Massachusetts Department of ENVIRONMENTAL PROTECTION

2012 DWM ENVIRONMENTAL MONITORING OVERVIEW

(CN 410.0)

A brief overview of the surface water monitoring performed in 2012 by personnel of the MassDEP's Division of Watershed Management (DWM) is presented here. Information pertaining to the individual components of DWM's Surface Water Monitoring Program is presented at http://www.mass.gov/dep/water/resources/envmonit.htm.

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 (2010 – 2014). 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.

Since 1992, water quality monitoring, assessment and management activities of the MassDEP have been sequentially performed in accordance with a rotating five-year watershed schedule. Surface waters are typically monitored during "Year Two" of this cycle by the DWM Watershed Planning Section. While the DWM will continue to monitor in accordance with a five-year rotating schedule, the makeup of the watershed groups that are the focus of monitoring each year was adjusted in 2009 to more efficiently focus limited resources in the field and laboratory, and to respond to evolving requirements of the Environmental Protection Agency (EPA) for surface water data and related information to support reporting under the Clean Water Act (CWA). An explanation of how and why the new watershed alignment was established is presented at http://www.mass.gov/dep/water/resources/swmonadj.htm. While the watersheds were originally arranged to evenly distribute the administrative workload (i.e., permit issuance) from year to year, the water resources to be monitored (i.e., river miles) were not equitably distributed and were scattered throughout the Commonwealth. The new alignment balances the allocation of monitoring resources each year and focuses them more efficiently in one region.

The 2012 surface water monitoring program continued the implementation of the statistically valid sampling design for Massachusetts' shallow (i.e., "wadeable") streams that was initiated in 2010. The EPA strongly encourages states to adopt this approach for one or more waterbody types. The probabilistic survey design provides for the assessment of 100% of waters in a target population by monitoring a random sample of those waters. The ultimate goal of the DWM is to expend about 35% of annual monitoring resources on the probabilistic monitoring effort to satisfy the reporting requirements of CWA Section 305(b) while allotting the remaining 65% to deterministic or targeted data collection efforts such as the identification of pollution sources or the development of TMDLs. With the loss of full-time monitoring personnel in recent years, however, DWM's surface water monitoring efforts in 2012 focused primarily on the implementation of the probabilistic wadeable stream survey, with much less attention given to deterministic monitoring activities. All of the monitoring activities of the DWM in 2012 are briefly described below.

PROBABILISTIC MONITORING & ASSESSMENT PROGRAM (MAP2) – The goals of the probabilistic survey are to provide an unbiased assessment (Support/Impaired) of aquatic life, recreational and aesthetic uses in wadeable (i.e., 1^{st} – 4^{th} Strahler Order), non-tidal perennial streams of Massachusetts, and, over time, to provide an analysis of trends in the use assessments of those streams. The random sampling design allows for the determination, with a known statistical confidence, the percentage of wadeable stream miles supporting and not supporting their designated uses. To implement the survey, Massachusetts' 1^{st} – 4^{th} order streams were apportioned into five separate groups or strata, one of which – the "Western" – was the focus of monitoring in 2012. The Western Group comprises the Deerfield, Farmington, Hoosic, Housatonic and Westfield watersheds.

A total of 36 sites were monitored in 2012 (Table 1). The sites were divided into six groups that were visited on a weekly rotation to facilitate survey logistics and balance the sample load to the respective analytical laboratories. The primary objective at each sampling site was to collect sufficient data to assess, using the DWM's existing assessment methodology, the status (support/impaired) of aquatic life, recreational and aesthetic uses. All sampling and QA/QC was performed in accordance with the DWM's standard operating procedures, QAPP and SAP. A list of the water quality and ecological variables measured at each site, along with their sampling frequencies, is presented in Table 2.

Table 1. Location of randomly selected sites in the "Western" region of Massachusetts that were sampled in 2012 as part of the probabilistic wadeable stream survey.

