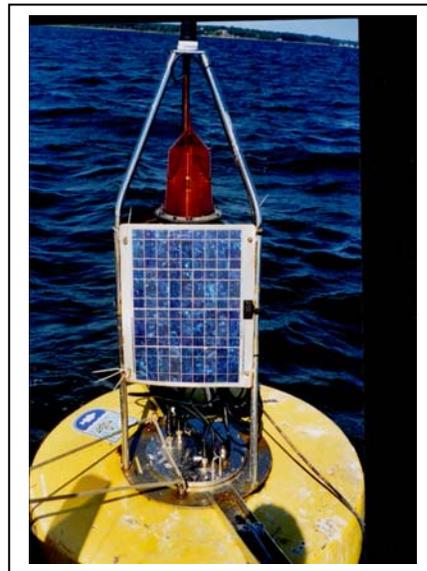
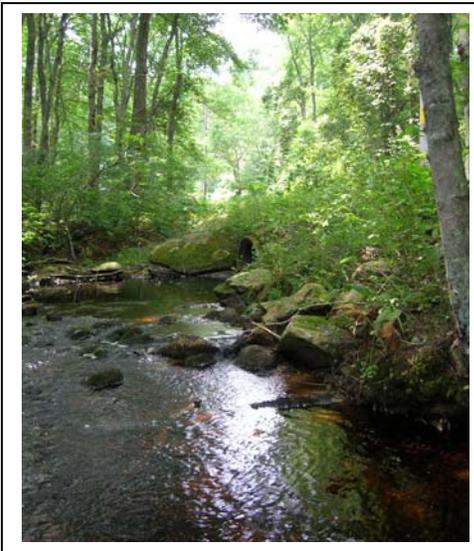


Rhode Island Environmental Monitoring Collaborative

Annual Report to the Rhode Island Bays, Rivers and Watersheds Coordination Team

Priority Monitoring Initiatives

May 2009



Preface

Following its formation in 2004, the Rhode Island Environmental Monitoring Collaborative (RIEMC) undertook a review and prioritization of needed improvements to the monitoring of the state's environment. In 2005 and annually thereafter, the RIEMC reported its recommendations regarding monitoring to the RI Bays, Rivers and Watersheds Coordination Team (BRW CT) and state leaders. Due to the availability of new funding sources in FY2007, the Coordination Team has been able to support a selected number of the RIEMC-designated priority monitoring programs. This report summarizes the status of the RIEMC recommended programs, noting where progress has been made and where further investment is still needed.

It is not the intent of this report to describe the full range of monitoring activities that are undertaken collectively by state or federal agencies, their partners, their contractors; or academic institutions and non-governmental organizations (NGOs). Rather, this report captures the actions undertaken during 2008 to enhance, strengthen or expand critical water-related monitoring programs previously identified by the RIEMC as of highest importance. As evidenced in the report, environmental monitoring in Rhode Island continues to be a highly collaborative effort among state agencies, academic researchers, other governmental and NGOs as well as citizen volunteers. The RIEMC will continue to provide leadership and a forum that facilitates coordination and collaboration among those involved in monitoring Rhode Island's environment.

Submitted by

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Cover Photo credits: RI Department of Environmental Management and ESS Group.

RI Environmental Monitoring Collaborative

Synopses of Work Accomplished in 2008 Priority RIEMC Monitoring Activities

Streamflow Gage Network provided by Sue Kiernan, RI DEM

The Rhode Island network of continuous streamflow gages continued operation during 2008. A total of 32 gages are maintained by the United State Geological Survey (USGS) via contracts with the Rhode Island Department of Environmental Management (DEM), the Rhode Island Water Resources Board (WRB), Providence Water Supply Board, and Ocean State Power. These data are critically important and used for a variety of purposes including, but not limited to:

- Continuing development of DEM standards to ensure adequate flows in rivers and streams;
- Pollutant loading calculations and development of water quality restoration plans (TMDLs);
- Water quality modeling;
- Drought management;
- Emergency management including floodplain management;
- Basin planning related to water supply management;
- Water supply development planning and design in the Big River Watershed (WRB).

Measurement at the gages throughout the network is expected to continue for the next several years. Once a sufficient time series of data is available, data analysis can establish the means to estimate with confidence the expected flow regime in the stream or river. As such analyses are completed, the design of the network may change, possibly reducing the number of gages needed to be maintained long-term.

Streamflow data are made available on a real-time basis by USGS at:

<http://tinyurl.com/RIEMC-FLOW>

See Appendix A for a list of current network gages. The Coordination Team contributed to a portion of contractual costs for the streamflow gage network operations during FY2009.

