional nutrients were collected (dissolved reactive phosphorus and nitrate). In-situ multi-probe measurements for temperature, dissolved oxygen, percent oxygen saturation, pH, specific conductance, and total dissolved solids were collected at 41 water quality sites using attended multi-probe QC units. Continuous temperature and dissolved oxygen monitoring with unattended metered probes was carried out at 30 sites. The unattended probes were deployed to 15 sites on Friday of the weeks preceding the water sampling surveys then re-positioned on Mondays to the other 15 sites. Final retrieval was on Wednesday of that sampling week.

2) **Biological Monitoring:** Benthic macroinvertebrate and habitat assessments were performed at 16 stations to assess the aquatic life use status for 305(b) reporting requirements. The macroinvertebrate sampling procedures utilized Rapid Bioassessment Protocols (RBPs). Periphyton assessments were performed at 20 sites including those sites where macroinvertebrate sampling was conducted. Periphyton assessment consisted of an approximation of the algal coverage within the reach, and scrapes of various substrates within the riffle zone to obtain samples for taxonomic identification to genus. Additionally, phytoplankton samples were collected at 10 sites within the watershed, many in association with macroinvertebrate sampling sites. Finally, fish population monitoring was conducted on seven locations in the Blackstone River Watershed. Staff used backpack type electro-fishing units to sample small streams for the presence/absence of resident fish species. All fish collected were returned to the source waterbody and a habitat assessment was produced for

each sample site.

3) **Fish Toxics Monitoring:** Fish toxics monitoring was performed at two (2) locations. Fish collections were made on July 8 at the Blackstone River impoundment upstream of the Gorge in Blackstone and on June 19 at Manchaug Pond in Sutton. Edible fillets from the Blackstone River were analyzed for the presence of mercury, PCBs, and organochlorine pesticides while edible fillets from Manchaug Pond were analyzed only for mercury. Fish consumption advisories will be issued by the MDPH if necessary.

4) **Continuous Temperature Monitoring:** Long-term temperature sondes (thermistors) were deployed at 12 sites beginning as early as late June and extending into October. Data were collected to determine whether waterbodies were meeting cold or warmwater fishery standards as part of the Aquatic Life Use assessment.

5) **Dissolved Metals Monitoring:** Samples were collected at 11 stations throughout the Blackstone River Watershed. Three samples were collected at each site. Survey dates were June 26, September 11-12, and September 22.

6) **Algae and Chlorophyll *a* Investigations:** Several different types of algal and chlorophyll *a* surveys were conducted at the Blackstone River and its tributaries in 2008. As part of the biological surveys, which also included macroinvertebrate and habitat assessment, qualitative sampling was done at 12 tributary and mainstem stations. Scrapes of the substrate surfaces were examined for the dominant algae and estimates were made of the abundance of the most prevalent taxa. The habitat and substrate type were recorded and a description was made of the appearance of the biofilm as well as an estimate of the percent cover. These were done July 7-10. Semi-quantitative sampling was performed at five additional stations to aide in determining the percent cover of the macro and micro algae within the riffle.

Besides the biosurveys, the benthic algae were sampled twice (July and September) at three stations for chlorophyll *a* analysis. These surveys were specifically done to provide biomass information for modeling work that is being done on the Blackstone River. In addition to the benthic work, water column samples were collected for chlorophyll analysis of the phytoplankton at five in-stream stations in June and July. Water column samples from five impoundments were analyzed for chlorophyll *a* in September. The water column samples (15) were also examined microscopically to determine if any blooms were present and its major constituents if there was a bloom.

7) **Impoundment Investigations (TMDL development):** A total of five impoundments within the Blackstone River mainstem (Singing Dam, Fisherville, Farnumsville, Rice City Pond, and Riverdale impoundments) were investigated as part of TMDL development. Each impoundment had two site visits to deploy unattended dissolved oxygen/temperature probes and to collect total phosphorus/total reactive phosphorus. A basic macrophyte map was also created for each impoundment.

Blackstone Watershed – 2008 Water Quality and Biological Sampling Matrix

River/Stream	Monitoring Site Description (sample type*)
Dark Brook	Berlin St., Auburn (6, 9)
Dark Brook	Route 12, Auburn (2, 3)

Kettle Brook	Downstream from Earle Street, Leicester (5, 7, 8)
Kettle Brook	Webster St., Worcester (5, 7, 8)
Unnamed Tributary (locally considered part of Tatnuck Brook)	June St., Worcester (2, 3, 5, 7, 8)
Beaver Brook	Park Avenue, Worcester (2, 3, 5, 7, 8)
Middle River	Millbury St., Worcester (1, 2, 3, 4, 5, 7, 8, 10, 11, 13)
Unnamed Tributary ("Mill Brook")	Grove Street at Tire Warehouse, Worcester [underground] (1, 2, 3, 4, 10, 11)
Blackstone River	Millbury St., Worcester (1, 2, 3, 4, 10, 11, 13)
Blackstone River	Approximately 60 feet upstream/north of Upper Blackstone WWTP effluent channel, Millbury (1, 2, 3, 4, 13)
Blackstone River	Downstream/south of Route 90, directly upstream of the Worcester Flood Diversion Channel, Millbury (1, 2, 3, 4, 7, 12, 13)
Worcester Flood Diversion Channel	Greenwood Street, Millbury (2, 3, 13)
Blackstone River	McCracken Rd., Millbury (1, 2, 3, 5, 7, 8, 13)
Singletary Brook	Sycamore St., Millbury (1, 2, 3, 4, 13)
Blackstone River	Riverlin St. Millbury (1, 2, 3, 4, 13)
Blackstone River	Downstream from Singing Dam, Sutton (1, 2, 3, 7, 12, 13)
Blackstone River	Pleasant St., Grafton (1, 2, 3, 13)
Cronin Brook	Follette St., Grafton (1, 2, 3, 4, 9, 13)
Sewall Brook	Sewall St., Boylston (1, 2, 3, 4, 9)
Poor Farm Brook	Route 70, Shrewsbury (1, 2, 3, 4, 9)
Coal Mine Brook	Lake Ave North, Worcester (1, 2, 3, 4)
West Brook	Sadler Avenue, Shrewsbury (1, 2, 3, 4)
Quinsigamond River	Bridge St. (abandoned bridge) off Route 140, Grafton (2, 3, 5, 7, 8)
Quinsigamond River	Pleasant St., Grafton (1, 2, 3, 4, 13)
Blackstone River	Route 122A, Grafton (1, 2, 3, 13)
Blackstone River	Depot St., Grafton (1, 2, 3, 13)
Blackstone River	At USGS gage, Northbridge (1, 2, 3, 4, 5, 7, 8, 10, 11, 13)
Blackstone River	Riverdale St., Northbridge (upstream of dam) (1, 2, 3, 12, 13)
Blackstone River	Church St., Northbridge (1, 2, 3, 4, 13)
Blackstone River	Below Rice City Pond, off Hartford St., Uxbridge (2, 3, 10, 13)
Miscoe Brook	Moroney Road, Grafton (1, 2, 3)
Warren Brook	Route 140, Upton (1, 2, 3, 4)
West River	Between Glen Ave and Williams St (below dam), Upton (1, 2, 3, 4, 6, 9)
Center Brook	Mendon St., Upton (1, 2, 3, 9)
Taft Pond Brook	Downstream from the unnamed dirt road off South St., Upton (2, 3)
West River	East Hartford Avenue, Uxbridge (1, 2, 3, 4, 5, 8, 10, 11, 13)
Blackstone River	Route 16, Uxbridge (2, 3, 13)
Unnamed tributary (“Whitins Brook”)	Conservation Drive, Douglas (6, 9)
Mumford River	Manchaug St., Douglas (5, 7, 8)
Centerville Brook	West St., Douglas (6, 9)
Mumford River	South of Gilboa St., approximately 500 feet downstream of Gilboa Pond, Douglas (1, 2, 3, 4, 5, 7, 8, 10, 11, 13)
Cook Allen Brook	Mendon Road, Sutton (5, 7, 8)
Cold Spring Brook	Hazel St., Uxbridge (1, 2, 3, 4, 13)
Blackstone River	Route 122, Uxbridge (1, 2, 3, 13)