Site	Watershed	Waterbody	Site Description
MAP2-163	Westfield	Billings Brook	[approximately 1600 feet downstream of Plainfield Road, Hawley/Grant Street, Plainfield]
MAP2-165	Deerfield	West Branch North River	[approximately 600 feet downstream of Heath Road, Colrain]
MAP2-166	Housatonic	Smith Brook	[approximately 2200 feet downstream of West Street, Pittsfield]
MAP2-167	Westfield	West Branch	[approximately 225 feet upstream of Main Road (Route 143), Chesterfield]
MAP2-168	Westfield	West Branch Westfield River	[north of Russell Street, approximately 2500 feet upstream of Worthington Road (Route 112), Huntington]
MAP2-169	Deerfield	Green River	[east of Route 91, approximately 3000 feet upstream of Colrain Street, Greenfield]
MAP2-171	Housatonic	Hop Brook	[southwest of Main Road, approximately 6300 feet downstream of Jerusalem Road, Tyringham]
MAP2-172	Farmington	Slocum Brook	[east of Colebrook River Road, approximately 4700 feet upstream of the Cranberry Pond Brook confluence, Tolland]
MAP2-173	Deerfield	Cold River	[approximately 1150 feet upstream of Cold River Road, Charlemont]
MAP2-175	Housatonic	West Brook	[approximately 1300 feet downstream of the Beartown Road crossing nearest the intersection with Beartown Mountain Road, Great Barrington]
MAP2-177	Deerfield	Unnamed	[unnamed tributary to Creamery Brook, approximately 1700 feet downstream of West Road, Ashfield]
MAP2-180[b]	Westfield	West Branch Westfield River	[approximately 7600 feet downstream of Town Hill Road/Bancroft Road, Middlefield/Becket]
MAP2-181	Deerfield	East Branch North River	[approximately 2225 feet upstream of the Route 112 crossing nearest Jesse Wood Road, Colrain]
MAP2-182	Hudson	Kinderhook Creek	[approximately 1675 feet upstream of Potter Mountain Road, Hancock]
MAP2-184	Westfield	Pond Brook	[approximately 1450 feet downstream of Otis Stage Road (Route 23), Blanford]
MAP2-186	Housatonic	East Branch Housatonic River	[approximately 65 feet upstream of Old Windsor Road, Dalton]
MAP2-187	Farmington	Clam River	[approximately 2150 feet upstream from the confluence of the unnamed tributary from Lower Spectacle Pond, Sandisfield]

Table 1. Location of randomly selected sites in the "Western" region of Massachusetts that were sampled in 2012 as part of the probabilistic wadeable stream survey.

Site	Watershed	Waterbody	Site Description
MAP2-193[c]	Deerfield	South River	[approximately 400 feet upstream of Main Street (Route 116), Conway (approximately 200 feet upstream of confluence of Pumpkin Hollow Brook)]
MAP2-194	Hudson	Hoosic River	[approximately 1900 feet downstream of Hodges Cross Road (Route 8A), North Adams]
MAP2-195	Westfield	Middle Branch Westfield River	[approximately 200 feet downstream of River Road, Worthington]
MAP2-197	Deerfield	East Glen Brook	[east of East Glen Road, approximately 4225 feet upstream of the inlet of the Greenfield Reservoir, Leyden]
MAP2-199	Westfield	Munn Brook	[approximately 550 feet upstream of Loomis Street, Westfield]
MAP2-202	Hudson	Green River	[approximately 2750 feet upstream of the Eastlawn Cemetery access road, east of Water Street (Route 43), Williamstown]
MAP2-203	Housatonic	East Brook	[approximately 1500 feet upstream of Meadow Street, Lee]
MAP2-204	Housatonic	Umpachene River	[east of New Marlborough-Southfield Road, approximately 4325 feet upstream of Norfolk Road, New Marlborough]
MAP2-205	Hudson	Hoosic River	[approximately 1625 feet upstream of Hodges Cross Road (Route 8A), North Adams]
MAP2-206	Westfield	Westfield River	[approximately 3675 feet downstream of the River Road crossing nearest Griffin Hill Road, Savoy]
MAP2-207	Westfield	Middle Branch Westfield River	[approximately 2000 feet upstream of Goss Hill Road, Huntington]
MAP2-209	Westfield	Webster Brook	[approximately 625 feet downstream of Main Road (Route 143), Chesterfield (approximately 625 feet upstream from the confluence with Page Brook)]
MAP2-210	Housatonic	Cone Brook	[east of Swamp Road, approximately 475 feet downstream from the Swamp Road crossing nearest Steven Glen Road, Richmond]
MAP2-211	Westfield	Westfield River	[approximately 2325 feet downstream of the Marine Corps League Highway (Route 9) crossing nearest Mougin Road, Cummington]
MAP2-212	Farmington	Thomas Brook	[approximately 1025 feet downstream of Werden Road, Otis]
MAP2-213	Deerfield	Hinsdale Brook	[approximately 3550 feet upstream of Green River Road, Shelburne (and approximately 700 feet downstream of the Stewart Brook confluence)]