Narragansett Bay Fixed-Site Monitoring Network (NBFSMN) provided by Sue Kiernan, RI DEM

The Narragansett Bay Fixed-Site Monitoring Network, a multi-agency collaborative monitoring program, was once again expanded by the addition of a second monitoring station in Greenwich Bay at Sally Rock (Station B14). This provided data from the middle of Greenwich Bay in addition to the land-based location (F5) from its western-most boundary – a station that has consistently reported poor water quality results. During 2008, the network consisted of a total of 13 locations: 8 buoys and 5 land-based sites. The network is standardized on YSI equipment that uses sensors to measure water quality every 15 minutes, 24 hours per day. Nine of the 13 stations are maintained under an agreement between the DEM Office of Water Resources and the University of Rhode Island Graduate School of Oceanography. DEM funding for this agreement is from the National Oceanographic and Atmospheric Administration (NOAA) Bay Window Program and the BRW Coordination Team. NBC maintains two stations: one site (F4) is located at the Phillipsdale Landing dock on the Seekonk River, downstream of the Bucklin Point Wastewater Treatment facility. The second monitoring site (B4) is a buoy located at Bullock’s Reach in the Providence River, several miles downstream from the Field’s Point facility. The remaining sites are maintained and funded by the Narragansett Bay National Estuarine Research Reserve (a NOAA/DEM partnership). Additional funds are needed to add stations to portions of the Bay not yet covered in the monitoring network, including the lower Bay and Sakonnet River.

Data were reviewed weekly as part of DEM’s tracking of Bay conditions during May-October. Processed datasets (2003-2007) are posted on the DEM website with summaries and raw also posted to www.narrbay.org web site. The data were used by DEM to designate an additional 7.62 square miles of mid Narragansett Bay as impaired due to low dissolved oxygen in 2008 (DEM, 2008; Appendix B.) A report on activities during 2005-2008 is available:

<http://tinyurl.com/RIEMC-NBAY>

Researchers and managers are collaborating to use the fixed-site datasets in combination with other data in a continuing effort to improve the understanding of the extent and nature of hypoxia in Narragansett Bay. Recent analyses have quantified the frequency of low oxygen events and documented their occurrence

between June and October in the mid to upper Bay, Providence and Seekonk Rivers and Greenwich Bay (RIDEM, 2009). The years with the higher frequencies of events tend to have high late-spring river inflows and/or warmer temperatures (Codiga, D. L., In Press). The data are relied upon by researchers associated with the Narragansett Bay multi-year Coastal Hypoxia Research Program (CHRP), a project that includes model development.

Large River Water Quality Monitoring
provided by Sue Kiernan, RI DEM and Thomas Uva, Narragansett Bay
Commission

In 2008, Rhode Island made progress toward more fully implementing its monitoring strategy for large rivers by expanding the program to include the Pawcatuck River. Pursuant to a cooperative agreement with DEM, six stations are monitored monthly by the United States Geological Survey (USGS). The stations are located on the Branch, Blackstone, Pawtuxet, and Pawcatuck Rivers and provide data that are representative of river conditions influenced by large drainage areas. Monthly data are obtained for a range of water quality parameters including nutrients and pathogens. Samples are analyzed at quarterly intervals for metals. Data undergo federal quality assurance procedures and then are made available via the USGS information system – NWIS at

<http://tinyurl.com/RIEMC-WATER>

These data are critically important for evaluating long-term trends and tracking pollutant loadings into the Upper Bay from the rivers. They are also used in various state water programs. One station is monitored near the MA/RI state line on the Blackstone in order to help define pollutant contributions from the Massachusetts portion of that watershed. Three others are located near the mouths of the Blackstone, Pawtuxet and Pawcatuck Rivers in order to be representative of the pollutant loadings from these tributaries into coastal waters. To fully implement this program, as recommended in the RI Water Monitoring Strategy, a second station on the Pawtuxet River would need to be added along with ensuring regular monitoring of the Taunton River in Massachusetts.

The Narragansett Bay Commission (NBC) has well established bacteria and nutrients monitoring initiatives designed to evaluate water quality conditions and nutrient loadings of all the large river tributaries to the Upper Bay. In 2005 the NBC established a large river nutrients monitoring program to evaluate nutrient loadings from the major rivers flowing into Rhode Island waters from Massachusetts. This initiative was greatly expanded in 2006 to include many

smaller border rivers also. Monitoring is conducted bimonthly at the RI/MA border and samples are analyzed for the full suite of nitrogen parameters, orthophosphate, and total suspended solids. Total organic carbon is being added to this parameter list in 2009.

Rivers sampled at the state borders by the NBC include the Blackstone, Taunton, Ten Mile, Warren Reservoir/Kickemuit, Palmer, Runnins, Cole and Lee Rivers. In addition to the border nutrients monitoring initiative, the NBC also samples the Woonasquatucket, Moshassuck, and Pawtuxet Rivers every other week for these same parameters.