Emerson Brook	Route 146A (Quaker Highway), Uxbridge (1, 2, 3, 4)
Bacon Brook	Route 146A, Uxbridge (6, 9)
Blackstone River	Downstream from railroad trestle near Route 122, Millville (1, 2, 3, 4, 5, 8, 10, 11)
Blackstone River	Route 122, Blackstone (1, 2, 3, 4, 13)
Branch River	Route 146, Slatersville, RI (1, 2, 3, 4, 13)
Blackstone River	Bridge St./Canal St. (upstream of dam), Blackstone (1, 2, 3, 4, 5, 8, 10, 11, 13)
Fox Brook	Route 122, Blackstone (1, 2, 3, 4)
Muddy Brook	Bellingham St., Mendon (1, 2, 3, 4)
Mill River	Summer St., Blackstone (1, 2, 3, 5, 7, 8, 10, 11)
Mill River	East School Street (Town debris storage lot opposite Veterans Park), Woonsocket, RI (1, 2, 3, 4, 13)
Arnolds Brook	Pine Grove Ave., Bellingham (1, 2, 3, 4)
Peters River	Paine St., Bellingham (1, 2, 3, 9, 10, 11)
Peters River	Route 114, Woonsocket, RI (1, 2, 3, 4, 13)
Tinkerville Brook	Hemlock St., Douglas (5, 7, 8)
Abbott Run	Depot St./Mendon Road, North Attleboro (9)
Blackstone River	Upstream of Fisherville Dam, Grafton (12)
Blackstone River	Upstream of Singing Dam, Blackstone Street, Sutton (12)
Blackstone River	Upstream of Rice City Pond dam, East Hartford Avenue, Uxbridge (12)
Blackstone River	Route 146 (most northerly of two road crossings), Worcester (7, 12)
Blackstone River	Upstream of Farnumsville Impoundment dam (12)
UBWPAD Effluent Pipe	UBWPAD Effluent Pipe (within the plant) (2, 13)
UBWPAD Effluent Bypass Channel	Upstream from final effluent discharge (2, 13)
Lake Quinsigamond	Off Eastern Point Condominiums, off of discharge, Shrewsbury (9)
Blackstone River	Waters St, Millbury (7, 12)
Blackstone River	Central St, Millville (7)
Blackstone River	Upstream of "Tupperware Dam", Blackstone (7)
West River	Williams St, Upton (7)
Blackstone River	Directly downstream of the Worcester Flood Diversion Channel, Millbury (12)

*1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – nutrients, color, turbidity, hardness, 3 – bacteria samples, 4 – unattended continuous dissolved oxygen and temperature, 5 – Rapid Bioassessment Protocol (RBP) III (macroinvertebrate) sampling, 6 – fish population, 7 – Periphyton, 8 – habitat assessment, 9 – unattended continuous temperature, 10 – dissolved metals, 11 – hardness, 12 – phytoplankton, 13 – additional nutrients (dissolved reactive phosphorus and nitrate)

CHICOPEE

The 2008 surveys of the Chicopee River Watershed focused on obtaining information to meet the following objectives:

- Collect biological data (benthic macroinvertebrate, fish population, habitat assessments and algal population) to assess the *Aquatic Life Use*. Fish population data will also be used to determine whether a cold water fishery exists in segments sampled.

- Collect bacteria data to assess the *Primary and Secondary Contact Recreational Uses*. Perform field observations during sampling to assess the *Aesthetics Use*.

- Screen fish to provide information to MDPH for public health risk assessment due to fish tissue contaminants (metals, PCBs and pesticides).

- Gather data to determine long-term trends in water quality in the Chicopee River Watershed.

- Gather stream temperature data to determine whether a cold water fishery exists in segments sampled and determine the impact of point source discharges.

The specific sampling activities of the 2008 Chicopee River Watershed Year 2 Survey are listed below. Monitoring stations are summarized in the table at the end of this section.

1) **Water Quality:** Water quality surveys were conducted a total of 6 times (weeks of May 19, June 16, July 7 [bacteria only], July 21, August 18, and September 22). Water quality data were collected at 49 stations throughout the sampling season including 5 stations visited by CERO SMART program staff. Grab samples from 49 stations were analyzed for total phosphorus, total nitrogen, ammonia nitrogen, color and turbidity. Samples were taken at 53 stations for *E. coli* analysis. *In-situ* measurements of temperature, dissolved oxygen, pH, and conductivity were collected at 14 stations. Continuous temperature and dissolved oxygen monitoring with unattended probes was carried out for a minimum duration of 24 hours at 41 sites. In August a number of dissolved oxygen probes were deployed in the Ware River to determine the spatial dynamics of dissolved oxygen. Dissolved oxygen monitoring with unattended probes was also completed in the Quaboag River downstream of Quaboag Pond on two separate occasions in September in response to a reported fish kill and to help elucidate the nature of low dissolved oxygen levels noted during previous water quality surveys.