Table 1. Location of randomly selected sites in the "Western" region of Massachusetts that were sampled in 2012 as part of the probabilistic wadeable stream survey.

Site	Watershed	Waterbody	Site Description
MAP2-215	Westfield	Great Brook	[approximately 175 feet downstream of the Shaker Road crossing nearest the Kellog Brook confluence (which is approximately 600 feet downstream of station), Westfield]
MAP2-217[c]	Deerfield	North River	[approximately 2725 feet upstream of the Main Road (Route 112) crossing nearest the Johnson Brook confluence (which is approximately 500 feet upstream of station), Colrain]
MAP2-218[a]	Hudson	Hopper Brook	[approximately 6025 feet upstream of the Hopper Road crossing nearest Bressett Road, Williamstown]

a – Bacteria and continuous dissolved oxygen data not collected.
b – Only macroinvertebrate community and continuous temperature data collected.
c – Fish population data not collected due to resource limitations

Table 2. Sampling frequency of water quality and ecological variables measured at probabilistic sites.

Variable	Sample Frequency (Minimum)
Bacteria (*E. coli*)	6
Nutrients (TN,TP, Nitrate/Nitrite, Ammonia)	5
Color	5
Turbidity	5
Chloride	5
Metals	3
Dissolved Oxygen Probe Deploys (120 hours)	3
Temperature Probe Deploys (May-September)	1
Habitat Assessment	1
Fish Community	1
Macroinvertebrate Community	1

Individual components of the wadeable stream survey are described below.

***Water Quality (Chemical, Microbiological and Physical)*:** Each month, from May to September, grab water samples were collected at each site, field preserved, as appropriate, and delivered to the Senator William X. Wall Experiment Station in Lawrence (WES) for nutrient (total phosphorus, total nitrogen and ammonia nitrogen) and chloride analysis and a commercial laboratory in Westfield for *E. coli*, turbidity and color analysis. A sixth sampling event for *E. coli* only was also performed.

On three separate occasions, multi-probed water quality sondes were deployed in-situ for approximately 120 hours to obtain continuous analyses for temperature, dissolved oxygen, percent oxygen saturation, pH, specific conductance, and total dissolved solids. In addition, temperature sensors were deployed at all sites from May through September to obtain long-term, continuous water temperature data.

Samples for the analysis of dissolved metals were collected from each site on three occasions by personnel of the USEPA using wade-in, clean-hands techniques. Samples were filtered in the field and transported to the USEPA's New England Regional Laboratory (NERL) in Chelmsford for analysis.

***Biological Monitoring (Macroinvertebrates, Fish, Habitat)*:** Benthic macroinvertebrate and fish community assessments, along with associated habitat evaluations, were performed at each site to assess the aquatic life use status. These communities integrate environmental conditions (chemical – including nutrients and toxics, and physical – including flow and water temperature) over extended periods of time and are an excellent measure of a waterbody's overall "health". Standard RBP habitat assessments were completed during both the invertebrate and fish sampling events.

The benthic macroinvertebrate community was sampled at each site once during the index period July through September, using Rapid Bioassessment Protocols (RBP) III or a modification thereof, depending upon available habitat. For example, typical RBP III kick-sampling protocols could not be used at low-gradient sites so a multi-habitat sampling method (i.e., multiple net sweeps) was employed. Specimens were preserved in the field and transported to the DWM lab for further processing. Where applicable, benthic macroinvertebrate functional feeding group, community composition, biotic index using pollution tolerance, and abundance metrics will be calculated to determine biological condition and aquatic life use status.