In 1997 the NBC established an urban rivers bacteria monitoring program as an element of the agency's Nine Minimum CSO Control Program. Samples are collected every week from twenty (20) sites located upstream and downstream of combined sewer overflow pipes to identify dry weather overflows and to establish baseline bacteria levels that will be used to gauge the success of the NBC CSO abatement projects. The twenty samples are collected from specific sites along the Moshassuck, Woonasquatucket, West, Blackstone, Seekonk, and Providence Rivers. A location on the mouth of the Pawtuxet River was added in 2005.

Rotating Assessments of Rivers & Streams provided by Sue Kiernan, RI DEM

The DEM Office of Water Resources continued implementation of the rotating basin monitoring strategy for wadeable rivers and streams that is aimed at reducing the large gap in available data on RI rivers and streams. The sampling design has now been applied statewide in all stream drainage areas of 5 square miles or larger. See map in Appendix C. Under this program, rivers and streams are sampled for physical, chemical and biological (macroinvertebrate) parameters. Data are used in various DEM water programs including identifying water quality problems,

Adapting Monitoring to Management Needs: Evaluating the Success of Combined Sewer Overflow Abatement

NBC ratepayers, with some assistance from RI taxpayers, have invested over \$387 million to implement Phase I of the NBC combined sewer overflow abatement strategy. Monitoring has been initiated by NBC and RIDEM in order to evaluate the effectiveness of the controls and its effect on the management of shellfish growing areas. In the fall of 2008, the NBC conducted a special study to determine fecal coliform levels in the Upper Bay prior to, during and following a rain event. This study was conducted prior to completion of Phase I of the NBC CSO Abatement Project so that baseline data would be available for comparison with future results obtained once the CSO abatement project is completed. Due to an extended period of rain, sampling was conducted daily during a 13-day time period from the end of September through the beginning of October. Fecal coliform samples were collected at 19 stations from Collier Point Park in the upper Providence River to a southerly point located in Conditional Shellfishing Area B off of Poppasquash Neck in Bristol. Samples were also collected in both Conditional Areas A and B, as well as at several stations north of the Conditional Areas in the Providence River, to determine bacteria levels observed in the shellfishing beds before and after this type of storm event.

Since the NBC's CSO Abatement Tunnel went on-line on October 31, 2008, the RIDEM and NBC have continued to coordinate monitoring activities in an effort to reopen shellfishing areas sooner when water quality allows. RIDEM reached an agreement with the US Food and Drug Administration on new monitoring procedures that will allow RIDEM to reopen shellfishing growing areas in the Upper Bay region (Conditional Areas A & B) more quickly provided water quality data reflects acceptable conditions. RIDEM developed the post-storm monitoring plan to expedite the benefits of the NBC CSO tunnel project. The plan relies on post-storm monitoring conducted by RIDEM, with some assistance from NBC, and CSO operational data from NBC. To date, the monitoring has provided a basis for opening several days earlier on several occasions. Once sufficient data is generated on the performance of CSO controls under varying rainfall conditions, RIDEM expects to refine the criteria used as triggers to close and reopen shellfish growing areas in the Upper Bay. The NBC and DEM will continue collaborating during 2009 to more fully evaluate water quality improvements resulting from the completion of the CSO tunnel and to identify other non-point sources of bacterial pollution impacting the Upper Bay and shellfishing areas.

permitting decisions, biocriteria development, and water quality restoration planning (TMDL development).

Despite working with significant resource limitations, over 200 stations were established and monitored during five rotational cycles (2004-2008). The fifth cycle will be completed in the Fall of 2009. This program successfully reduced the data gap with the percentage of rivers with no available data dropping from 62% in 2004 to 51% in 2008 (DEM, 2008). A larger reduction is anticipated for 2010 when more of the data will have been considered during the next DEM statewide assessment of water quality conditions. DEM is currently focused on developing reports to summarize and improve public access to the data generated by this monitoring program. DEM has established an effective working arrangement with the Department of Health (DOH) Laboratory to obtain sample analyses in a more timely manner. In addition, the program currently obtains services for taxonomic identification of macroinvertebrate samples from a contractor, the ESS Group. The program is supported by DEM with federal funds from the Environmental Protection Agency (EPA).

