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Historical Review of Water Quality Management & Pollution

Abatement in Narragansett Bay 114 pp

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Narragansett Bay Estuary Program

**Historical Review of Water  
Quality Management and  
Pollution Abatement in  
Narragansett Bay**

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**NBP-90-45**

## FOREWORD

The United States Congress created the National Estuary Program in 1984, citing its concern for the "health and ecological integrity" of the nation's estuaries and estuarine resources. Narragansett Bay was selected for inclusion in the National Estuary Program in 1984 and designated an "estuary of national significance" in 1988. The Narragansett Bay Project (NBP) was established in 1985. Under the joint sponsorship of the U.S. Environmental Protection Agency and the Rhode Island Department of Environmental Management, the NBP's mandate is to direct a five-year program of research and planning focussed on managing Narragansett Bay and its resources for future generations. The NBP will develop a comprehensive management plan by December, 1990, which will recommend actions to improve and protect the Bay and its natural resources.

The NBP has established the following seven priority issues for Narragansett Bay:

- \* management of fisheries
- \* nutrients and potential for eutrophication
- \* impacts of toxic contaminants
- \* health and abundance of living resources
- \* health risk to consumers of contaminated seafood
- \* land-based impacts on water quality
- \* recreational uses

The NBP is taking an ecosystem approach to address these problems and has funded research that will help to improve our understanding of various aspects of these priority problems. The Project is also working to expand and coordinate existing programs among state agencies, governmental institutions, and academic researchers in order to apply research findings to the practical needs of managing the Bay and improving the environmental quality of its watershed.

This report represents the technical results of an investigation performed for the Narragansett Bay Project. The information in this document has been funded wholly or in part by the Rhode Island Department of Environmental Management under account #8710-17100. It has been subject to the Agency's and the Narragansett Bay Project's peer and administrative review and has been accepted for publication by the Management Committee of the Narragansett Bay Project. The results and conclusions contained herein are those of the author(s), and do not necessarily represent the views or recommendations of the NBP. Final recommendations for management actions will be based upon the results of this and other investigations.

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# **HISTORICAL REVIEW OF WATER QUALITY MANAGEMENT AND POLLUTION ABATEMENT IN NARRAGANSETT BAY**

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# HISTORICAL REVIEW OF WATER QUALITY MANAGEMENT AND POLLUTION ABATEMENT IN NARRAGANSETT BAY

## EXECUTIVE SUMMARY

### INTRODUCTION

The Comprehensive Conservation and Management Plan (CCMP) for Narragansett Bay required under the Clean Water Act amendments of 1987 provides a much needed opportunity to assess the accomplishments of the Federal-State pollution control partnership which was set into high gear under the 1972 Clean Water Act. The Narragansett Bay Project has the challenge and responsibility for setting the specific pollution control and prevention agenda for different sections of the estuary and serving as a focal point for implementing and refining this agenda into the first decade of the twenty-first century. This report examines two key aspects of Narragansett Bay water pollution control: the origin and evolution of the current planning and regulatory system, and the specific plans and accomplishments of the past decade in the major segments of the Bay.

### THE GOVERNANCE FRAMEWORK FOR WATER POLLUTION CONTROL

The governance of pollution control in Narragansett Bay has evolved over the better part of the twentieth century into an increasingly complex and more powerful network of federal, state and local authorities which have tried to respond to the public desire to restore and protect the water quality of the estuary. In the early part of the century each major city was expected to take responsibility and leadership necessary to build sewers and combat pollution. State government involvement increased after 1920, with the creation of the Board of Purification of Waters but the pace of improvements was slow especially given the rapid growth of the Providence metropolitan area. After World War II water quality management concerns were almost entirely dedicated to protecting public health by controlling the most serious point sources of pollution and the construction of Publicly owned Treatment Works (POTWs) and sewers. The creation of the Blackstone Valley District Commission in 1948 marked a significant new level of state involvement in building and wastewater treatment facilities. The post war period also produced the first attempt at classifying the waters of the entire Bay in terms of existing and desired conditions and created a planning approach which set pollution control priorities based on the linkage between pollution and its effect on the Bay.

In the 1970s environmental protection began to emerge as a new theme in water pollution control. Federal policy initiatives resulted in major new environmental legislation including:

- the National Environmental Policy Act of 1969 which required environmental impact assessments of major federal actions,
- the Clean Water Act of 1972 which promoted environmental and technical research; the setting of wastewater discharge and water quality standards; financial support for planning and constructing POTWs and federal enforcement of pollution control regulations,
- the 1972 Coastal Zone Management Act promoted natural resources inventories, regulatory programs for coastal development, balancing economic uses with natural resource protection, public access and waterfront redevelopment.