Fish community sampling for the presence/absence of resident fish species was performed once at all but two sites during the late summer. Fish were collected within a 100-meter reach using a backpack or tote barge-mounted electro-fishing equipment and held in plastic buckets containing stream water. Fish were identified to species and a minimum of 25 individuals of each species were measured and weighed. Fish were then redistributed throughout the reach.

DETERMINISTIC ("TARGETED") MONITORING PROGRAM (TMP) – Although the majority of DWM's monitoring efforts in 2012 were focused on the probabilistic wadeable stream survey described above, some waterbodies were selected, or "targeted", for monitoring activities designed to fulfill the needs for specific data and information to support such program elements as TMDL calculation, criteria development and human health risk assessment. While some targeted monitoring activities were focused in the Western Group of watersheds in accordance with the rotating watershed schedule, other monitoring work was carried out in watersheds throughout Massachusetts. More detail pertaining to the targeted monitoring activities of the DWM in 2012 is presented below.

Reference Site Network (RSN): The DWM has identified the need to characterize the reference condition for Massachusetts' surface waters to support multiple program objectives including, but not limited to, the interpretation of biological data obtained from the probabilistic monitoring network as well as the development of biocriteria and nutrient criteria. For example, the DWM is currently exploring the development of tiered aquatic life uses that will increase the accuracy of aquatic life use assessments and improve water quality goal-setting processes. An understanding of the inter-year and intra-year variation within indices of biotic integrity used for assessment is a critical initial step toward the development and implementation of biocriteria and tiered aquatic life use.

Least-disturbed reference sites were selected from the two most prominent Level III ecoregions (Northeastern Highlands, Northeastern Coastal Plain) in Massachusetts through the application of a Human Disturbance Index that was derived from six individual streamflow and landscape disturbance indicators. A total of ten (10) sites were chosen for intensive study over three years, beginning in 2011. Five additional sites were added to this network in 2012 (Table 3). The primary objective at each sampling site was to collect sufficient data to begin evaluating inter-year and intra-year variation in the biological communities at the end of the project. Monitoring activities included habitat assessment; macroinvertebrate and fish population assessments; and physicochemical sampling. All sampling and QA/QC was performed in accordance with the DWM's standard operating procedures, QAPP and SAP. A list of the water quality and ecological variables measured at each site, along with their sampling frequencies, is presented in Table 4. More detail pertaining to each component of the RSN is presented below.

Table 3. Location of selected "reference/least disturbed" sites that were sampled in 2012 as part of the reference site network.

Site	Watershed	Waterbody	Site Description
TB01	Deerfield	Thorne Brook	[east of Green River Road, approximately 100 feet upstream of confluence with the Green River, Leyden]
WB01	Millers	Whetstone Brook	[approximately 160 feet downstream of Kentfield Road (Kempfield Road), Wendell]
WSR01	Chicopee	West Branch Swift River	[approximately 640 feet upstream from Cooleyville Road Extension, Shutesbury]
EBT01	Millers	East Branch Tully River	[approximately 2000 feet upstream from Route 68 (Warwick Road), Royalston]
TR01	Nashua	Trout Brook	[approximately 140 feet upstream of Manning Street, Holden]
PB01	Westfield	Pond Brook	[approximately 275 feet upstream of Beech Hill Road, Blandford]
FB01	Westfield	Factory Brook	[east off Town Hill Road, approximately 4400 feet upstream of confluence with the Westfield River, Middlefield]
SB01	Westfield	Sanderson Brook	[Sanderson Brook Road bridge nearest Route 20, Chester]
BB01	Quinebaug	Browns Brook	[approximately 2120 feet upstream from May Brook Road, Holland]
BNB01[b]	Quinebaug	Breakneck Brook	[approximately 5290 feet downstream from MA/CT state line, Sturbridge]
EB01	Blackstone	Emerson Brook	[approximately 200 feet upstream of the Route 146 southbound off-ramp to Chocolog Road, Uxbridge]
BH01	Hudson	Bashbish Brook	[south of Falls Road, approximately 200 feet upstream of the confluence of Wright Brook, Mount Washington]

Table 3. Location of selected "reference/least disturbed" sites that were sampled in 2012 as part of the reference site network.