Rotating Assessments of Coastal Waters provided by Sue Kiernan, RIDEM

While other monitoring strategies are in place to provide water quality information on Narragansett Bay, such data are not considered representative of the conditions in coves and embayments. In addition, there are gaps in the collection of data in the coastal salt ponds. To address this, the RI Water Monitoring Strategy recommended a rotating schedule for assessing these areas. With no funding, this approach has yet to be implemented, however, during 2008 data from these waters has been produced by volunteer monitors in the coastal ponds and via certain projects such as TMDL work in lower Pawcatuck River. Additionally, the NBNERR has used a monitoring protocol known as DATAFLOW during 2008 to monitor the surface water in shallow embayments, including Greenwich Bay and Wickford Harbor. Building on work initiated in 2007, the approach involves the use of flow-through monitoring instrumentation fixed to a boat that simultaneously records GPS coordinates and water quality data. Four cruises were completed in 2008. Review of the data indicates that water quality conditions in coves can be expected to vary from the larger Narragansett Bay estuary. NBNERR reported the spatial patterns were probably related to the size, depth and geomorphology of the waterbody. Details are available in a report available on the NBNERR website:

<http://tinyurl.com/RIEMC-NBNERR>

Freshwater Fish Contamination provided by Sue Kiernan, RI DEM

One of the state's largest data gaps involves fish tissue contamination. RI has never established its own program to screen fish tissue, but instead, has relied on limited data generated by primarily by EPA researchers to identify waters that require fish consumption advisories for protection of public health. Preliminary sampling suggests mercury levels (originating from coal-fired power plants in the mid-west) are very high. In addition to certain marine fish, the Rhode Island Department of Health has advised women who are pregnant, nursing, or planning to have a baby in the next year not to eat freshwater fish from Rhode Island waters except for stocked trout. Other specific fish consumption advisories are posted at

<http://tinyurl.com/RIEMC-FISH>

To begin to address this gap, the DEM Division of Fish and Wildlife and Office of Water Resources continued to collaborate with EPA in 2008 to collect fish tissue samples during regularly scheduled surveys of fish communities. The surveys that utilize electroshocking are conducted to identify the number and species of freshwater fish living in a water body. During these surveys, a sample of fish are retained for fish tissue sampling. To date, this program has allowed fish tissue samples to be collected from multiple species of fish collected from ten lakes and portions of the Pawcatuck and Blackstone Rivers. DEM is expecting to receive tissue assay results from EPA later this year. Data will be shared with and reviewed by the HEALTH Office of Environmental Risk Assessment to determine if any further fish advisories are needed. Appendix D includes a map that reflects the areas sampled during 2007-2008 as well as waters previously sampled and assessed for fish tissue contamination. Continuation of this effort in 2009 will be contingent on the availability of DEM staff.

Invasive Species provided by Sue Kiernan, RI DEM; David Gregg, RINHS; Kevin Cute, CRMC; and Ken Raposa, NBNERR

Collaborative work by DEM, CRMC, RI Natural History Survey (RINHS), and URI Watershed Watch during 2008 contributed valuable new data on the aquatic invasive species (AIS) problem in Rhode Island, raised public awareness of AIS, and continued work to prepare and respond to the threat. Monitoring for AIS is one element of the state's first statewide plan for AIS, entitled "Rhode Island

Aquatic Invasive Species Management Plan (RIAIS Plan).” When the federal Aquatic Nuisance Species Task Force approved the RIAIS Plan in 2007, Rhode Island became eligible for a federal grant to fund activities that address AIS in the state's marine and freshwater ecosystems. During 2008, the first year of funding under the RIAIS Plan, field activities were focused primarily on freshwater AIS issues including an effort to eradicate the first reported population of water chestnut in the state. On the marine side, an AIS volunteer monitoring project was developed by the CRMC for implementation in 2009. To ensure the continuing availability of funding for AIS activities in Rhode Island, the CRMC also prepared the state's application for the 2009 federal grant in 2008.

During 2008, the Narragansett Bay National Estuary Research Reserve (NBNERR), located on Prudence Island, expanded its invasive crab monitoring program targeting the Asian shore crab, *Hemigrapsus*. Initiated in 2007, the program during the past year involved surveillance of four permanent sites on Prudence Island and in collaboration with URI personnel which monitor 11 sites around Narragansett Bay. The program examines cobble crab species composition, density, size, and sex-ratios.

RINHS, URI Watershed Watch, and DEM collaborated to host a training workshop on AIS, with a focus on freshwater plants. The goal was to encourage volunteer monitors to observe and identify AIS in lakes and ponds. Volunteers were able to bring plant specimens for species identification or confirmation by experts. About 40 persons participated in the workshop.

In response to the growing concern with AIS, the DEM Office of Water Resources integrated AIS screening into the field reconnaissance for the Rotating Basin Water Quality Monitoring Program and continued its summer surveys at public access points to screen for the presence of invasive plants. The data are compiled and made available via the agency website at:

<http://tinyurl.com/RIEMC-INVASIVE>

To date, DEM has found AIS at 74% of 59 sites surveyed. Combination of all available data from DEM monitoring, DEM herbicide applications, URI Watershed Watch, and RINHS reveals AIS are widespread in RI. RINHS also continues to capture invasive species observations made by the public in an *ad hoc* fashion using web-based tools it designed to channel rare species observations into its BORIIS database and to monitor and disseminate regional invasive species news using its listserv and website.