2) **Biological Monitoring:** Benthic macroinvertebrate and habitat assessments were performed at 17 stations to assess the aquatic life use status for 305(b) reporting requirements. The macroinvertebrate sampling procedures utilized Rapid Biomonitoring Protocols (RBPs). Periphyton assessments were performed at all 17 sites where macroinvertebrate sampling was conducted. Fish population monitoring using backpack electrofishing equipment was conducted at six locations.

3) **Lake Monitoring:** Lake surveys were performed three times throughout the monitoring season at Asnacomet Pond (Hubbardston) and the Red Bridge Impoundment (Ludlow/Wilbraham). Sampling included grab samples for water chemistry, chlorophyll *a* (both grab and depth-integrated), color and turbidity, as well as dissolved oxygen profiles and Secchi disc readings. Macrophyte mapping was also conducted once at Asnacomet Pond.

4) **Fish Toxics Monitoring:** Fish toxics monitoring was performed at two locations. Fish collections were made on July 29 and August 14 at Browning Pond (Oakham/Spencer) and on July 31 at Red Bridge Impoundment (Ludlow/Wilbraham). Edible fillets were analyzed for the presence of heavy metals (including mercury), PCBs, and organochlorine pesticides. Fish consumption advisories will be issued by the MDPH if necessary.

5) **Continuous Temperature Monitoring:** Continuous temperature monitoring was conducted

at 14 stations to determine whether a cold water fishery exists in sampled segments and/or to determine the impact of point source discharges.

6) **Dissolved Metals Monitoring:** Samples were collected on June 19 and September 11at three sites in the Chicopee River Watershed.

7) **Field Audit with Massachusetts DCR:** A field audit, consisting of side-by-side water sampling was conducted with the Quabbin Section of the Massachusetts Department of Conservation and Recreation (MA DCR) Water Supply Division. MA DCR typically collects water quality data on tributaries to Quabbin Reservoir and at sites upstream from their Ware River diversion intake.

Chicopee River Watershed – 2008 Water Quality and Biological Sampling Matrix

River/Stream	Monitoring Site Description (sample type*)
Joslin Brook	New Westminster Road, Hubbardston (3)
East Branch Ware River	Off Route 62, approximately 60 feet downstream of Old Colony Road Extension, Princeton, (2,3,4,5)
Burnshirt River	Downstream Route 62, Hubbardston (2,3,4)
Ware River	Approximately 175 feet downstream of old crossing (Covered Bridge Road), Barre (4,8)
Ware River	South of Route 122 at weir downstream of Shaft #8 water supply intake, Barre (2,3,4,8)
Ware River	Approximately 20 feet downstream of Vernon Avenue, Barre (1,2,3)
Prince River	Route 122, Barre (2,3,4)
Galloway Brook	Downstream Route 32, Barre (3)
Ware River	Downstream Route 32 in Barre Plains, Barre (2,3)
Ware River	Approximately 2.63 miles upstream of the Wheelright Impoundment Dam, Hardwick/New Braintree (4)
Ware River	Approximately 200 feet upstream of Wheelwright Dam, Hardwick (4)
Moose Brook	Approximately 1600 feet downstream of Taylor Hill Road, Hardwick (2,3,4,6)
Ware River	Approximately 200 feet upstream of Hardwick Road, Hardwick (2,3,4)
Ware River	Creamery Road/Unitas Road, Hardwick/New Braintree (2,3,4)
Danforth Brook	Route 32, downtown Gilbertville, Hardwick (3)
Ware River	Bridge St. (Covered Bridge), Gilbertville (2,3,4,5)
Ware River	Upper Church Street, Ware (2,3,4)
Muddy Brook	Approximately 230 feet upstream of Route 32, Ware (2,3)
Ware River	Route 32 at Gibbs Crossing, Ware (2,3,4,5)
Ware River	State St., Palmer (1,2,3)
Ware River	Route 181, Palmer (2,3,4)
Asnacomet Pond	Deep Hole, Hubbardston (16)
West Branch Swift River	Cooleyville Road, Shutesbury (6)
Middle Branch Swift River	Off north side of Neilson Road, New Salem (6)
East Branch Fever Brook	Downstream of Camels Hump Road, Petersham (5)
East Branch Swift River	Upstream of Glen Valley Road, Petersham (5)

Swift River	At USGS flow gauging station west of River Road, Ware/Belchertown (2,3,4)
Swift River	Cold Spring Road/Old Belchertown Road, Belchertown/Ware (2,3,4)
Swift River	Route 181, Belchertown/Palmer (2,3,4)
Jabish Brook	Downstream of Jabish Road, Belchertown (2,3,4,5)
Jabish Brook	Aldrich Road (upstream canal diversion), Belchertown (2,3)
Browning Pond	Oakham/Spencer (10)
Turkey Hill Brook	Wire Village Road, Spencer (2,3,4,5)
Sevenmile River	Cooney Road at USGS flow gauging station, Spencer (2,3,4,5)
Sevenmile River	Smithville Road, Spencer (2,3,4)
Sevenmile River	Approximately 200 feet upstream of Route 9 (West Main Street), Spencer (2,3,4)
Sevenmile River	Cottage St./Bridge St., East Brookfield (2,3,5)
East Brookfield River	Approximatley 200 feet downstream of Route 9, East Brookfield (2,3,4)
Forget-Me-Not Brook	East Brookfield Road/Donovan Road (approximately 1100 feet upstream of North Brookfield WWTP discharge), North Brookfield (2,3)
Forget-Me-Not Brook	Approximately 40 feet upstream of East Brookfield Road, North Brookfield (4)
Forget-Me-Not Brook	West of East Brookfield Road (approximately 1300 feet downstream of North Brookfield WWTP discharge), North Brookfield (2,3,4,5)
Dunn Brook	Approximately 350 feet upstream of Route 9, East Brookfield (2,3,4)
Quaboag River	Approximately 900 feet downstream of Route 148, Brookfield (4)
Quaboag River	Approximately 2200 feet downstream of Route 148, Brookfield (4)
Quaboag River	Approximately 5800 feet downstream of Route 148, Brookfield (4)
Quaboag River	Approximately 6400 feet downstream of Route 148, Brookfield (4)
Quaboag River	Approximately 1700 feet upstream of Long Hill Road, West Brookfield (4)
Quaboag River	Approximately 200 feet downstream of Long Hill Road, West Brookfield (2,3,4)
Quaboag River	Approximately 70 meters upstream of Route 67, West Brookfield (4)
Quaboag River	Approximately 800 feet downstream of RR bridge, West Brookfield (1)
Quaboag River	Approximately 80 feet downstream of Route 67, West Brookfield (1)
Wickaboag Pond	At outlet, approximately 250 feet downstream of Route 9, West Brookfield (1)
Quaboag River	Approximately 500 feet downstream of confluence with Wickaboag Pond outlet, West Brookfield (1)
Quaboag River	Gilbert Road, Warren (1,2,3,5)
Quaboag River	Off Route 67 (downstream Warren POTW), Warrren (1,2,3,5)
Quaboag River	East of Route 67 (near USGS flow gauging station), Palmer/Brimfield (2,3,4)
Penny Brook	Off Haley Road (across from telephone pole #12), Brimfield (8)
Kings Brook	Route 67 (Boston Rd), Palmer (1,2,3,8)
Bottle Brook	Dunhampton/Palmer Road, Brimfield (1,2,3,8)
Bottle Brook	Dunhampton/Palmer Road (upstream of culvert, 300 ft east of Washington Road), Brimfield, (5)
Conant Brook	Upstream of Route 32, Monson (1,2,3,6)
Chicopee Brook	Off Bliss St. (Behind Polish American Citizens Club), Monson (6,14)
Chicopee Brook	Cushman Road, Monson (6)
Chicopee Brook	Approximately 160 feet upstream of State St., Monson (8)
Chicopee Brook	Approximately 70 feet upstream of State St., Monson (2,3,4,5,14)
Chicopee Brook	Off Route 32 (behind Monson well), Monson (8)
Chicopee Brook	Approximately 30 feet downstream of impoundment (upstream Polymer Corp discharges), Monson (8)
Chicopee Brook	Approximately 55 feet downstream of Polymer Corp discharge no. 1, Monson (8)
Chicopee Brook	Route 32 underpass (off Tobey Road), Monson (1,2,3)
Chicopee Brook	Downstream of Bunyan Road, Monson (2,3,4,8)
Quaboag River	Palmer Street, Palmer (2,3,4)
Quaboag River	Approximately 175 feet upstream of Main St., Palmer (1,2,3)