These acts reflected the expanded environmental awareness which had built up during the 1960s and incorporated the strong desire for public participation. At the same time, federal responsibilities were allocated to many separate agencies including the Environmental Protection Agency, National Oceanic and Atmospheric Administration, Department of Interior, Council on Environmental Quality.

An important objective of many of those laws was to strengthen State planning and implementation capability. In Rhode Island organizational changes were made that reflected these split responsibilities, and new agencies were formed such as the Coastal Resources Management Council in 1971 and the Department of Environmental Management in 1978. The planning efforts by these agencies were shaped by the specific eligibility requirements of federal financial aid programs, and did not produce a seamless, integrated protection program for Narragansett Bay.

The state's Section 208 Areawide Water Quality Management Plan, completed in 1979, did reflect the growing awareness of the connection between land-use, non-point sources and acknowledgement of the many remaining difficulties of completing the restoration of fishing and swimming in all sections of the bay. This plan was published at the same time as federal funding for pollution control was about to decline dramatically under the Reagan Administration, who wanted to make states more financially self-supporting in their pollution abatement endeavors. By 1987, when the need to address non-point source pollution (NPS) was mandated by amendments to the Federal Clean Water Quality Act, a stronger governance framework for water quality management had evolved at the state level, just as federal support was due to end.

During the 70s State initiatives to develop a water quality control program had been in response to the most visually obvious problems, as well as to comply with federal directives. State policy focused upon point source pollution control, which were the easiest sources to identify and proven technical means existed to remedy. Proposals to address the technically more complex, less visible and sometimes more expensive problems of combined sewer overflows (CSOs), non-point sources and tributary river systems, were slow to emerge. Fortunately many important planning initiatives have taken place in the late 1980's, whose results have only just been released, or are due out very shortly in 1990. The Department of Environmental Management has prepared a Non-point Source Management Plan and a State Clean Water Strategy. The state's Comprehensive Planning and Land Use Regulation Act is prompting a reexamination of local land use plans with the guidance of the Division of Planning. Local Harbor Management Planning is being led by the Coastal Resources Management Council. Progress is being made on CSO abatement planning by the Narragansett Bay Commission. Impending major permit reviews provide the opportunity to re-examine significant point source discharges. The interim report of the Environmental Quality Study Commission is focusing attention on the overall framework of state environmental management. These recent efforts present a window of opportunity for positive action to be undertaken at a time when public and political support to environmental efforts appears strong. This window may not be open very long because the present fiscal crisis in the State and the imminent termination of federal funding for pollution control could prove to be stumbling blocks that will not be easy to overcome. The Comprehensive Conservation and Management Plan being written by the Narragansett Bay Project has an important role to play in carefully selecting the most effective measures, and drawing upon every available organizational resource and capability to capture the opportunity for setting the Bay pollution control agenda into the twenty-first century.

## ASSESSMENT OF PROGRESS IN WATER POLLUTION CONTROL BY REGION

### The Providence River Region

There has been a tremendous effort required to maintain the earlier gains in water quality which resulted from the completion of secondary treatment at the Blackstone Valley District Commission (BVDC) facility at Bucklin Point in 1972. Water quality in the Providence River region has experienced little change over the past ten years. Although improving trends can be shown by the decline in loadings of toxic metals, biological oxygen demand and dissolved increased oxygen concentrations, the area of Bay waters unable to meet water quality standards, remains much the same as in 1972.

The state priority has been to upgrade wastewater treatment facilities to secondary levels. The creation of the Narragansett Bay Commission (NBC), proved necessary to overcoming the tremendous inertia of the city of Providence in upgrading its Field's Point facility, just as the City of Pawtucket's inaction prompted then Governor Pastore to create the BVDC in 1948. The NBC has achieved very good performance since new facilities went on line in 1988, successful implementation of its industrial pretreatment program; operates the first POTW water conservation program in the State; and is in the final stage of designing its innovative CSO abatement planning. Problem areas still remain. The Blackstone Valley District Commission is not expected to meet secondary criteria before June 1990; and West Warwick Treatment Plant is currently estimated not to meet secondary criteria until 1993.

Combined Sewer Overflows are now widely recognized by the public as a major unresolved pollution source to the Upper Bay. Lack of action on CSO abatement proposals has meant that the conditionally opened shellfishing areas have been closed more than 50 percent of the time every years since 1974. Lack of federal funding, fragmented, incomplete studies and the absence of a clear state CSO abatement policy have all combined to inhibit progress. However, CSO abatement is now clearly on the public agenda and State planning has shifted towards them a the construction of major point source controls are nearing completion. The Narragansett Bay Commission is just starting the final phase of its computer modeling of the entire Providence CSO system in order to choose construction priorities and a State CSO policy is currently being developed by the Department of Environmental Management. But progress towards improvement of the major CSOs in the Central Falls-Pawtucket area has been very limited. Planning studies from 1980 are now obsolete and it is thus likely that CSOs will remain a major source of pollution in the Providence River region for the 1990s and beyond.

