Rhode Island Environmental Monitoring Collaborative

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

Priority Monitoring Initiatives

March 2008

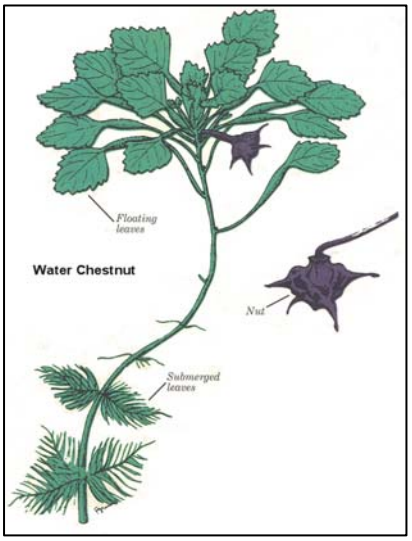

Photo credits: RI Department of Environmental Management, US Fish and Wildlife Service, and the ESS Group.

Preface

Following its formation in 2004, the Rhode Island Environmental Monitoring Collaborative (RIEMC) undertook a review and prioritization of 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 and state leaders. Beginning in FY2007, new funding was made available to the Coordination Team to support a selected number of the priority monitoring programs. This report summarizes the status of the priority monitoring initiative recommended by the RIEMC and indicates 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 by public agencies in RI, their partners or contractors. Rather, this report captures the actions undertaken recently to enhance, strengthen or expand critical monitoring programs previously identified by the RIEMC to be the 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 non-governmental organizations 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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Co-Chairs, RI Environmental Monitoring Collaborative

March 19, 2008

Synopses of Work Accomplished in 2007
Priority RIEMC Monitoring Activities

Streamflow Gage Network, provided by Sue Kiernan, RI DEM

The network of continuous streamflow gages was expanded based upon a report which prioritized needed stream gages (DEM/WRB/USGS, April 2004) and updated input from the RI Environmental Monitoring Collaborative. With Coordination Team funds, three permanent gage stations were installed by United States Geological Survey (USGS) under contract to the Department of Environmental Management (DEM): Blackstone River at Pawtucket, Hunt River at Davisville, and the Pawcatuck River at Kenyon. Several other stations were upgraded to real-time capability. In addition, the Water Resources Board ensured continuation of the gage on the Pawtuxet River and installed five additional gages on streams related to the Big River water supply development project. The total network now operates with 28 stations. The data are made available by USGS via the internet at http://waterdata.usgs.gov/ri/nwis/current/?type=flow. Data from the gages are used by multiple agencies for a number of programs including drought management, water quality restoration, permitting, etc. See Appendix A for a list of the network gages.

Bay-wide Water Quality Using the Fixed-Site Network, provided by Sue Kiernan, RI DEM

The multi-agency coordinated network of fixed monitoring sites in Narragansett Bay was expanded by two stations in 2005 (Mt. Hope Bay and Quonset) bringing the total to 13 locations: 7 buoys and 6 land-based sites. Eight 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. The remaining sites are maintained and funded by the Narragansett Bay Commission (NBC), the Narragansett Bay National Estuarine Research Reserve (NBNERR), and Roger Williams University. The network is standardized on YSI equipment that uses sensors to measure water quality every 15 minutes, 24 hours per day either seasonally or year-round. Using Coordination Team funds and NOAA Bay Window funds, equipment was upgraded in 2007 to improve network reliability.

Data were reviewed weekly as part of DEM's tracking of Bay conditions during May-October. Datasets were processed and posted to the DEM

website (2003-2006) with summaries also posted to the www.narrbay.org web site. In 2007, multiple years of data were used by DEM, with assistance from URI-GSO researchers, to assess compliance with new criteria for dissolved oxygen in estuarine waters and establish a baseline from which to measure improvements. This resulted in DEM categorizing an additional 7.62 square miles of Narragansett Bay as impaired due to low dissolved oxygen (Appendix B). The analysis indicated that low dissolved oxygen events have been observed between June and October in the Mid to Upper Bay, Providence and Seekonk Rivers, and Greenwich Bay. The years with the higher frequencies of events tend to have high late spring river inflows and/or warmer temperatures. Greenwich Bay was found to have the highest frequency of low oxygen events. Various researchers are using the fixed-site monitoring information in combination with other data in a continuing effort to improve the understanding of the extent and nature of hypoxia in Narragansett Bay. DEM is currently planning to add a new station in Greenwich Bay. New federal funds associated with the NOAA Bay Window Program are expected to continue to support the fixed-site network at its current level of effort during FY2009. Additional funds would be needed to add stations to portions of the Bay not yet covered in the network, for example, the Lower Bay and Sakonnet River.