Site	Watershed	Waterbody	Site Description
YB02[a]	Housatonic	Yokun Brook	[approximately 1800 feet upstream of Edgewood Drive, Lenox]
DU01	Deerfield	Dunbar Brook	[west of River Road, approximately 1400 feet upstream from the Dunbar Brook Dam (MA00222), Florida]
CR01[a]	Deerfield	Cold River	[approximately 325 feet upstream of Mohawk Trail (Route 2), Florida/Savoy (upstream of Black Brook confluence)]

a – Macroinvertebrate community data collected only in July.
b – Only macroinvertebrate data collected in September.

Table 4. Sampling frequency of water quality and ecological variables measured at RSN sites.

Variable	Sample Frequency (Minimum)
Nutrients (TN,TP, Nitrate/Nitrite, Ammonia)	5
Color	5
Turbidity	5
Chloride	5
Temperature Probe Deploys (May-October)	1
Habitat Assessment	1
Fish Community	1
Macroinvertebrate Community	2

***Water Quality (Physico-chemical)*:** Approximately monthly, from May to October, grab water samples were collected at each site, field preserved, as appropriate, and delivered to the Senator William X. Wall Experiment Station in Lawrence (WES) for nutrient (total phosphorus, total nitrogen and ammonia nitrogen) and chloride analysis and the DWM lab in Worcester for turbidity and color analysis. In addition, temperature sensors were deployed at all sites from May to October to obtain long-term, continuous water temperature data.

***Biological Monitoring (Macroinvertebrates, Fish, Habitat)*:** Benthic macroinvertebrate and fish community assessments, along with associated habitat evaluations, were performed at each site to assess the aquatic life use status. These communities integrate environmental conditions (chemical – including nutrients and toxics, and physical – including flow and water temperature) over extended periods of time and are an excellent measure of the overall "health" of a waterbody. Standard RBP habitat assessments were completed during both the invertebrate and fish sampling events

The benthic macroinvertebrate community was sampled twice at each site once during the months of April and May and again in July and August, using Rapid Bioassessment Protocols (RBP) III or a modification thereof, depending upon available habitat. For example, typical RBP III kick-sampling protocols could not be used at low-gradient sites so a multi-habitat sampling

method (i.e., multiple net sweeps) was employed. Specimens were preserved in the field and transported to the DWM lab for further processing. Where applicable, benthic macroinvertebrate functional feeding group, community composition, biotic index using pollution tolerance, and abundance metrics will be calculated for analysis.

Fish community sampling for the presence/absence of resident fish species was performed once at all but one site during the late summer. Fish were collected within a 100-meter reach using a backpack or tote barge-mounted electro-fishing equipment and held in plastic buckets containing stream water. Fish were identified to species and a minimum of 25 individuals of each species were measured and weighed. Fish were then redistributed throughout the reach.

Sampling in the Westfield River Watershed to Support Nutrient Criteria Development: The Westfield River was selected for study in the summer of 2012 to inform the nutrient management plan being developed as part of the Massachusetts Surface Water Quality Standards. Previous data suggested that the Westfield River was impaired by blooms of filamentous algae while exhibiting low average concentrations of total phosphorus in the water column. Several sites on the Westfield River, including some upstream tributaries, were selected for sampling of water and periphyton (Table 5). Filamentous algae density and benthic chlorophyll a data will be compared to nutrient concentrations to further refine recommendations for the development of nutrient criteria. Individual study components are presented below.

Table 5. Location of sites in the Westfield River Watershed that were sampled in 2012 to support nutrient criteria development.