Non-point source pollution is another source that has reached the public agenda in this region, due largely to the impact of urban runoff. Efforts to quantify NPS have been initiated by increased monitoring and a new State policy and plan has recently been developed. More information is urgently needed if NPS problems are to be taken seriously. There also exists a major gap between State policies and the actual behavior of local communities where implementation of most management practices has to take place.

In the river systems of the region, no dramatic water quality improvements are yet evident from pollution control efforts and it is assessed by the State that some stretches will never comply with the fishable-swimmable goals of the federal Clean Water Act. POTWs continue to play an important part in the health of these rivers. Pretreatment programs have had a very positive effect in reducing toxic loading. Impounded sediments remain a potential source of pollution but little effort has been made to determine the impact. Interstate cooperation in the Blackstone, Taunton and Pawcatuck River Basins has been once again recognized as a necessary component of water quality management and underlines the growing awareness of the linkage between activities in the upper reaches of the water shed and the health of Narragansett Bay.

In summary, the indications of some improving trends in the Providence River region is counterbalanced by the absence of dramatic change since 1972 in the ability of this section of the Bay to meet water quality standards and the enormous effort which has been required just to maintain existing conditions. Major commitment of financial resources and effort will be needed to carryout CSO pollution abatement, improved operation of POTWs and to develop better knowledge about the contribution of NPS to water quality conditions.

#### Mount Hope Bay Region

Mount Hope Bay receives pollution from all four sources discussed in this paper. Progress has been made to upgrade POTWs and their associated pretreatment programs have reduced toxic metal loadings, but as yet there has been no significant improvement in overall water quality in terms of meeting water quality standards. Funding for maintenance and operations of POTWs must be continued in order to sustain the progress which has already been made. Longer term planning is also needed to determine whether and how standards can be met. The problem of CSOs in this region has also reached the public agenda and remains the major concern as the largest source of pollution to Mount Hope Bay, but mitigation efforts over the past 15 years have been very limited. Studies of the Fall River CSOs carried out during this period are still not complete and it will take intense public and political pressure, supported by appropriate funds, to put plans into meaningful abatement actions. Meanwhile, the impact of CSOs is likely to overshadow considerations of pollution from other sources for some time to come. Control remedies are bound to be expensive and effective cooperation between the states and other agencies will be necessary. The effort faces a particular challenge due to the atmosphere of fiscal crisis which has constrained state agencies from carrying out the badly needed intensive monitoring of the region.

#### Upper and Lower Narragansett Bay

The water quality standards in this well flushed portion of the area are characterized by fishable-swimmable waters. Conditions have remained largely unchanged over the past ten years. The small pockets that do not meet these standards are generally affected by the limited number of point sources apart from the conditional areas in the Upper Bay, whose closure is attributable to wet weather CSO discharges from the Providence River. The Newport POTW and associated CSOs have represented a major pollution source in the past, but a construction program due to be completed in 1990 should bring positive improvements to the local water quality, after many years of delay in the program.

Overall NPS is not assessed as having a major impact on the estuary and it is not possible to correlate prevention control measures with detectable improvements. Local controversies have erupted over particular residential projects which rely on individual or small scale sewage disposal systems. Conflict also exists over the construction or expansion of marinas due to state policies which automatically close shellfishing in a zone around the marina. NPS issues have been addressed in the R.I. Non-point Source Management Plan and best management practices have been specified for control of erosion and sedimentation and mitigating possible impacts for ISDS. More information is needed to determine the impact of boat sewage on water quality in this well flushed portion of the Bay. Overall, this region meets high water quality standards and it will be the reduction of pollution in the Providence River that is most likely to have a beneficial impact.

#### Conclusions

The goal of collecting and properly treating municipal and industrial wastewater to restore a full range of uses to Narragansett Bay has preoccupied public officials for most of this century. In 1990 the last major POTW should achieve secondary treatment and the introduction of industrial pretreatment programs have clearly mitigated much point source

pollution. Today the more difficult problems of mitigating sources of pollution such as combined sewer overflows and non-point storm runoff must be squarely faced, as well as maintaining the efficiency and effectiveness of wastewater treatment facilities.

State and regional government has taken on an ever greater share of the pollution control burden both financially and administratively, bolstered by continued strong public support for pollution control programs. However, federal financial assistance is coming to an end with a number of difficult tasks remaining to be done. The need exists for a strong, clear pollution abatement policy for the next decade which can build realistic expectations about future progress, attract financial support and sustain the effort needed to put preventative programs into place.

The Narragansett Bay Project has a critical role to play, first in designing the basic water pollution control strategy for the estuary, secondly in maintaining a continuing role in the complex task of facilitating the implementation process and evaluating program effectiveness, and finally, in serving as a focal point for obtaining public involvement and therefore support for the difficult work which lies ahead.