Chicopee River	Near New Hampshire Avenue/Springfield Street, Palmer (2,3,4)
Red Bridge Impoundment	Ludlow/Wilbraham (10,16)
Chicopee River	Off Maynard Road, Wilbraham (4)
Calkins Brook	Upstream Crane Road, Wilbraham (3)
Twelvemile Brook	Approximately 82 feet downstream of Crane Hill St., Wilbraham (2,3,4,5)
Chicopee River	Miller Street/Cottage Avenue, Ludlow/Wilbraham (2,3)
Chicopee River	River Street/West Street, Springfield/Ludlow (2,3,4,5)
Chicopee River	Approximately 80 feet downstream of River Street/West Street, Springfield/Ludlow (8)
Poor Brook	Downstream of Cottage Stree, Springfield (2,3,14)
Poor Brook	Approximately 25 feet upstream of Storms Forge discharge tributary, Springfield (8)
Poor Brook	Approximately 15 feet downstream of Storms Forge discharge tributary, Springfield (8)
Unnamed Trib	3 feet downstream of discharge pipe, off exit 5 cloverleaf of Rte 291, Springfield (8)
Poor Brook	Downstream of Route 141 (E. Main Street), Chicopee (5)
Chicopee River	Route 116, Chicopee (1,2,3)

*1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – water chemistry (may include nutrients, hardness, color and turbidity), 3 – E. coli samples, 4 – unattended continuous dissolved oxygen and temperature, 5 – Rapid Bioassessment Protocol (RBP) III and habitat assessment, 6 – Fish population, 7 – Periphyton, 8 – unattended continuous temperature, 10 – fish toxics, 14 – Metals, 16 – Lake Sampling.

CONNECTICUT

The 2008 surveys of the Connecticut Watershed focused on obtaining information (i.e. water quality, bacteria, and benthic macroinvertebrate populations) at a total of 49 stations. The specific objectives of this monitoring were to:

- Provide biological and habitat data to document the status of benthic and fish communities over time (trend monitoring).

- Provide biological, habitat, and dissolved oxygen, temperature, and chemical data to DWM's Environmental Monitoring and Assessment Program to be used in making *Aquatic Life* and *Aesthetics* use assessments required by Section 305(b) of the Clean Water Act; provide data for other informational needs of Massachusetts regulatory agencies.

- Provide quality assured *E. coli* bacteria data for the purpose of assessing *Primary* and *Secondary Contact Recreation* uses.

Individual monitoring elements are described below. Water quality and biological monitoring sites are summarized in the matrix at the end of this section.

1) **Water Quality:** Water quality surveys were conducted a total of six times (weeks of May 5, June 2, June 30, July 28, August 25 [bacteria only] and September 8). Samples for total Phosphorous, total Nitrogen, Ammonia, Total Suspended Solids, color, turbidity, bacteria counts (*E. coli*), dissolved oxygen and other field measurements were obtained from a total of

33 stations on five occasions. On a sixth occasion only *E.coli* was collected. Additionally, continuous temperature and dissolved oxygen monitoring with unattended multiprobes was carried out for a duration of 96 hours at 15 sites. Continuous temperature monitoring was recorded from July through mid-October at 10 sites.

2) **Biological Monitoring:** Macroinvertebrate sampling, fish population monitoring, and habitat assessments were performed to assess the aquatic life use status for 305(b) reporting requirements. The macroinvertebrate sampling procedures utilized Rapid Biomonitoring Protocols (RBPs) and were conducted at 11 stations. Periphyton assessments were performed at all 11 sites where macroinvertebrate sampling was conducted. Habitat assessments were also conducted at 24 stations. Finally, fish population monitoring was conducted at 14 stations.

3) **Fish Toxics Monitoring:** Fish toxics monitoring was performed at the Oxbow (Northampton/Easthampton) and Barton Cove (Gill). Edible fillets were analyzed for the presence of heavy metals (including mercury), PCB, and organochlorine pesticides. Fish consumption advisories will be issued by the MDPH if necessary.