Site	Waterbody	Site Description
B0175	West Branch Westfield River	[Approx. 920 meters upstream/northwest from Route 112, Huntington, MA (approx. 25 meters downstream/east from footbridge)]
W2288	Westfield River	[East of Route 20, approximately 530 feet downstream from Route 90 crossing, just over the Russell border, Westfield, MA]
W1463	Westfield River	[North of Shepard Street and the Whitney Playground, Westfield, MA]
W2289	Westfield River	[Upstream Westfield Pollution Control Plant, near sewer crossing, Westfield, MA]
W0808	Little River	[Route 20 bridge, Westfield, MA]
W2285	Westfield Water Pollution Control Plant Outfall	[Outfall of Westfield Pollution Control Plant, Westfield, MA]
W1464	Westfield River	[North of Ascutney Avenue, Westfield, MA]
W2290	Westfield River	[Approximately 1200 feet upstream of Route 20 (East Main Street), Westfield, MA]

***Water Quality (Physico-chemical)*:** Water chemistry grab samples were collected once a month from May to September. Samples for the analysis of ammonia-nitrogen, total nitrogen, nitrate-nitrogen, dissolved reactive phosphorus (0.45uM filtered in the field), total phosphorus and total suspended solids were delivered to the WES in Lawrence. Dissolved reactive phosphorus samples were analyzed within 48 hours or frozen and analyzed within 7 days.

Samples were analyzed for turbidity and true color at the DWM lab in Worcester. In addition, a site below the Westfield Wastewater Treatment Plant was selected for continuous monitoring of turbidity with automatic collection of water samples during turbid events in an effort to locate sources of turbidity.

***Biological Monitoring (Periphyton community)*:** Periphyton sampling was performed at each of five sites up to three times over the months of June, July, August and September. For each sampling event, algal percent coverage was measured and periphyton biomass was estimated from the analysis of chlorophyll a in samples obtained from natural substrates. Standard habitat measurements included stream velocity determinations and estimates of light available to the benthic algae (e.g., canopy cover). Finally, diatom samples were collected in July and sent to a commercial laboratory for identification, counts, biovolumes and statistical analysis.

Periphyton Sampling to Support Resource Assessment: While most of the periphyton sampling in 2012 was performed in the Westfield River Watershed to support nutrient criteria development (see above), a few samples were collected and analyzed as part of ongoing investigations, such as the probabilistic and reference site monitoring networks (Table 6).

Table 6. List of sites where algal identifications and determinations of relative abundance were performed in 2012.

Watershed	Waterbody	Site Description
Millers	East Branch Tully River	[See Table 3]
Westfield	Middle Br. Westfield River	[See Table 1]
Westfield	Sanderson Brook	[See Table 3]
Deerfield	North River	[See Table 1]
Westfield	West Br. Westfield River	[See Table 1]
Westfield	West Br. Westfield River	[See Table 1]
Deerfield	Cold River	[See Table 1]
Blackstone	Blackstone River	[Depot Street, Millbury]
Hoosic	Hoosic River	[Upstream and downstream from Adams wastewater treatment plant]

Field and Lab Support for the Assessment and Management of Cyanobacteria Blooms: In 2012, MassDEP once again provided technical expertise and laboratory support to the investigation of potentially toxic algae (cyanobacteria) blooms. Working from MassDEP's DWM-Worcester and Southeast Regional (SERO) offices, respectively, and in collaboration with MassDPH, two staff biologists performed cyanobacterial counts and identifications on water

samples to determine whether cell counts exceeded MassDPH advisory levels for recreational waters. Lab services and technical support were provided to the Massachusetts Department of Conservation and Recreation (MassDCR), other State and Federal agency personnel and local public health officials. All taxonomic identifications and counts were forwarded to MassDPH for risk assessment and management. Where applicable, MassDPH health advisories were issued. A list of waterbodies from which MassDEP processed samples is presented in Table 7.

Table 7. Waterbodies from which algae samples were obtained and delivered to MassDEP biologists for taxonomic identifications and counts. Results were submitted to MassDPH.