## **HISTORICAL REVIEW OF WATER QUALITY MANAGEMENT AND POLLUTION ABATEMENT IN NARRAGANSETT BAY**

### **INTRODUCTION**

The United States undertook a series of bold legislative initiatives in environmental protection during the early 1970s, including the 1972 Clean Water Act and Coastal Zone Management Act, in part as a result of heightened concern about the degraded condition of U.S. estuaries. In 1984 the National Estuary Program was initiated by Congress to examine the progress and challenges yet to be met in a small number of urbanized and once heavily polluted estuaries, including Narragansett Bay.

The purpose of this historical review of water quality management and pollution abatement in Narragansett Bay is to examine what has been accomplished, summarize current assessments of what remains to be done and extract relevant lessons from the considerable body of experience in Rhode Island and Massachusetts in support of the Narragansett Bay Project's Comprehensive Conservation and Management Plan for Narragansett Bay.

The four sources of pollution considered by this paper will be: point sources, combined sewer overflows, non-point sources and river systems, with the major focus on the first two, due to the emphasis placed on them in federal, state and local programs. The historical review of the period between World War II and the 1970s will primarily concern itself with efforts to control point source pollution. The evolution of policies and programs for all four sources covers the past ten to fifteen years. The area of concern in this paper is the whole of Narragansett Bay and its watershed, but the assessments of pollution control programs and progress will address three separate regions: the Providence River and tributaries, Mount Hope Bay and tributaries and the combined Upper and Lower Narragansett Bay. (See Figure 1) The focus of the review will be on the major sources of pollution and the related efforts to manage their reduction.

Part I briefly describes the basic water pollution problems in Narragansett and sets forth the governance structure, policy framework and planning initiatives that have evolved to deal with these problems. Current and ongoing programs are then described, including projections of forthcoming pollution control actions through 1995 where possible. This is followed in Section II by a more detailed treatment of pollution abatement efforts in each of the three regions of the bay, and an assessment which attempts to indicate the linkages between the implementation of plans and policies with their outcome, in terms of achieving water quality standards. The conclusions include the major achievements of pollution abatement in the estuary and lessons from the considerable experiences to date in developing and implementing water pollution control policy.