The detection of new aquatic invasive species has led to management responses. During the spring and summer of 2008, a collaborative effort was undertaken to

control water chestnut in Belleville Pond in North Kingstown. First documented in 2007, the RINHS, in collaboration with DEM, organized a volunteer-based hand-pulling of this plant from the western side of the pond. Using canoes and kayaks, 9 volunteers removed a total of 350 pounds of this AIS. Due to how well the plant has established itself in the pond, additional plant removal will be needed during 2009 as part of what is expected to be a multi-year strategy for eliminating water chestnut at this location. During 2008, water chestnut was also documented at a second location - a private pond in West Greenwich. The landowner is expected to begin implementing a control strategy during 2009.

In response to freshwater AIS concerns, DEM has posted advisory signs at about 80% of fishing access sites, including boat ramps, to communicate the threat of invasive species and encourage boat hygiene. DEM is also in the process of developing rules to strengthen the regulations of aquatic invasive plants to discourage their further spread through RI waters.

Unassessed Lakes and Ponds provided by Linda Green, URI Watershed Watch

Rhode Island has 305 named lakes and ponds covering about 15% of the state, the highest percentage in New England. In 2008 URI Watershed Watch (URI-WW) volunteers monitored 67 of RI's lakes and ponds, about one-third of which were sponsored by RI DEM with a grant. These data are the foundation of RI's freshwater monitoring program for lakes and serves environmental managers, watershed organizations, researchers, and policy makers. By utilizing URI -WW lake data and some other sources, the DEM Office of Water Resources was able to report on water quality conditions in 78% of the total lake acreage in the state. Plans to expand the URI-WW Program to monitor lakes which lack volunteer participation have not been funded as yet. Without continued funding, URI Watershed Watch cannot maintain its level of activity and will be forced to reduce the number of monitoring sites, leaving the State with less data available from which to make the informed decisions necessary to protect and improve water quality.

Upper Bay Dissolved Oxygen (DO) Surveys provided by Christopher Deacutis, Narragansett Bay Estuary Program and Thomas Uva, Narragansett Bay Commission

To more fully understand the extent of hypoxia in Upper Narragansett Bay, the Narragansett Bay Estuary Program (NBEP) and Brown University continued full DO surveys using new Sea-Bird SBE 19 Plus SEACAT profilers purchased with

support from the NOAA Bay Window Project. The surveys targeted about 75 stations covering the Providence-Seekonk Rivers, Greenwich Bay, and the East and West Passages of Narragansett Bay. At each station, depth profiles of temperature, salinity, and dissolved oxygen were measured. This monitoring program provides an extensive spatial dataset that compliments the time-series dataset generated by the fixed-site network described above. A total of seven surveys were completed during June and September. Data and maps depicting the survey results are available at:

<http://tinyurl.com/RIEMC-DO>

Summer 2008 oxygen levels were poor compared with 2007. Recent analysis of data indicates that June freshwater river flows appear to affect the upper Bay significantly, with high June flows associated with poor oxygen conditions in July and August of that year (Codiga, et al. In Press).

The information was also reviewed by the RIDEM for their 2008 Integrated Assessment report (formerly 305b Report) and 303d compilation of marine waters not meeting CWA goals and state WQ standards for dissolved oxygen levels. The Narragansett Bay Estuary Program has also used these data in the recent Status and Trends Report which is in the process of being finalized. The data from this project continues to provide critical information on the interannual variability in extent and severity of hypoxia in Narragansett Bay. Results are being used by researchers developing models of hypoxia generation in Narragansett Bay under a separate NOAA CHRP grant award.

The Narragansett Bay Commission (NBC) routinely monitors and tracks dissolved oxygen conditions in the Upper Bay region. Five sites in Upper Narragansett Bay are regularly monitored by the NBC for dissolved oxygen using a SeaBird Profiler. Sampling sites are located at Bullock's Reach, Conimicut Point, Edgewood Yacht Club, Pomham Rocks, and India Point. Sampling begins in May and continues usually into November, and is completed twice per month as long as the weather is agreeable for such sampling. In addition to dissolved oxygen concentration and percent saturation, the SeaBird profiler records temperature, salinity, density, depth, and photosynthetic active radiation (PAR). The NBC has been tracking these parameters since this monitoring initiative began in 2006.

The NBC performs dissolved oxygen monitoring on a monthly or bimonthly basis at a site just upstream of the Providence Hurricane Barrier near the Point Street Bridge. Regular sampling at this station began in September of 2007 to investigate the effect the hurricane barrier has on water quality in this low-flushing area. Profiles are taken using a YSI 600 XL sonde which records

temperature, salinity, specific conductivity, depth, and pH, in addition to dissolved oxygen concentration and percent saturation.