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

With Coordination Team funds, DEM re-established water quality monitoring on two of the State's largest rivers by contracting with the U.S. Geological Survey. Beginning in February 2007, five stations have been sampled monthly on the Blackstone and its tributary the Branch River, and the Pawtuxet River for a range of water quality parameters including nutrients and pathogens. Samples are analyzed for metals quarterly. Data undergoes federal quality assurance procedures and are made available via the USGS information system – NWIS. These data are 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. Two others are located near the mouths of the Blackstone and Pawtuxet 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, additional stations on the Pawtuxet and Pawcatuck River need to be included.

The Narragansett Bay Commission (NBC) also began monitoring the large river tributaries to the Upper Bay and all the major MA/RI border rivers for nutrients and other parameters in 2006. Monitoring is monthly or bimonthly depending upon location and parameter. In addition, NBC continued its established programs to monitor the condition of its receiving waters, including the urban rivers weekly and Upper Bay for nutrients and bacteria biweekly. These data will help define the progress that is being made as a result of major investments planned or underway in wastewater treatment plant upgrades and combined sewer overflow (CSO) abatement actions.

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

In 2004, the DEM Office of Water Resources revised its sampling design for wadeable rivers and streams and adopted a rotating basin approach in order to reduce the large gap in available data on RI rivers and streams. Working within available resources, the design has been applied each year to different watersheds. Rivers and streams are sampled for physical, chemical and biological (macroinvertebrate) parameters. Data are used in various DEM water programs including assessment decisions and development of water quality restoration plans, also known as TMDLs. This program has begun to successfully reduce the data gap with the percentage of rivers with no available data dropping from 62% in 2004 to 51% in 2008. Monitoring has proceeded as follows: 2004-2005 – Wood River watershed; 2005-2006 – Pawcatuck River watershed (partial); 2006-2007 – Pawcatuck River watershed (remaining portions Queen), Big River, Flat River and south branch of the Pawtuxet River; 2007-2008 – remainder of the Pawtuxet River watershed (Appendix C). DEM is in the process of finishing a report for the Wood River Watershed and will be developing reports for the Pawcatuck River (2nd cycle) and Big River (3rd cycle) once all data are received from the contractor. Sampling initiated in Fall 2007 in the remainder of the Pawtuxet River watershed will continue through the summer of 2008. DEM is currently working with the DOH Laboratory to obtain sample analyses and ESS Group to obtain services for taxonomic identification of macroinvertebrate samples. Funding from the Coordination Team supported expansion of this effort in 2007.

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 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, a pilot project was conducted in 2007 that may have applicability to further development of a monitoring strategy for shallow coastal waters. In recognition of the spatial limitations of other monitoring programs, the NBNERR conducted a pilot project to test the feasibility of using a certain technology to monitor the surface water in a shallow embayment, in this case, Greenwich Bay. The approach, known as DATAFLOW, involves towing instruments and simultaneously recording GPS coordinates and water quality data. Five cruises were completed in 2007 and a preliminary analysis of the resulting data confirmed that water quality conditions in coves may vary from the larger estuary in both time and space.

Freshwater Fish Contamination, provided by Sue Kiernan, RI DEM

One of the state's largest data gaps involves fish tissue contamination. The state has never established its own program to screen fish tissue and 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. Sampling suggests mercury levels are elevated throughout the New England region, primarily due to the atmospheric deposition of mercury - a majority of which originates outside the northeast. 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://www.health.ri.gov/environment/risk/fish.php

To begin to address this gap, the DEM Division of Fish and Wildlife and Office of Water Resources collaborated with EPA in 2007 to collect fish tissue samples during regularly scheduled surveys of fish communities. The surveys are conducted to identify the number and species of freshwater fish living in a water body. During these surveys, a sub-sample of fish was retained for fish tissue sampling. The project allowed fish tissue samples to be collected from multiple species of fish in five lakes (Upper Slatersville, Keech, Tiogue, Wilson, Echo) and a portion of the Pawcatuck River. Samples have been processed and are awaiting analysis for mercury contamination by EPA. Data will be shared with and reviewed by the HEALTH Office of Environmental Risk Assessment to determine if any further fish advisories are needed. This pilot project is planned for continuation in 2008.