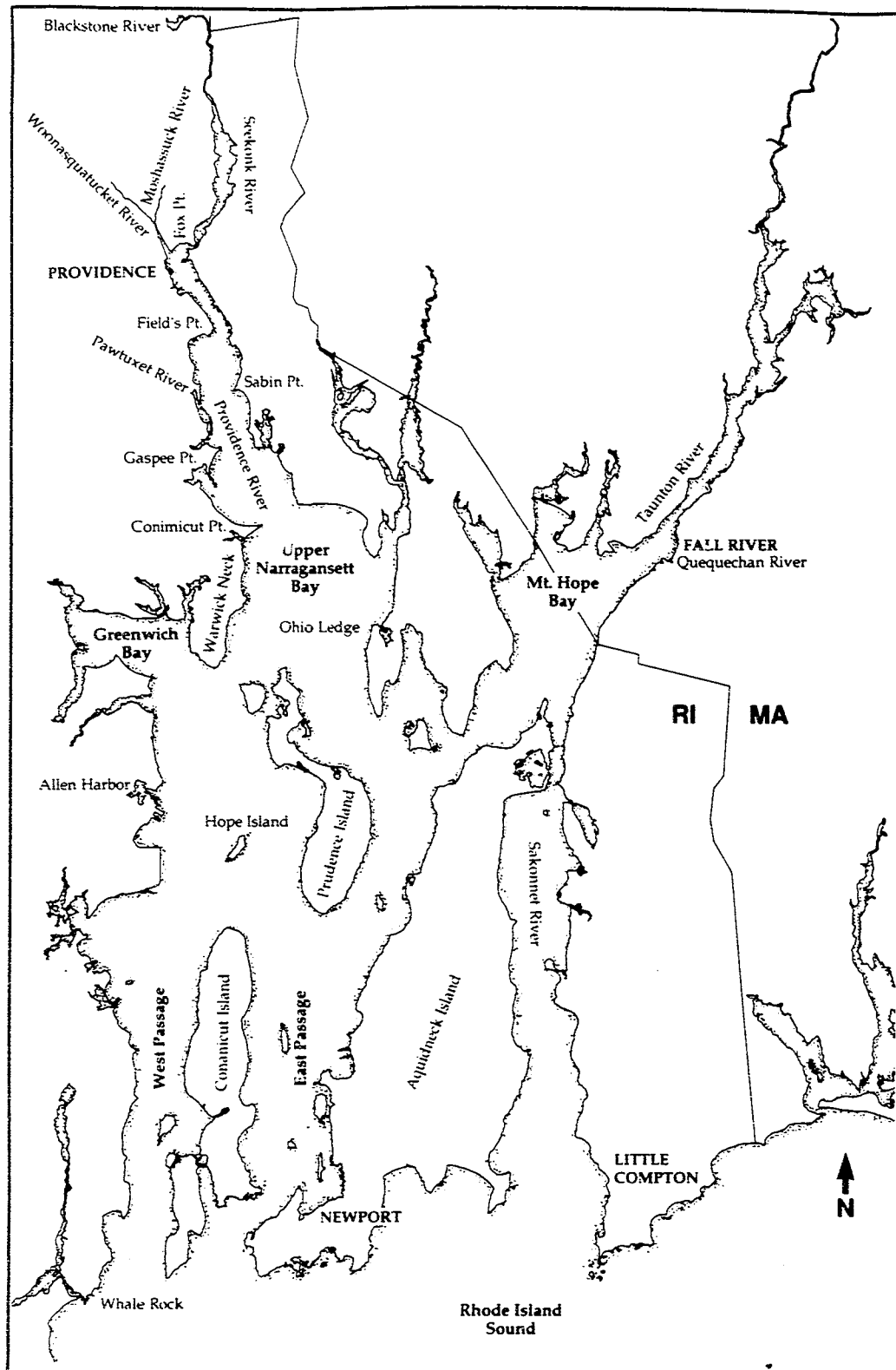


Figure 1. Narragansett Bay



## **I. THE GOVERNANCE FRAMEWORK FOR POLLUTION CONTROL IN NARRAGANSETT BAY**

### **A. WATER POLLUTION AS A PROBLEM IN NARRAGANSETT BAY**

The water pollution problems of Narragansett Bay can be traced back to the Industrial Revolution and the subsequent dramatic population growth and urbanization of the late nineteenth century. The legacy of economic development in the estuary watershed was dramatically manifested early in the twentieth century by foul smelling and unsightly water conditions, fish kills, loss of fisheries habitat and the imposition of shellfish harvesting restrictions. Much has been done to mitigate those early problems, in terms of the construction of sewer systems and wastewater treatment facilities. Contemporary pollution problems in Narragansett Bay can be better understood when viewed as items on an unfinished agenda which has its roots in the first decades of this century.

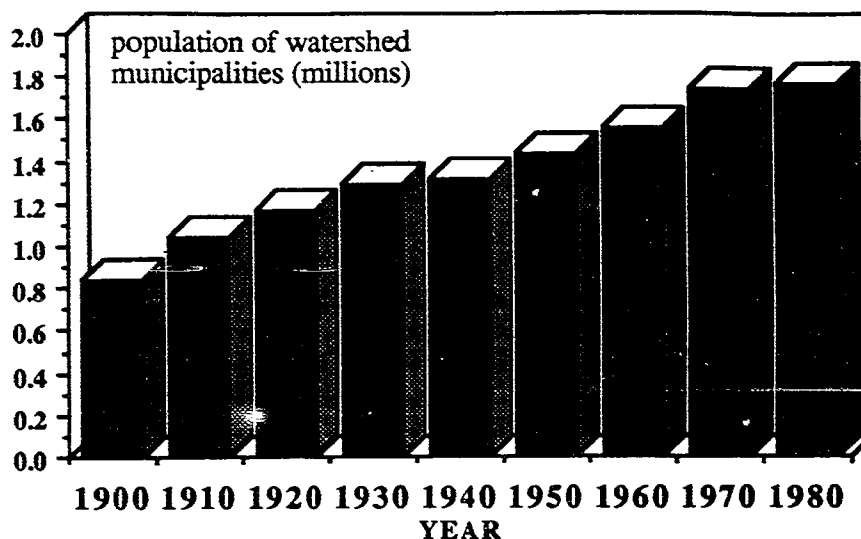
#### **(1) Progress in water pollution control prior to World War II**

The City of Providence began to build sewers in the 1880s following the plans of Samuel Gray to intercept sewage from the dozens of sewer outfalls which drained wastewater and stormwater from particular streets or districts directly into nearby rivers, and convey it to the tidally flushed Providence River at the Fields Point on the southern edge of the city. The first wastewater treatment plant opened at Field's Point in Providence in 1901. Other municipalities, such as Pawtucket and Central Falls built sewers which discharged raw sewage directly to receiving waters. The degradation of oyster beds was an early indicator of the impact of pollution on the estuary itself but it was not until 1920 that the first Act was passed in Rhode Island: "to prohibit and regulate the pollution of waters of the state and establish the State Board of Purification of Waters."<sup>(1)</sup> Early efforts to abate pollution were directed towards identifying the most serious pollution problems and, construction of sewers and treatment plants. Municipalities were expected to bear the full cost of these facilities. As a result, progress remained painfully slow. It was not until 1932 that all seweried municipalities had their first wastewater treatment facilities with the exception of Bristol (which was still under construction) and Pawtucket which was under State orders to construct intercepting sewers and wastewater treatment facilities. Some manufacturers had tied into the sewage system of Providence or had installed pollution control equipment. But in 1934 it was estimated that 24 million gallons per year of untreated mill waste were still entering river systems<sup>(2)</sup>.