Freshwater Beach Water Quality Monitoring provided by Amie Parris, RI DOH

The Rhode Island Department of Health Beach Monitoring Program licenses and oversees monitoring at 50 freshwater beaches and 68 saltwater beaches throughout the state. Using a federal grant provided by the Environmental Protection Agency (EPA), the HEALTH Beach Program has developed and applied a risk-based monitoring schedule for saltwater beaches that is applied from May through September. This schedule results in more frequent monitoring at beaches with higher risks of pollution. Recent partnerships with volunteer-based organizations have begun to provide data from saltwater beaches in the off-season as well. As the federal grant is restricted to monitoring at saltwater beaches from May through September, the risk-based approach has not yet been applied to freshwater beach monitoring. Due to the lack of funding, most freshwater beaches are only monitored once a month by the operating facility (e.g., beach manager). Operating facility sampling is minimal due to the expense of laboratory analysis and the short beach season. The HEALTH Beach Program is also unable to conduct surveys of the beach areas or work with beach owners to address possible sources of contamination due to constraints in funding. The current limited monitoring of these beaches leaves beach goers at risk of illness due to water contamination.

There is substantial evidence to support the importance of monitoring freshwater beaches. Fifty out of 118 licensed beaches in Rhode Island are freshwater. Though there is limited sampling of freshwater beaches, they accounted for 24% of closure days in 2008. This is an increase from 23% in 2007. The stagnant nature of many freshwater sites leads to more irregular and problematic bacterial contamination. Additionally, many freshwater beaches serve as campgrounds to thousands of children who are extremely susceptible to swallowing water and therefore becoming ill due to harmful bacteria or other pathogens. Infection may also occur through cuts and scrapes.

The Beach Program tests for *Enterococci* bacteria that come from the intestines of all warm-blooded animals. When sewage is present in the water, *Enterococci* will also be present. In addition to *Enterococci*, many other water-borne pathogens may also be present in untreated sewage. These pathogens can cause a wide range of health problems including ear, nose, and throat infections, gastroenteritis, hepatitis, and respiratory illness. Because there are so many

potential pathogens and testing for all of them is not feasible, *Enterococci* are used as an indicator of the potential presence of these pathogens.

If freshwater beach monitoring is not conducted, there is the potential for large numbers of children, campers, and others to become ill. Illness associated with water contamination may be very serious and should not be taken lightly. Insufficient monitoring not only jeopardizes public health, it also threatens Rhode Island's multi-billion dollar tourism industry.

Database Capacity

provided by Chuck LaBash, URI EDC and Sue Kiernan, RI DEM

While funding has not been made available to assess data management and dissemination capacity among RI's environmental agencies, through specific projects, some progress has been made in improving data management systems. The RIEMC convened a meeting of LiDAR (**L**ight **D**etection and **R**anging) data users in 2009 to evaluate where data are available and their technical specifications. LiDAR measurements are used to accurately measure the elevation of the land. Our existing statewide elevation data are very crude (\pm 2-3 m) and do not support accurate mapping required to evaluate areas at risk from flooding due to storms and sea level rise. The EMC-sponsored LiDAR data workshop produced a complete synopsis of what is available and what is needed for statewide applications (available at <http://tinyurl.com/RIEMC-LIDAR>)

In 2008 DEM completed a project to build a new database known as the State Water Information Management System (SWIMS) that will for the first time provide multiple water -related programs within DEM access to a central repository of water quality data. The new database system represents a major enhancement over current database capabilities. SWIMS has been designed to be linked to the HEALTH laboratory and designed to exchange data via the web with the national EPA data warehouse Storet/WQX. The next step for DEM will be migration of existing data into the new data system. To facilitate this and future data transfers, DEM expects to work with its monitoring partners and contractors to institute improved electronic submittal of data. The database has been designed to allow eventual public access via the internet following some further enhancements.

SWIMS will house primarily water chemistry data and is not intended to serve all data management needs related to environmental monitoring. There remains a need to assess data management capacity and needs among the state environmental agencies in order to identify the most appropriate systematic approach to making critical inventory and monitoring data available to resource

managers and scientists. Until further improvements are made, the result is that key data will not be readily available to support decision-making and resource allocation associated with the health of RI's environment.

Emergency Response Data Review provided by Peter August, URI Coastal Institute

Funding has not been made available for this activity and no progress has been made. There have been, however, development of several new geospatial datasets that would be important for emergency response planning and/or damage assessment. These include high resolution, large scale digital imagery obtained in Spring 2008 by the RI E-911 program and available through the RIGIS system and the RI Digital Atlas (<http://tinyurl.com/RIEMC-RIATLAS>).