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

By forming partnerships and conducting cooperative projects, the DEM, CRMC, RI Natural History Survey, and URI Watershed Watch accomplished a number of projects in 2007 which provided valuable new data on the aquatic invasive species (AIS) problem, raised public awareness of AIS, and took small but significant steps to better prepare RI for the threat. The first Rhode Island Aquatic Invasive Species Management Plan (RIAIS Plan) was completed and approved by the federal Aquatic Nuisance Species (ANS) Task Force, thereby positioning Rhode Island to apply for federal funds for implementation of the plan. The origin of the RIAIS Plan is with the Northeast Aquatic Nuisance Species Panel (NEANS Panel), a regional panel of the ANS Task Force. The NEANS panel, currently co-chaired by CRMC, coordinates AIS activities in the New England States, the State of New York, and the Canadian Provinces of New Brunswick, Nova Scotia, and Quebec. The NEANS panel is seeking to further strengthen state and provincial coordination through a proclamation and partnership with the New England Governor's and Eastern Canadian Premiers Conference, which has recognized invasive species as a significant regional problem. At the state level, the RIAIS Plan proposed by CRMC was developed through a collaborative effort involving DEM, RINHS, URI, and other stakeholders. A Rhode Island Aquatic Invasive Species Working Group, co-chaired by CRMC and DEM, will coordinate implementation of the plan. Looking ahead, the pending award of new federal funds to CRMC are expected to be targeted to the following activities: (1) coordination of AIS activities in RI with neighboring states, regional and federal and international agencies and organizations; (2) development of an early-detection and rapid response strategy; (3) implementation of measures to prevent and minimize the risk of AIS introductions from recreational fishing and boating; and (4) other enhancements to activities carried out by non-governmental entities that support implementation of the RI AIS Plan. In partnership with several New England states, CRMC has purchased waterproof field kits for use by volunteers involved in marine AIS monitoring efforts.

RINHS hosted a statewide conference highlighting recent research findings on invasive species attended by 198 people and CRMC hosted a two-day meeting of the Northeast Aquatic Nuisance Species Panel attended by 46. To advance invasives monitoring in marine waters, CRMC, the Narragansett Bay Estuary Program, DEM and RINHS put out a public alert for Chinese Mitten Crab (*Eriocheir sinensis*) which was recently discovered in several East Coast

estuaries. The alert was coordinated with the Marine Invasives Research Lab of the Smithsonian Environmental Research Center and the MIT Sea Grant program to ensure broad coverage in the northeast. Locally, the Narragansett Bay Estuary Program, RI Sea Grant, and CRMC produced a television segment on marine invasives that was aired by WJAR during the summer of 2007. The CRMC also produced and distributed posters that included taxonomic information on the Chinese Mitten Crab and local contact information in the event a specimen was found. In addition, the Narragansett Bay National Estuary Research Reserve, located on Prudence Island, initiated an invasive crab monitoring program targeting the Asian shore crab, H*emigrapsus.* Preliminary work involving four sites on Prudence Island was used to refine field protocols that will establish a permanent invasive crab monitoring program. Working with URI, NBNERR has plans for a full-scale Bay survey this coming summer (2008).

To advance invasives monitoring in freshwater ecosystems, the RINHS and URI Watershed Watch hosted four training sessions and workshops attended by a total of 54 environmental monitoring volunteers. Watershed Watch volunteers subsequently provided data on AIS in 13 water bodies. The DEM Office of Water Resources integrated AIS screening into the field reconnaissance for the Rotating Basin Water Quality Monitoring Program and conducted other surveys at public access points to screen for the presence of invasive plants. DEM found AIS at 79% of 43 sites surveyed. A combination of all available data from DEM monitoring, DEM herbicide applications, URI Watershed Watch, and RINHS reveals AIS are widespread in RI, being known from 82 locations across the state. RINHS 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.

In response to freshwater AIS concerns, DEM has produced new signs that will be posted at boat ramps and other access points to communicate the threat of invasive species and encourage boat hygiene. Additionally, in late 2007, DEM met with lake property owners in northern RI to provide guidance on managing excessive plant growth. RINHS responded to the identification of invasive water chestnut in Belleville Pond, North Kingstown, by convening a community meeting to plan a 2008 eradication campaign. This proposed campaign is currently unfunded.

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 2007 URI Watershed Watch (URI-WW) volunteers monitored 72 of RI's lakes and ponds, one-third of which were sponsored by a grant from RI DEM. This monitoring found that many lakes had no oxygen in their bottom waters during the summer. Many water bodies had high levels of nutrients, leading to severe algae blooms and weed-choked shallows. The lowest lake levels in years were noted by volunteers due to the late-season drought. 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 to date been funded. 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 reinstituted full DO surveys using new Sea-Bird SBE 19 Plus SEACAT profilers purchased with support from the NOAA Bay Window Project. In 2005, the NBEP working with Brown University & DEM conducted 4 surveys of the upper Bay. In 2006, the program expanded to include three boats (Brown , NBEP/DEM, and Save The Bay/USDA) to sample about 75 stations covering the Providence River, 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.