Connecticut Watershed – 2008 Water Quality and Biological Sampling Matrix

River/Stream	Monitoring Site Description (sample type*)
Amethyst Brook	Allen Mill Road, Amherst (1,2,3,5,7,8)
Bachelor Brook	Route 47/Hadley Street, South Hadley (1,2,3,4)
Barton Cove	Boat launch off Route 2, Gill (10)
Bloody Brook	Whately Road, Deerfield (1,2,3,4,7)
Broad Brook	Hendrick Street, Easthampton (6,7)
Buttery Brook	Above Intelicoat, South Hadley (9)
Buttery Brook	Below Intelicoat, South Hadley (9)
Connecticut River	At end of Old Bernardston Road, Northfield (1,2,3,4,9)
Connecticut River	Route 9 Bridge/Sportmans Arena docks, Hadley (1,2,3,4,9)
Connecticut River	Route 116, Deerfield/Sunderland (1,2,3)
Connecticut River	At USGS gage # 01184000, Enfield, Connecticut (1,2,3)
Cushman Brook	At footbridge off of State Street, Amherst (5,7,8)
Dry Brook	Main St., Gill (1,2,3,4,7)
East Branch Mill River	East Main Street, Williamsburg (6,7)
Fall River	East of Driveway of #54 Factory Hollow Road, Gill (1,2,3,5,6,7,8,9)
Fort River	Route 47, Hadley (1,2,3,4)
Fort River	At bike path bridge off of Mill Lane, Amherst (1,2,3)
Fourmile Brook	Pine Meadow Road, Northfield (1,2,3,7)
Hop Brook	Station Road, Amherst (1,2,3)
Lampson Brook	George Hannum Street, Belchertown (1,2,3,4,5,6,7,8)
Long Plain Brook	Route 116, Sunderland (1,2,3)
Longmeadow Brook	(slip road west of) Route 5, Longmeadow (1,2,3,4)
Manhan River	Gunn Road, Southampton (1,2,3)
Manhan River	Fort Hill Road, Easthampton (1,2,3,4)
Manhan River (upper)	100m upstream of Fomer Road, Southampton (6,7)
Mill River	Mill River Lane, Hadley (1,2,3,4)
Mill River	North St., Whately (1,2,3,7)
Mill River	Christian Lane, Whately (9)
Mill River	Maple Street, Hatfield (1,2,3,4,9)
Mill River	Clement Street, Northampton (1,2,3,4,5,7,8)

Mill River	Cherry and Clifton Streets, Springfield (1,2,3,4)
Moose Brook	Moose Brook Road, Southampton (1,2,3,6,7)
North Branch Manhan River	Pomeroy Meadow Road, Easthampton (1,2,3)
North Branch Manhan River	Downstream of Route 66 , Northampton (5,6,7,8)
The Oxbow	Northampton/Easthampton (10)
Roaring Brook	Chestnut Plain Road, Whately (1,2,3,5,7,8)
Russelville Brook	Route 47, Hadley (1,2,3,7)
Sawmill River	South Ferry Road, Montague (1,2,3,5,7,8)
Scantic River	Mill Road, Hampden (1,2,3,9)
Scantic River	Behind VFW, Main Street, Hampden (6,7)
Scantic River	Above confluence with Temple Brook, Hampden (6,9)
Shattuck Keets Brook	Keets Brook Road, Bernardston (5,6,7,8)
Stony Brook	Morgan Street, Granby (most downstream crossing of) (1,2,3)
Stony Brook	Upstream of one lane bridge off Route 116/College St., South Hadley (1,2,3,4,5,7,8)
Temple Brook	Scantic Road, Hampden (6,7,9)
West Branch Mill River (upper)	Route 143, Williamsburg (6,7)
West Brook	Chestnut Plain Road, Whately (6,7)
Weston Brook	Boardman Road, Belchertown (1,2,3,4,5,6,7,8)
Willamansett Brook	Upstream side of Yelle St., Chicopee (1,2,3)

*1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – nutrients, TSS, color and turbidity, 3 – E. coli samples, 4 – unattended continuous dissolved oxygen and temperature, 5 – Rapid Bioassessment Protocol (RBP) III (macroinvertebrate), 6 – Fish population, 7 – Habitat assessment, 8 – Periphyton, 9 – unattended continuous temperature, 10 – fish toxics

NASHUA RIVER

The 2008 surveys of the Nashua River Watersheds focused on obtaining information to meet the following objectives:

- Provide biological, habitat, dissolved oxygen, temperature, chemical and ambient toxicity data for the purpose of assessing *Aquatic Life* and *Aesthetics* uses as required by Section 305(b) of the Clean Water Act and documenting biological, chemical, and physical changes over time (trend monitoring); provide data for other informational needs of Massachusetts regulatory agencies such as NPDES permitting and TMDL development.

- Provide biological, habitat, dissolved oxygen, temperature, chemical and ambient toxicity data to confirm Category 5 303(d) listings and findings of external organizations.

- Provide quality-assured *E. coli* data for the purpose of assessing *Primary and Secondary Contact Recreational* uses and documenting changes in pathogen levels over time (trend monitoring).

- Provide data to the Massachusetts Department of Public Health (MDPH) for public health risk assessment due to fish tissue contaminants (metals, polychlorinated biphenyls (PCBs) and pesticides).

The specific sampling activities of the 2008 Nashua River Watershed Year 2 Surveys are listed below. A total of 72 river stations (including water quality, ambient toxicity and biomonitoring) and one lake were sampled to address the above objectives. Monitoring stations are summarized in the table at the end of this section.

1) **Water Quality:** Water quality surveys were conducted a total of six times (weeks of May 12, June 9, July 14, August 11, September 1 [bacteria only] and October 16). Grab samples for *Escherichia coli* were collected at a total of 50 stations. Grab samples for total phosphorus, total nitrogen, ammonia-nitrogen, color, and turbidity were collected at 23 stations. On the 1st and 3rd surveys, grab samples for hardness were collected at a total of four stations. Continuous temperature and dissolved oxygen monitoring with unattended metered probes was carried out at 25 sites. These unattended probes were deployed during the months of June, July, August, and September on Friday of the weeks preceding the water sampling surveys for that month and retrieved five days later. Finally, long-term temperature-only data loggers were deployed at 14 sites.

2) **Biological Monitoring:** Benthic macroinvertebrate, periphyton, and associated habitat surveys were conducted at 13 stations. The macroinvertebrate sampling procedures utilized Rapid Biomonitoring Protocols (RBPs). Macroinvertebrate samples were also collected from four wetland sites in the Cold Spring Brook watershed in support of a BWP project. Fish population surveys using a backpack electro-fisher and associated habitat assessments were conducted at nine sites.

3) **Fish Toxics Monitoring:** Fish tissue monitoring was performed at Lake Shirley (Lunenburg). Edible fillets were analyzed for the presence of heavy metals (including mercury), PCB, and organochlorine pesticides. Fish consumption advisories will be issued by the MDPH, if necessary.

4) **Ambient Toxicity/Metals:** Ambient toxicity and metal grab samples were collected once in October and November at a total of four sites on the North Nashua River (MA81-01 and MA81-02). Grab samples were collected for metals at three sites on Cold Spring Brook in support of a BWP project. The EPA toxicity lab in Chelmsford processed the ambient toxicity samples and the metals samples were processed at the MassDEP's Wall Experiment Station (WES).