Many of the essential data that would be critical in emergency response and damage assessment are scattered among various state and federal agencies. In terms of information management, we are poorly prepared to respond to environmental emergencies. A new RIGIS Executive Director, Mr. Shane White, has been recently hired and this bodes well for making improvements in data issues associated with emergency response.

Monitoring Grants Program provided by Peter August, URI Coastal Institute

Funding has not been made available for this activity and no progress has been made.

FY 2009 Budget Shortfalls for Priority Monitoring

By the end of the two-year period FY2007-FY2008, the State will have invested through the BRW Coordination Team an additional \$386,000 to strategically improve environmental monitoring. The expenditures, to date consisting of contractual and equipment expenses, include the following: \$158,900 for large river water quality, \$99,550 for additional streamflow gages, \$61,050 for the fixed-site network in Narragansett Bay, and \$66,500 for the rotating assessment of rivers and streams. Funding will be required annually for these programs which are all designed to collect data on a long-term basis.

The RIEMC has estimated a shortfall of \$1,141,249 in annual funding that remains outstanding for all recommended priority monitoring programs to be

fully implemented. Unless otherwise noted, the shortfalls are estimates of annual program costs.

Stream-flow Gage Network, \$26,899

Bay-wide Water Quality (Fixed-Sites), No shortfall anticipated for FY2010

Large River Water Quality, No shortfall anticipated for FY2010

Rotating Assessment of Rivers and Streams, \$240,000 (full implementation)

Rotating Assessment of Coastal Waters, \$250,000

Freshwater Fish Contamination, \$105,000

Invasive Species, \$150,000

Unassessed Lakes and Ponds, \$80,000

Upper Bay DO Surveys, No shortfall anticipated for FY2010

Freshwater Beach Water Quality, \$100,000

Database Capacity, \$53,000

Emergency Response Data Review, \$11,350

Monitoring Grants Program, \$125,000

References

Codiga, D. L. , Stoffel, H.E., Deacutis. C.F., Kiernan, S. and Oviatt, C.A. In Press. Narragansett Bay Hypoxic Event Characteristics Based on Fixed-Site Monitoring Network Time Series: Inter-Annual Variability, Geographic Distribution, Intermittency and Spatial Synchronicity. *Estuaries and Coasts*

RIDEM, 2008. 2008 Integrated Water Quality Monitoring and Assessment Report, Office of Water Resources, Rhode Island Department of Environmental Management, 92 pp.

RIDEM, 2009. Narragansett Bay Fixed-Site Monitoring Network: Final Report on Activities during 2005-2008, Office of Water Resources, Rhode Island Department of Environmental Management. 25 pp and appendices.

Appendix A.