In the summer of 2007, dissolved oxygen (DO) was measured during five on-the-water surveys. Four neap tide surveys were completed on 6/7/07, 6/26/07, 7/24/07, 8/14/07 as well as one spring tide survey on 8/24/07. Hypoxia was minimal in the summer 2007 during all surveys. This past

summer appears to have been a "good water quality" year, and will provide useful contrasting physical and biological conditions against those of last summer (2006), when extensive and severe hypoxia occurred in July and August.

The results of the fixed-site monitoring of the Bay during 2007 were drastically different from the previous summer (2006). Dissolved oxygen monitoring results for summer 2007 from both surveys and fixed sites show only very mild hypoxia this year except in the Seekonk River and the lower Providence River (just below the Wastewater Treatment facilities). Greenwich Bay exhibited the most severe hypoxic impacts.

The radical difference in oxygen levels between the two years for early July and August surveys highlights the critical need for multiple years of monitoring data to differentiate local weather-driven differences from responses to management efforts. The change in nutrient loads from wastewater facilities between the two summers is negligible, and we suspect that the contrast in DO levels between the last two years is due to the difference in precipitation, especially in early summer (June), and its effect on stratification. This period seems to be particularly important in "setting up" the Bay for late summer conditions: low precipitation yields reasonably good oxygen levels in the upper Bay and passages while heavy precipitation in June is associated with low oxygen (hypoxic) levels. Surveys are expected to continue in 2008, but due to minimal funding would be vulnerable to disruption in the event of equipment failure.

The Narragansett Bay Commission (NBC) is also tracking dissolved oxygen conditions in the Upper Bay region. Five sites in the Upper Narragansett Bay/Providence River are regularly monitored for dissolved oxygen using a SeaBird Profiler. Sampling sites are Bullock's Reach, Conimicut Point, Edgewood Yacht Club, Pomham Rocks, and India Point. Sampling begins in May and continues for as long as weather permits, usually into November, and is completed twice per month weather permitting. In addition to dissolved oxygen concentration and percent saturation, the SeaBird profiler records temperature, salinity, density, depth, and photosynthetic active radiation (PAR).

Dissolved oxygen data are also obtained near the Point Street Bridge, either on a monthly or bimonthly basis. Regular sampling at this station began in September of 2007, continued into December, and is continuing as weather permits. 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 Bonnie Blair, RI DOH

The Rhode Island Department of Health Beach Monitoring Program licenses and oversees monitoring at 49 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 to 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. Forty-nine out of 117 licensed beaches in Rhode Island are freshwater. Though there is limited sampling of freshwater beaches, they accounted for 23% of closure days in 2007. The stagnant nature of many freshwater sites leads to more irregular and problematic bacterial contamination. With a longer flushing rate, contamination is also magnified. Additionally, many freshwater beaches serve as campgrounds to thousands of children who are extremely susceptible to swallowing water and possibly 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* is 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 obtained 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 biodiversity data producers and consumers on December 2007 to discuss details relating to the release of and access to datasets important to the natural resource management community. Newly developed data include updated statewide land use data interpreted from 2003-2004 orthophotography, LiDAR elevation data and 15cm digital aerial imagery for select areas in RI, and a 2006 baywide eelgrass inventory and associated digital orthophotography. The group discussed new technologies that are making it easier to share and access biodiversity data within the state.

DEM is completing a project to build a new water quality database known as the State Water Information Management System (SWIMS) that will for the first time provide multiple water–related programs within DEM with access to a central respository of water quality data. The new enterprise system represents a major enhancement over current database capabilities. SWIMS will be linked to the HEALTH laboratory and designed to exchange data via the web with the national EPA data warehouse, now known as Storet/WQX. In the coming year, DEM expects to work with its monitoring partners and contractors to institute 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 challenges 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 are not always 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 obtained 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 a detailed eelgrass inventory of Narragansett Bay and Block Island, updated land cover data, LIDAR-derived elevations for some regions along the south shore and state management areas, and detailed orthophotography for Narragansett Bay and various areas in the state. The LIDAR elevation data require significant analysis and processing before they can be used for applications such as inundation modeling and coastal flooding risk assessment.

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. This situation is exacerbated by turnover in senior personnel at RIEMA.