5) Nashua Nutrient TMDL Monitoring: Impoundment water quality surveys were conducted twice (July 16 and September 3). Grab samples for total phosphorus, total nitrogen, ammonia-nitrogen, total reactive phosphorus, and chlorophyll *a* were collected at three sites. Continuous dissolved oxygen monitoring with unattended probes was carried out at three sites. These unattended probes were deployed during the months of July and September on Friday of the weeks preceding the water sampling surveys for that month and retrieved five days later. River water quality surveys were conducted five times (weeks of May 12, June 9, July 14, August 11, and October 16). Grab samples for dissolved reactive phosphorus were collected at eight stations.

Nashua River Watershed – 2008 Water Quality and Biological Sampling Matrix

River/Stream	Monitoring Site Description (sample type*)
North Nashua River	Approximately 340 feet downstream of Depot Street, Fitchburg (1,2,3,9,11,12,14,15)

North Nashua River	Airport Road, Fitchburg (1,2,3,4,5,7,11,12,14,15)
North Nashua River	Hamilton Street, Leominster (1,14,15)
North Nashua River	Circle Street, Fitchburg (1,14,15)
North Nashua River	Approximately 600 feet downstream of Route 2, Leominster (2,3,4,9,11,12)
North Nashua River	Approximately 200 feet downstream of Route 190 bridge, Lancaster (4)
North Nashua River	Route 70, Lancaster (2,3,11,12)
Nashua River	Route 2A, Shirley/Ayer (2,3,4,11,12)
Nashua River	Near tank bridge at Still River Depot Road canoe launch, Harvard (2,3,4,9,11,12)
Nashua River	Route 111/119, Pepperell/Groton (4)
Nashua River	400 feet upstream of Pepperell Dam, Pepperell (1,2,4,12,13)
Nashua River	Ayer Road/West Main Street, Shirley/Harvard (1,2,4,12,13)
Nashua River	Groton School Boat House, Groton (1,2,4,12,13)
Nashua River	Route 111, Hollis, New Hampshire (2,3,4,5,7,11,12)
Nashua River "South Branch"	East of Route 110, Clinton (upstream of Clinton WWTP outfall) (2,3,4,11,12)
Nashua River "South Branch"	Bolton Road, Lancaster (4)
Flag Brook	Approximately 150 feet upstream from railroad bridge crossing east of Route 31, Fitchburg (3)
Whitman River	Whitmanville Road, Westminster (2,3,4,5,7,11)
Whitman River	Route 2A, Westminster (3)
Phillips Brook	Approximately 1000 feet downstream from Westminster Hill Road, Fitchburg (3)
Phillips Brook	The Route 12 crossing nearest to and north of the Fred Smith Road/Bean Porridge Hill Road intersection, Westminster (2,3,4,6,8,11)
Monoosnuc Brook	Commercial Road, Leominster (3)
Monoosnuc Brook	Granite Street, Leominster (3)
Still River	West off Route 110 at footbridge at Bolton Flats Wildlife Management Area entrance (southwest of Autumn Lane), Bolton (3)
Catacoonamug Brook	Approximately 190 feet upstream of Main Street, Shirley (2,3,4,5,7,11)
Nonacoicus Brook	MacPherson Road, Ayer (2,3,4,11)
Squannacook River	West of Townsend Road (directly across from Candice Lane), Groton (4,8)
Squannacook River	Elm Street (Route 13), Townsend (2,3,4,8,11)
Squannacook River	Approximately 1 mile downstream from Route 225 (off Shirley Rod & Gun Club private road), Shirley (3,5,7)
James Brook	Route 111, Ayer (2,3,4,11)
Nissitissit River	Mill Street, Pepperell (2,3,4,6,8,9,11)
Nissitissit River	West Hollis Road, Hollis, New Hampshire (3,8)
Sucker Brook	Brookline Street, Pepperell (2,3,4,11)
Gates Brook	Approximately 600 feet from confluence with Wachusett Reservoir (Gates Cove), West Boylston (5,6,7,8)
Malden Brook	Thomas Street, West Boylston (6,8)
Malagasco Brook	West Temple Street, Boylston (2,3,4,5,7,11)
Stillwater River	Muddy Pond Road, Sterling (6,8)
Quinapoxet River	North off River Road, approximately 2200 feet east of Route 190, West Boylston (2,3,4,11)

Quinapoxet River	River Street crossing nearest Route 31, Holden (5,6,7,8)
Chaffins Brook	Access from Meadow Wood Drive, Holden (5,7)
Mulpus Brook	Holman Street, Lunenburg (2,3,4,8,11)
Mulpus Brook	Trailer park road directly across from Kittredge Road, Shirley (2,3,4,6,8,11)
Mulpus Brook	Route 225, Lunenburg (3,8)
Fall Brook	Lakeview Drive, Leominster (3)
Fall Brook	Route 117, Leominster (3)
Fall Brook	Approximately 450 feet upstream of Route 12, Leominster (6,8)
Asnebumskit Brook	Princeton Street, Holden (5,7)
Still River	Route 117, Bolton (2,3,4,8,11)
Unkety Brook	River Street, Dunstable (3)
Bowers Brook	Lancaster County Road, Harvard (2,3,4,11)
Wekepeke Brook	Flanagan Hill Road, Sterling (3)
Willard Brook	West Meadow Road, Townsend (2,3,4,11)
Trapfall Brook	Turnpike Road, Ashby (3)
Locke Brook	West Meadow Road, Townsend (3)
Pearle Hill Brook	South off end of Pearl Brook Road, Townsend (3)
Falulah Brook	Crawford Street, Fitchburg (3)
Falulah Brook	Fisher Road, Fitchburg (3)
South Wachusetts Brook	Ball Hill Road, Princeton (3)
Governor Brook	Sterling Road, Holden (3)
Muschopauge Brook	Route 68, Rutland (3)
Cobb Brook	Ball Hill Road, Princeton (3)
Cold Spring Brook	Barnum Road, Ayer (3,14)
Catacoonamug Brook	Reservoir Road, Lunenburg (3)
Gulf Brook	Lawrence Street, Pepperell (3)
Witch Brook	Warren Road, Townsend (3)
Pearl Hill Brook	Pleasant Street, Lunenburg (3)
Monoosnuc Brook	Whitney Street, Leominster (5,7)
Nissitissit River	Prescott Street, Pepperell (5,7)
Nashua River	McPherson Road, Ayer (5,7)
Unnamed Tributary to Still River	Forbush Road, Bolton (6)
Lake Shirley	Lunenburg (10)