Waterbody	Municipality
East White Island Pond	Plymouth
West Monponsett Pond[a]	Halifax[b]
Buffumville Reservoir	Charlton
Molls Pond	Eastham
Micajah Pond	Plymouth
Buttonwood Park Pond	New Bedford
Little Long Pond	Plymouth

a – public water supply
b – backup supply that is occasionally diverted to Silver Lake, principal supply to the City of Brockton

In addition to the work cited above, technical support was provided to municipal drinking water officials who were investigating real or apparent Cyanobacteria blooms at Water Treatment Facilities. Following a bloom (*Aphanizomenon*) at the Danvers Water Treatment Facility, MassDEP staff provided Instruction on how to count cyanobacteria and report results, and provided technical advice on the management of harmful algae blooms.

Finally, MassDEP personnel responded to reports of a potential cyanobacteria problem at the Milford Water Treatment Plant that were later found to be unsubstantiated. Water samples were collected from Echo Lake and five locations throughout the water treatment facility. Cyanobacteria taxonomic identifications and counts were completed and test kits were used to analyse samples for the presence of the toxin microcystin-LR.

Fish Toxics Monitoring: DWM completed fish sampling at two sites at the recommendation of the Inter-agency Fish Toxics Committee (Table 8). Edible fillets from fish collected at both waterbodies were analyzed for the presence of mercury. If necessary, fish consumption advisories will be issued by the Massachusetts Department of Public Health (MassDPH).

Table 8. 2012 fish toxics monitoring sites.

Watershed	Monitoring Site
Chicopee	Springfield Reservoir (Ludlow)
French	Sargent Pond (Leicester)

Lake Monitoring: Baseline lakes sampling in the summer of 2012 focused on follow-up monitoring of the East and West White Island Pond in Plymouth as part of the implementation of the TMDL for phosphorus. In addition, DWM sampled East and West Monponsett ponds in Halifax as the next likely targets for TMDL development. Data from this sampling effort will

support a pre-draft TMDL for these lakes and also may be used for regulatory purposes. Sampling consisted of three monthly visits to each lake and samples were also collected from inlet streams and observations were made of duckweed on White Oak Reservoir. Data collection focused on total phosphorus and total nitrogen. Secchi disk transparency, color, chlorophyll *a* and multi-probe data were also collected. Blooms of cyanobacteria were identified and counted and results passed on to MassDPH for evaluation and, where applicable, public advisories against swimming or contact due to toxic cyanobacteria.

Bacteria Source Tracking Activities of the Southeast Regional Office (SERO): The DWM regional monitoring coordinator, aided by an additional regional staff member and a college student intern, used the IDEXX quanti-tray system on site in the Southeast Region lab, to determine the concentration of "indicator bacteria" (E.coli and Enterococcus) in surface water, at stormdrain outfalls and within drainage infrastructure (manholes) (Table 9).

Additional source tracking tools used were:

- Hach test kits: to determine detergent concentrations.
- Ammonia and potassium meters: to determine ammonia/potassium ratios

These data were combined with field observations and in some cases, discussions with local watershed groups and/or municipal officials to refine sampling locations, in an attempt to track and isolate the dry weather source(s) of E. coli and/or Enterococcus bacteria. A small number of opportunities for "Human Marker" analyses (fluorescent whitening agents, DNA, and caffeine) were made available by the WES State Lab. These analyses were utilized in cases where bacteria concentrations were high but no obvious source could be immediately located, in an attempt to determine if the bacteria were from a human or animal source.

Highlights of the 2012 sampling season

- Continuing work started in 2011; Wet weather sampling (at stormwater outfalls discharging to Provincetown Harbor) was conducted in an attempt to help the town identify which outfalls were the biggest contributors of bacterial pollution to the harbor during a wet weather event. In addition, a dry weather investigation was made of all drainage infrastructures for the "dirtiest" drain outfalls, to rule out dry weather sources that might pool up further back up-pipe and influence bacteria concentrations at outfalls during wet weather. This investigation included sampling any standing water found in drain manholes and in storm vortech treatment units. To conclude the efforts, a quick-view camera on loan from EPA Region-1 was used to investigate any suspect areas, highlighted by the dry weather sampling data.

- The "BST for lakes & ponds" effort was continued on from 2011. Upon request from regional and municipal contacts, sampling was continued at Monponsett Pond (Halifax/Hanson) for bacteria at stormwater outfalls and at set locations along the shoreline of the ponds, in an attempt to identify the presence of faulty septic systems and measure their impact (in terms of bacterial pollution) on the ponds.