A 1928 study by the U.S. Public Health Service clearly showed the relationship between oyster health and pollution and some shellfishing closures were instituted in the Providence River. Mount Hope Bay was officially closed to shellfishing for the first time in 1935.<sup>(3)</sup> By the mid-1930s people were becoming frustrated by lack of action to abate the most serious pollution sources, as exemplified by the continuing discharge of raw sewage into the Blackstone and Seekonk Rivers by the City of Pawtucket in defiance of State orders and legal action. Through the initiative of the Bristol County Lions Club in the late 1930s, a coalition of civic groups formed to push for a stronger state role in pollution control.<sup>(4)</sup> This movement was rapidly gaining public support when it was cut short by U.S. involvement in World War II. Pollution abatement measures were all but forgotten during the war years.

#### **(2) Post War Developments**

After WWII, attention turned again to the abatement of pollution. Since the turn of the century the increase in population over the entire watershed of Narragansett Bay had been relatively slow and steady, but beginning in the 1940s the movement to outlying communities from the older cities of Providence, Pawtucket, Newport and Fall River was



Source: U.S. Department of Commerce, Bureau of the Census

**Figure 2. Population of all cities and towns within the Narragansett Bay watershed, 1900-1980.**

dramatic (Figure 2). Higher standards of living led to increased interest in access to the water and proliferation of waterfront development. Housing development took place in areas where larger properties could be sited on plots of greater dimensions, often close to the waters of the Bay. This in turn created increased demands for services such as centralized wastewater collection and treatment facilities and emphasized the need for sensible zoning by communities. Major efforts continued to be directed towards the control of point sources and municipalities still showed little enthusiasm for playing the lead role. A 1946 report by the Chief of Sanitary Engineering, Walter Shea, made at the request of Governor John O. Pastore, was the first attempt to classify the existing condition of the waters of the Bay and its tributaries. Shea based his assessment on surveys<sup>(5)</sup> and studies prepared for the Board of Purification of Waters during the previous 25 years. The report proposed that the State take an active role in improving the condition of the Seekonk and Providence Rivers, and proposed goals for the future water quality conditions and specific abatement measures. The first priority was to create a regional agency to intercept and treat the raw wastewater from the Cities of Pawtucket and Central Falls.

Shea's recommendations for abatement rekindled the public support for State action and legislative support, and led to Governor Pastore's unprecedented initiative. Within weeks of submission in 1941, the General Assembly passed a bill to create the Blackstone Valley District Commission, the regional wastewater management agency recommended by Shea. Rhode Island voters unhesitatingly supported a \$5 million bond issue referendum that fall, to finance the design and structure of the associated POTW at Bucklin Point. Construction

of the initial phase of interception sewers and a primary treatment facility serving Pawtucket and Central Falls was completed in 1950. For the next fifteen years the State's pollution abatement programs continued to focus on the elimination of major point discharges. Little attention was given to the problems of the numerous combined sewer overflows which had been created as a result of the construction of intercepting sewers, despite their recognition as a priority issue.

The environmental movement of the 1960s, however, began to direct public attention to the broader aspects of water pollution in Narragansett Bay, in addition to municipal wastewater treatment. The bay shoreline, which had been largely rural, experienced rapid expansion, which not only tested the capacity of the POTWs, but underlined a need for the management of land and shore uses, if these diverse and often conflicting activities were to co-exist. Thus a larger constituency was developing, which had an interest in the condition of natural resources of Narragansett Bay. The implications of the changes taking place were instrumental in focusing the attention of prominent leaders and the public on pollution abatement and resulted in the formation of the Coastal Resources Management Council (CRMC) in 1971 and new citizen groups such as Save the Bay.

The environmental awareness of the 1970s led to the expression of other concerns such as recreation opportunities, urban waterfront development, public access and visual qualities of the coastal landscape. There was also a recognition that other sources of pollution existed which had an impact on the Bay, but had not been seriously considered, due in part to previous abatement measures being dedicated to the treatments of municipal wastewater. Among these pollution sources were: urban runoff which included lead from gasoline, oil from cars, animal faeces, street sweepings, infiltration and inflow to sewers and construction materials; agricultural runoff of pesticides and fertilizers; leachate from landfills and ISDS and marine activities such as oil transfer spills, dredging and boating. All these sources possessed potential for causing significant pollution, yet were difficult to quantify due to the lack of significant quantitative information to identify their origins. These sources of water degradation which were dispersed became known as non-point source (NPS) pollution. Concerns were that control of point sources would not be enough to meet the State's water quality goals. Efforts were made during the 1970s<sup>(6)</sup> to increase scientific knowledge by monitoring the waters of the Bay and its tributaries, in an effort to define the associated problems. These monitoring efforts indicated that many more pollutants were entering the bay from non-point sources than had been previously thought. However, recognition of the adverse impacts and the connection to land-use management and development has emerged slowly.