*1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – nutrients, 3 – E. coli samples, 4 – unattended continuous dissolved oxygen and temperature, 5 – Rapid Bioassessment Protocol (RBP) III (macroinvertebrate) and habitat assessment, 6 – Fish population, 7 – Periphyton, 8 – unattended continuous temperature, 9 – hardness, 10 – fish toxics, 11 – color and turbidity, 12 – reactive phosphorus, 13 – chlorophyll *a*, 14 – Metals, 15 – ambient toxicity

ADDITIONAL MONITORING ACTIVITIES – Some monitoring activities were performed in watersheds that were not actually in "Year 2" of the five-year watershed cycle. These are briefly described below:

1) **Fish Toxics Monitoring:** In addition to the sites in the "Year 2" watersheds identified above, DWM completed fish sampling at the following seven sites at the recommendation of the Inter-agency Fish Toxics Committee:

Watershed	Monitoring Site Description
Cape Cod	Kinnacum Pond, Wellfleet
Cape Cod	Spectacle Pond, Wellfleet
Cape Cod	Round Pond (west), Truro
Mystic (Boston Harbor)	Lower Mystic Lake, Medford/Arlington
Mystic (Boston Harbor)	Alewife Brook, Cambridge/Arlington
Neponset (Boston Harbor)	Neponset River, Canton/Norwood
Westfield	Windsor Lake, Windsor

Edible fillets were analyzed for the presence of heavy metals (including mercury), PCB, and organochlorine pesticides. If necessary, fish consumption advisories will be issued by the Massachusetts Department of Public Health.

2) **Lake Monitoring:** Baseline lakes sampling in the summer of 2008 focused on following up on previous sampling of White Island Pond (both East and West) in the Plymouth area of Southeast Massachusetts. Data from this sampling effort will support a pre-draft TMDL for this lake (in preparation), and also may be used by SERO for regulatory purposes. In addition, several other lakes in the Plymouth area that were reported to be impacted by cranberry bogs were also sampled. These included Billington Sea, Bartletts Pond and Indian Brook Reservoir and some tributaries and/or commercial cranberry discharges thereto. Sampling consisted of three monthly visits to each lake. Data collection focused on total phosphorus but some samples were also taken for dissolved (soluble reactive) phosphorus. Secchi disk transparency, color, chlorophyll *a* and multi-probe data were also collected. Blooms of cyanobacteria were identified and counted (see item 3 below). Field assistance was also provided to SERO staff who wished to begin sampling Blackmore Pond in Wareham.

3) **Blue-green Algae Bloom Investigation:** During the summer of 2008 two sites from the lower Charles River basin were sampled approximately every other week from May 20 until September 18 for cyanobacteria. A total of 16 samples were examined and counts of the cyanobacteria made to aid in determining if blooms of potentially toxic algae were occurring. This work was done in collaboration with the Mass. Department of Conservation and Recreation (DCR), Mass. Department of Public Health (DPH) and the Charles River Watershed Association to ensure that cyanobacteria cell counts or toxicity measurements did not exceed DPH protocols for recreational waters. Besides the Charles River stations, counts and identications were performed on samples provided by SERO, lake associations, other DEP personnel and the Army Corps of Engineers. The water bodies represented were: Lake Quannapowitt, White Island Pond, Buffumville Reservoir, West Monponsett Pond, Mystic River Lakes (Ell Pond), Fulton Pond and the Muddy River.

4) **Precautionary screening for *Didymosphenia geminata*:** While *Didymosphenia geminata* (aka “rock snot”) has not been found in Massachusetts to date, there is concern that individuals who fish and recreate on waters in New Hampshire and Vermont, where its presence has been confirmed, may transport this nuisance diatom into the Commonwealth while engaged in similar activities in Massachusetts’ waters. Therefore, diatom sampling was carried out to determine whether *Didymosphenia geminata* was present in two Massachusetts watersheds (i.e., Connecticut/Deerfield and Nashua/Nissitissitt) offering good recreational potential near the boundaries of these neighboring states. Six stations in the Connecticut/Deerfield watersheds were sampled once in June. The sampling included both the examination of water column

organisms recovered using a plankton net as well as quantitative scrapes of the substratum. The same procedure was followed at two Nissitissitt River sites sampled in July; however, in September, only qualitative scrapes of the substratum were made. *Didymosphenia geminata* was **not** found at any of the sampling sites.

5) **2008 Bacteria Source Tracking:** Bacteria source tracking (BST) studies were performed in 2008 in selected subwatersheds by the DWM Regional Monitoring Coordinators (RMC) based at the MassDEP Western (WERO), Southeast (SERO) and Northeast (NERO) regional offices. The bacteria source tracking surveys followed protocols developed in 2004 by the DWM that provide site-specific data for the identification and abatement of specific bacterial pollution sources.

Northeast Region (NERO):
In 2008, DEP/NERO continued its Bacteria Source Tracking program using the same model as in 2007. In order to identify targeted sub-basins, the NERO BST program coordinators reviewed historical MassDEP data from water quality assessment reports, TMDLs, and the Integrated List of Waters, data from the Massachusetts Department of Public Health, Office of Coastal Zone Management, United States Environmental Protection Agency, University of Massachusetts-Boston, and individual municipalities. In addition the NERO BST coordinators hosted a meeting of the region's watershed associations to foster information exchange. As in the past, the in-house Colilert® and Enterolert® system was used to determine *E. coli* concentrations in fresh water and *Enterococcus* spp. concentrations in brackish/marine waters. Other analyses used as screening methods to identify wastewater sources included ammonia test strips, chlorine test strips, a surfactants kit, and optical brightener pads. In addition human marker analysis, performed by MassDEP's Wall Experiment Station, was used to identify human sources of bacteria.