Rhode Island Stream Gage Network – January 2009

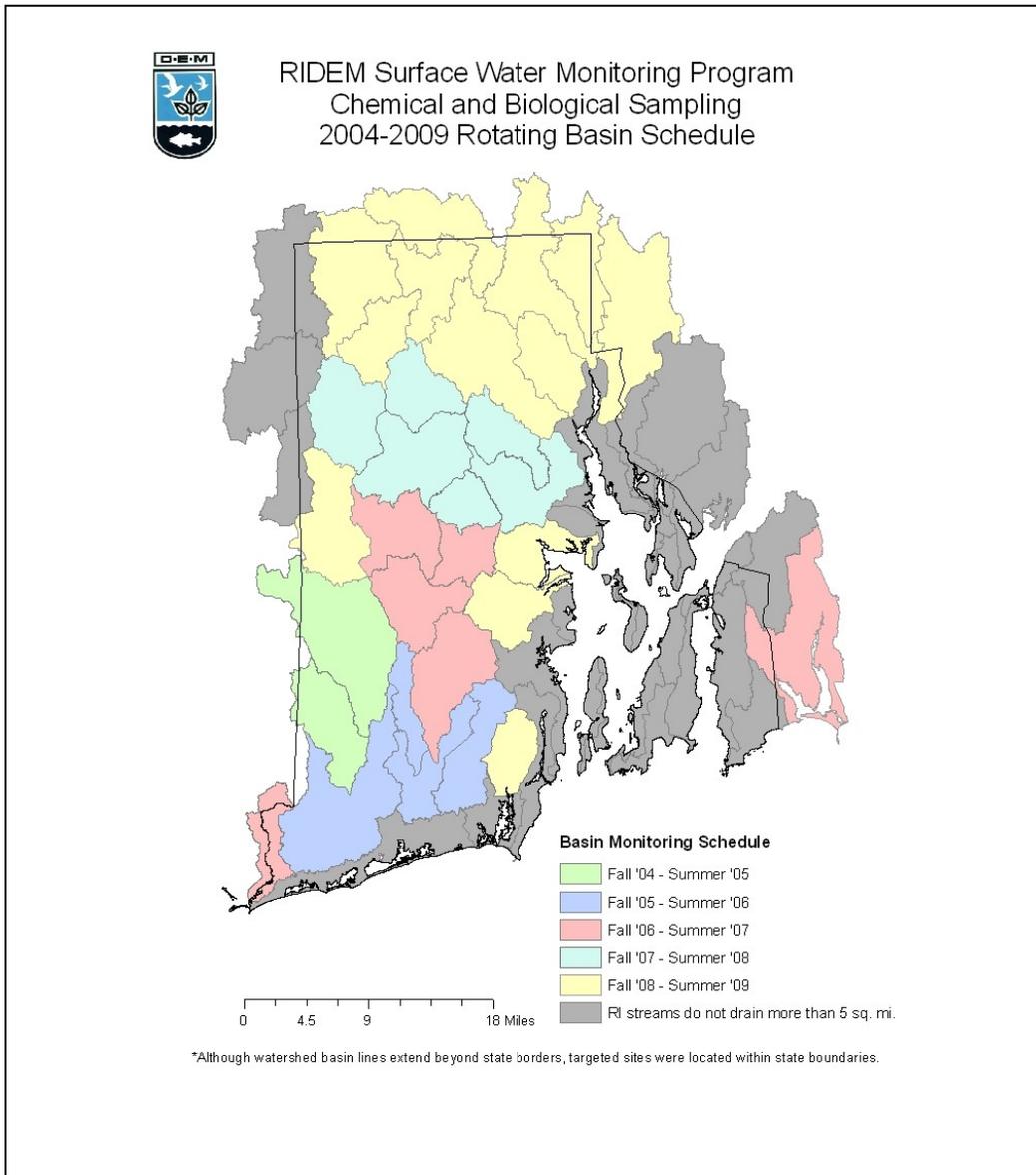
Number	Watershed Location 12-digit HUC Name	Gage #	Potential Site Location	Existing Funding Source
1	Beaver River	01117468	Beaver River	WRB
2	Branch River	01111500	At Forestdale	RIDEM
3	Blackstone River-West River to Peters	01112500	Blackstone @ Woonsocket	Ocean State Power
4	Chipuxet River	01117350	Chipuxet River	WRB
5	Clear River	01111300	Nipmuc River	RIDEM
6	Hunt River	01117000	Hunt River	WRB
7	Millers River	01113695	Catamint Brook	RIDEM
8	Moshassuck	01114000	Moshassuck River	RIDEM
9	Pawcatuck Mainstem	01117500	Wood River Junction	USGS
10	Pawcatuck (Lower)	01118500	Westerly	WRB
11	Pawtuxet River Mainstem	01116500	Pawtuxet at Cranston	WRB
12	Pawtuxet River (South Branch)	01116000	South Branch-Pawtuxet	WRB
13	Ponagansett and Barden Reservoirs	01115187	Ponaganset River	RIDEM
14	Queen River	01117370	Liberty Lane	RIDEM
15	Regulating and Moswansicut Reservoir	01115098	Peepetoad Brook	Providence Water Supply Board (PWSB)
16	Ten Mile River	01109403	Ten Mile River	RIDEM
17	Usquepaug River	01117420	Usquepaug	WRB
18	Wood River (Upper)	01117800	Arcadia	WRB
19	Wood River (Lower)	01118000	Hope Valley	WRB
20	Woonasquatucket	01114500	Woonasquatucket River	RIDEM
21	Blackstone River	01113895	Blackstone @ Roosevelt	RIDEM
22	Pawcatuck (Upper)	01117430	Pawcatuck @ Kenyon	RIDEM
23	Big River	01115833	Big River - Harkney Hill	WRB
24	Nooseneck River	01115630	Nooseneck @ Rt. 3	WRB
25	Hunt River (Upper)	01116905	Hunt River	RIDEM
26	Big River	01115770	Carr River	WRB
27	Big River	01115670	Congdon River	WRB
28	Big River	01115800	Big River near Nooseneck	WRB
29	Barden Reservoir	01115265	Hemlock Brook	PWSB
30	Scituate Reservoir	01115276	Westconnaug Brook	PWSB
31	Scituate Reservoir	01115280	Cork Brook	PWSB
32	Pawtuxet River	01115110	Huntinghouse Brook	PWSB

Appendix B. Additional Estuarine Waters in the Mid- and Upper Bay Designated by DEM as Impaired for Hypoxia Mid- and Upper Bay Designated by DEM as Impaired for Hypoxia

(Area of interest are waters in which hypoxia has been documented occasionally and in which continued data collection is needed to further define if an impairment exists.)



Appendix C.
Implementation of the Rotating Basin Approach - DEM



Appendix D.
Fish Tissue Contamination in Rhode Island