The association between pollution and fisheries, particularly shell fisheries, was well established early in this century. The number and size of the areas of the bay which were permanently closed due to their inability to meet federally imposed health limits gradually increased. In 1969 the State also instituted temporary closures of certain shellfish areas, after major rain events. These "conditional" areas were mainly situated in Upper Narragansett Bay and created significant controversy as they extended over particularly prolific hard shell clam beds.

The increased effort in the 1970s to identify and measure the monitoring levels of toxic chemicals in point and non-point discharges confirmed that some pollutants were reaching or exceeding concentrations harmful to many marine organisms. CSOs were recognized as a pathway which carried pollutants such as raw sewage, untreated industrial wastewater and stormwater to the Bay. Despite the awareness of the impact of CSOs and consistent recommendations for their elimination in a series of plans,<sup>(7)</sup> priority for implementation was still allocated to upgrading major POTWs.

Heavy manufacturing industries declined but the State still relied upon such industries as jewelry and electroplating as an economic base, and the disposal of their wastes was a problem that was difficult to address. With the introduction of high technology based industries into the state in the late 70s, living standards continued to increase suburbanization and the demand for waterside property led to further rapid development of the coastal zone. Continued residential and commercial use in the watersheds of the Bay accentuated the problems of non-point source pollution.

The 1980s saw the achievement of secondary treatment capability at all the major POTWs, but only minor improvements to the combined sewer overflow situation. Greater effort was placed in assessing the condition of waters in lakes and river systems such as the Pawtuxet and Blackstone. Interest in addressing the issue of non-point source pollution has also become part of the public agenda. Many of the cases heard before the Coastal Resources Management Council center on the impact on Bay water quality from housing subdivisions, ISDS installations, storm drains and marinas.

As the '90s approach, it is clear that significant successes have been made in controlling point source pollution but the problems associated with CSOs remain. More effort is now being devoted to the analysis of non-point source pollution and the need for effective community as well as State planning and management to resolve problems, which have been created by the continued urbanization of the Narragansett Bay coast and watershed.

## B. THE EVOLUTION OF POLLUTION CONTROL POLICY AND PROGRAMS FOR NARRAGANSETT BAY

Governance includes not only the laws, regulations and programs for environmental control related to the various users of the Bay, but also the key organizations and agencies with their policy and planning that help to develop those laws, regulations and programs. This section will present the evolution of the major agencies involved in water quality management at federal, state and local levels; and the evolution of the policy and planning framework from 1946 to 1987.

### (1) Development of federal policy

Although Rhode Island has a rich history of pollution control efforts, events of the past two decades have been overshadowed by programs initiated by Congress and the Environmental Protection Agency. Early federal interest in the abatement of pollution was manifested in the enactment of the Federal Water Pollution Control Act (FWPCA) in 1948, which expressed a national commitment to improve and protect the quality of surface waters. Subsequent amendments in 1965 reinforced that commitment and significantly increased the financial support to states and municipalities. In order to qualify for these funds, states had to establish water quality standards and identify pollution control priorities. Rhode Island submitted its classification System in 1967. The FWPCA was further amended by the Clean Water Act (CWA) in 1972, which clearly signalled a long range commitment by the federal government to eliminate pollution in the nation's waters, and this program has dominated Rhode Island's point source pollution control efforts.

The Clean Water Act established a major federal role in setting treatment requirements, as well as funding POTW construction and capital improvements, through grants, to meet the designated standards. The Clean Water Act mandated many levels of planning by regional, state and local agencies through a Continuing Planning Process. It also introduced the National Pollutant Discharge Elimination System (NPDES) which required issuance of a permit for all point source discharges to surface waters. Such permits represent the major form of regulation and generally contain conditions designed to assure compliance with water quality standards and effluent limitations. The goal of the Act was to eliminate the discharge of all pollution by 1985. The EPA was given responsibility to implement the Act, although it was intended that states would in due course be delegated parts of the program such as construction grant applications and permit authorization. In 1984 the CWA was amended to include a National Estuaries Program under which EPA and NOAA can initiate management and research programs for individual estuaries.