In 2008, the DEP/NERO Bacteria Source Tracking Program (BST) sampled in all of the basins in the Northeast region. Although the goal of the program was to conduct iterative dry weather sampling, marginal wet weather samples were often collected due to significant precipitation throughout a large part of the summer. Bacteria source tracking was conducted in the following sub-watersheds (those denoted with a * were follow-up sites from 2007):

*Alewife Brook: Somerville, Arlington	(Boston Harbor – Mystic Watershed)
Ell Pond: Melrose	(Boston Harbor – Mystic Watershed)
Horn Pond Brook: Melrose	(Boston Harbor – Mystic Watershed)
*Mystic River: Somerville	(Boston Harbor – Mystic Watershed)
Tenean Beach- pipes & Pine Neck Creek: Boston	(Boston Harbor- Neponset Watershed)
*Pine Tree Brook: Milton	(Boston Harbor – Neponset Watershed)
*Unquity Brook: Milton	(Boston Harbor – Neponset Watershed)
Furnace Brook & Blacks Creek: Quincy	(Boston Harbor- Weymouth and Weir Watershed)
Wollaston Beach pipes: Quincy	(Boston Harbor- Weymouth and Weir Watershed)
Charles River pipes: Boston	(Charles Watershed)
*Farley Brook: Ipswich	(Ipswich Watershed)
Howlett Brook: Topsfield	(Ipswich Watershed)
*Kimball Brook: Ipswich	(Ipswich Watershed)
Forest Lake: Methuen	(Merrimack Watershed)

Powwow River: Amesbury	(Merrimack Watershed)
Spickett River: Lawrence, Methuen	(Merrimack Watershed)
Phillips Beach: Swampscott	(North Coastal Watershed)
Stramski Beach: Marblehead	(North Coastal Watershed)
Derby Wharf pipe: Salem	(North Coastal Watershed)
North River: Salem	(North Coastal Watershed)
Frost Fish Brook: Danvers	(North Coastal Watershed)
Little River: Newbury, Newburyport	(Parker Watershed)
Mill River pipes & tributaries: Rowley	(Parker Watershed)
*Lower Shawsheen basin: Andover, Lawrence	(Shawsheen Watershed)
Rogers Brook: Andover	(Shawsheen Watershed)
Cochituate/Bannister Brook: Framingham	(SuAsCo Watershed)

An aggressive enforcement approach to confirmed bacteria "hot spots" led to enforcement actions against five municipalities. Enforcement actions were closely coordinated with USEPA staff. NERO BST coordinators continue to track progress on enforcement actions initiated in 2007, conduct follow-up sampling, and meet with municipal officials as appropriate.

Western Region (WERO):
Bacteria Source Tracking Projects were performed in 2008 at selected subwatersheds in the Chicopee, Connecticut, Deerfield, Hoosic, Housatonic, Millers, and Westfield Watersheds by the DWM Regional Monitoring Coordinators (RMC) located at the DEP Western Regional Office (WERO). The bacteria source tracking surveys followed protocols developed in 2004 by the DWM that provide site-specific data for the identification and abatement of specific bacterial pollution sources. This year the RMC's focused their BST sampling efforts on HUC 12 segments that were impaired for pathogens on MassDEP's 2004 Integrated List of Waters. Two additional watersheds were sampled in response to complaints received by the Water Pollution Control Program at WERO. For each subwatershed chosen, pertinent information was reviewed (such as GIS land use and storm drain and sewer infrastructure maps) and field reconnaissance was conducted to design the sampling plan and to aid in interpreting the data.

Screening level bacteria sampling for *E. coli* was conducted during dry weather in each subwatershed. Sample analysis was conducted by RMC's with an enzyme substrate testing system in a laboratory at the DEP WERO. If screening sampling revealed bacteria contamination, iterative sampling for *E. coli* during both dry and wet weather conditions continued in order to isolate the source(s) of bacteria.

Bacteria source tracking was conducted in the following subwatersheds:

Ware River: Ware	(Chicopee Watershed)
CT River storm drains: West Springfield/Chicopee	(Connecticut Watershed)
Muddy Brook: Granby	(Connecticut Watershed)
Chickley River: Charlemont/Hawley	(Deerfield Watershed)
Tophet Brook: Adams	(Hoosic Watershed)
Hubbard Brook: Sheffield/Egremont	(Housatonic Watershed)
Millers River Mainstem: Orange	(Millers Watershed)
West Branch Westfield River: Huntington	(Westfield Watershed)

Sources of significant bacteria contamination were located in the following subwatersheds: Ware River, Ware; Chickley River, Charlemont/Hawley; Tophet Brook, Adams; and CT River storm drains, West Spingfield/Chicopee. The DEP WERO notified the appropriate municipal authorities in Ware and Chicopee about the BST results and advised them to immediately begin remediation. The DEP WERO is currently monitoring the actions these communities are taking to eliminate the illicit sewage inputs to these waterbodies. As the pollution in the Chickler River and Tophet Brook were determined to result from agricultural practices, the BST results for these systems were forwarded to MassDAR for further investigation and remediation.

The RMC's also conducted follow-up sampling in subwatersheds where 2006 and 2007 BST efforts identified bacteria contamination to determine the progress of remediation efforts. Remediation efforts in Athol reduced the bacteria pollution but more work needs to be done to fully stop the pollution. The *E. coli* pollution from storm drains to both the Hoosic River mainstem and the North Branch Hoosic River in North Adams is still significant.

Southeast Region (SERO):
DWM regional monitoring coordinators in SERO used the Colilert® and Enterolert® system located at the Southeast Region DEP office to analyze bacteria surface water quality samples. DWM regional monitoring coordinators reviewed the data and refined sampling locations based on bacteria "signals", field observations and, in some cases, discussions with local watershed groups and/or municipal officials. If screening sampling results revealed bacteria contamination, iterative dry weather bacteria sampling for *E. coli* (Enterococcus in brackish waters) continued in an attempt to track and isolate the dry weather source(s) of bacteria. Occasionally, follow-up analyses (such as the use of optical brighteners, DNA, and caffeine testing) were performed in an attempt to determine if the bacteria were from human or animal sources.

In the MassDEP **Southeast Region** bacteria source tracking was conducted in the following subwatersheds (includes the names of those municipalities where sampling took place):

Speedway Brook: Attleboro	(Ten Mile Watershed)
Drinkwater River: Hanover	(South Coastal watersheds)
Meadow Brook: East Bridgewater	(Taunton Watershed)
Mill River: Taunton	(Taunton Watershed)
Salisbury Brook: Avon, Brockton	(Taunton Watershed)
Taunton River: Taunton	(Taunton Watershed)
Trout Brook: Brockton	(Taunton Watershed)
Runnins River: Seekonk	(Narragansett Bay watersheds)
Buttonwood Brook: New Bedford	(Buzzards Bay watersheds)
Mattapoisett Harbor: Mattapoisett	(Buzzards Bay watersheds)
Unnamed tributary to Apponagansett Bay: Dartmouth	(Buzzards Bay watersheds)
East Branch Westport River: Westport	(Buzzards Bay watersheds)
Bread and Cheese Brook: Westport	(Buzzards Bay watersheds)
Sandwich Harbor: Sandwich	(Cape Cod watersheds)
Bucks Creek: Chatham	(Cape Cod watersheds)
Oyster Pond: Chatham	(Cape Cod watersheds)