- The partnership with the North South River Watershed Association continued with joint bacteria source tracking efforts in the Kent Park area of the South River and in the French Stream watershed.

- The partnership with the Jones River Watershed Association and the Town of Kingston continued with focused sampling on a hot-spot area highlighted in 2011, i.e. Tussock Brook and the connected wetland area upstream of Rt.3. Sampling was conducted during wet and dry weather conditions to determine the exact nature of the biggest sources of bacteria to the wetland and aid future restoration efforts.

- A good working relationship was maintained with the City of New Bedford and Buttonwood Park Zoo. A round of wet weather sampling was conducted to highlight the influence of run-off from certain zoo exhibits on the bacteria concentrations in Buttonwood Brook. Meetings and conversations with the City and Zoo focused on design of exhibit re-structuring projects used in conjunction with BMP's that could improve the quality of wash-water and stormwater run-off from exhibits.

- Successful multi-year partnerships with the Cities of Norwood, Taunton and Brockton continued with successful joint source tracking efforts and corrections within the drainage infrastructures, influencing numerous Taunton and Boston Harbor watersheds.

- A partnership with EPA Region 1 and Rhode Island DEM was started towards the end of the sample season, to conduct bacteria source tracking throughout the Palmer River Watershed. One round of dry weather screening sampling was conducted at 40 locations throughout the watershed by a team of EPA, RIDEM and SERO staff. Lab analyses were conducted by the EPA. This partnership is expected to continue into next year with additional rounds of screening sampling as well as more focused source tracking sampling.

Table 9. Subwatersheds where bacteria source tracking was conducted over the course of approximately 30 sample days. Note: This table includes only the names of those municipalities where sampling took place and new sub-watersheds are highlighted in **bold.**

Name	Basin	Segment	Municipalities sampled	Number of sample days
Ten Mile River	Ten Mile	MA52-02	North Attleboro	1+ Human Marker
Speedway Brook	Ten Mile	MA52-05	Attleboro	1
Bungay River	Ten Mile	MA52-06	Attleboro	1
Runnins River	Narragansett Bay	MA53-01	Seekonk	1 + Human Marker
Rocky Run Brook	Narragansett Bay	MA53-16	Rehoboth	2
Lee River	Mt. Hope Bay	MA61-01	Swansea	2 + Human Marker
Palmer River	**Narragansett Bay**	**Multiple**	**Rehoboth & Seekonk**	**1**
Taunton River (Tributary Cobb Brook)	Taunton	MA62-02	Taunton	2
Taunton River (Main stem & other tribs)	Taunton	MA62-02	Taunton	2
Salisbury Plain River	Taunton	MA62-05	Brockton	1
Trout Brook	Taunton	MA62-07	Brockton	7 + Camera work
Salisbury Brook	Taunton	MA62-08	Brockton	3 + Smoke & camera
Mill River	Taunton	MA62-29	Taunton	1
Meadow Brook	Taunton	MA62-38	East Bridgewater	1
Lovett Brook	Taunton	MA62-46	Brockton	1

Muddy Cove Brook	Taunton	MA62-51	Dighton	2
Monponsett Pond	Taunton	MA62218	Halifax & Hanson	1
Hawes Brook	Boston Harbor	MA73-16	Norwood	3 + Human Marker
Germany Brook	Boston Harbor	MA73-15	Norwood	1
Weymouth Back River	Weymouth & Weir	MA74-13	Weymouth	1 + Human Marker
South River	South Coastal	MA94-09	Marshfield	1
Jones River	South Coastal	MA94-14	Kingston	4 + Human Marker
French Stream	**South Coastal**	**MA94-03**	**Rockland**	**3**
Buttonwood Brook	Buzzards Bay	MA95-13	New Bedford	1
Mattapoisett Harbor	Buzzards Bay	MA95-35	Mattapoisett	3
East Branch Westport River	Buzzards Bay	MA95-41	Westport	3
Provincetown Harbor	Cape Cod	MA96-29	Provincetown	4