Monitoring Grants Program, provided by Peter August, URI Coastal Institute

Funding has not been obtained 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 Coordination Team an additional $386,000 to strategically improve environmental monitoring. The expenditures, to date, consist of contractual and equipment expenses and 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 the shortfalls in funding that remain for all the recommended priority monitoring programs. Unless otherwise noted, the shortfalls are estimates of annual program costs.

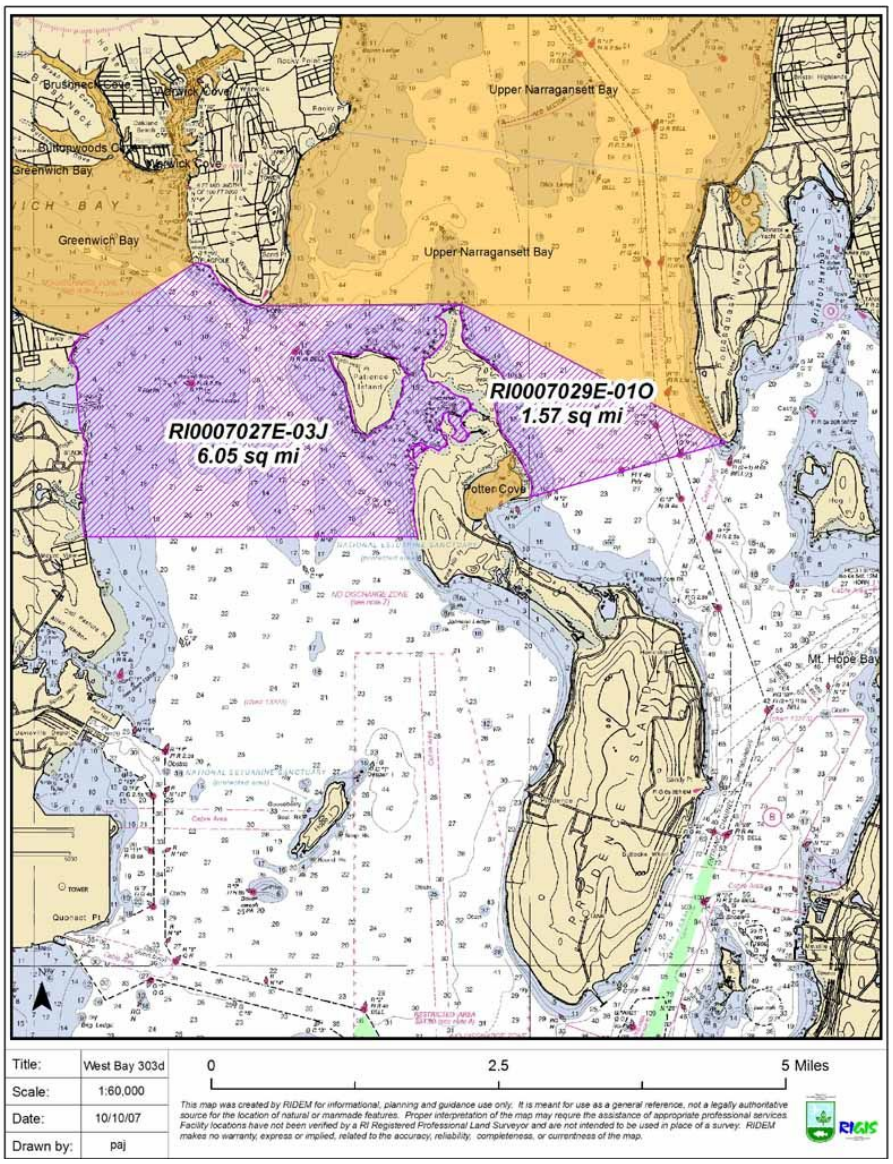
Stream-flow Gage Network: $4,650 over FY2008 costs
Bay-wide Water Quality (Fixed-Sites): No shortfall anticipated
Large River Water Quality: $43,000 over FY2008 costs
Rotating Assessment of Rivers and Streams: $240,000 (full implementation)
Rotating Assessment of Coastal Waters: $250,000
Freshwater Fish Contamination: $105,000
Invasive Species: $150,000
Unassessed Lakes and Ponds: $80,000
Upper Bay DO Surveys: $42,500
Freshwater Beach Water Quality: $100,000
Database Capacity: $53,000
Emergency Response Data Review: $11,350
Monitoring Grants Program: $125,000

Appendix A. Rhode Island Stream Gage Network – January 2008

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	02227000	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	Peeptoad Brook	Providence Water Supply Board
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	01115800	Big River at Rt. 3	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

* Streamflow gages added with Coordination Team funds

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



Appendix C. Implementation of RI DEM's Rotating Basin Approach.