1972 also saw the creation of the Office of Coastal Resources Management, under NOAA in the Department of Commerce, charged with overseeing the implementation of the newly enacted Coastal Zone Management Act (CZMA) which had as objectives the preservation, protection, development and enhancement of coastal resources; through state programs. The CZMA was intended to balance environmental protection and economic development objectives in the Coastal Zone, which was generally defined as extending from the outer limit of the U.S. territorial Sea, inland to the extent necessary to control shorelands, the use of which have a direct and significant impact on coastal waters."<sup>(8)</sup> States were given the option of creating a new agency, a network of existing authorities or delegating to local communities, and were provided with detailed guidance to develop management programs. Once approved by the federal agency, states received significant financial support for program implementation. Fishing and matters relating to water quality have been largely excluded from state programs developed under the provisions of the CZMA, but the Act was nevertheless designed to support an ecosystem approach to management.

The introduction of these federal acts led to a revolution in public involvement in environmental management as they both mandated public participation in their implementation. The programs derived from these two acts were based on different strategies for environmental protection and are the responsibility of two different federal agencies. However, the CWA emphasized the identification and elimination of all point source pollution, while the CZMA emphasized balancing competing uses and careful analysis of the resources in the coastal area prior to setting a management strategy. The State of Rhode Island was generally eager to comply with federal timetables in an effort to obtain funds, sometimes prior to the establishment of a policy and associated planning framework at state level.

Another major federal act which influenced water quality management, was the National Environment Policy Act (NEPA) of 1969 which required all federal agencies to prepare an Environmental Impact Statement for all major projects, before commencing construction or operation. It required assessment of the impact on the environment of a proposed project, such as power stations, and if necessary, identification of mitigating measures. The State of Rhode Island has never adopted a statute modeled after NEPA although environmental assessment techniques are employed in a variety of regulatory permit decisions. In conjunction with then EPA a major step occurred in 1970 when the Nixon administration created the Environmental Protection Agency (EPA), which through its regional office immediately became the dominant force in federal pollution control planning, permitting and enforcement.

The Department of Agriculture became increasingly involved as the land-use problems of urbanizing towns became associated with non-point sources of pollution. Soil Conservation Districts were created, where programs dealing with agricultural erosion and animal waste were federally funded and administered by the Agricultural Stabilization and Conservation Service and the Soil Conservation Service. Site specific problems were also supported with cost-share funds for voluntary implementation. The U.S. Army Corps of Engineers (ACE) had been involved in construction permit applications since the Rivers and Harbors Act was introduced in 1899, and then took on additional responsibility when the CWA (Sect.404) established a permit program to regulate dredge material discharges into U.S. Waters. Both EPA and ACE maintain regional offices, which act as the State's link with Washington. The Federal Food and Drug Administration also had a long history of involvement as the authority responsible for setting the limits of pollutants acceptable for human consumption of fish and shellfish; thus being another important actor in decisions regarding the regulation of shellfish beds.

Regional organizations funded by the federal government have also played a role in pollution control in the 1970s, most notably the New England River Basins Commission, which published a series of environmental management plans which integrated growth management and major pollution control facilities siting. A plan covering the southern New England region was released in 1976. However, no authority and few funds were provided to implement it. A regional non-federal agency, the New England Interstate Water Pollution Control Commission, was also formed shortly after World War II, with the task of encouraging cooperation and mediating interstate pollution control efforts. It also adopted a water quality classification system similar to that introduced by R.I. Department of Health (DOH), and although the commission lacked regulatory authority, it is still in existence today.

## (2) Development of State Planning

At the turn of the century, municipalities were responsible for pollution control, financing their own studies and projects. The Rhode Island General Assembly recognized the need for concerted action to prevent further pollution of State waters in 1920 with the creation of the Board of Purification of Waters. With a policy of eliminating the discharge of raw or incompletely treated sewage, the Board produced a plan and introduced regulations to control pollution.<sup>(9)</sup> The emphasis of the Board was on the investigation of known sources of pollution and the construction of treatment plants relying primarily on the voluntary compliance of local authorities, after preliminary assessment and advice from the Board. Progress was reviewed in its annual reports to the General Assembly. The power to fine or institute legal proceedings was also used to pressure municipalities to install wastewater treatment plants.

Municipalities, in turn have long argued for state funding of pollution control facilities. In 1933 the Rhode Island General Assembly created the Metropolitan Sewage Commission, charged with preparing a plan to control pollution discharges to Upper Narragansett Bay for a district composed of 18 cities and towns. The Commission proposed creating a regional sewer authority and constructing a regional POTW on Prudence Island, discharging to deep water. This plan was rejected in 1934 by the Board of Purification of Waters, which was alarmed by the idea of allocating state funds to a project that would not serve the entire state, objected to the duplication of already existing facilities and pointed out the engineering problems which could be anticipated in the project. Fishermen were also opposed due to the possible pollution impacts in the mid-Bay; and other agencies opposed the project due to the excessive estimated cost of \$15-20 million, for which a federal contribution could not be guaranteed. Inhibited by lack of State funds, municipalities moved slowly to improve wastewater treatment. It was not until 1935 that all sewered communities, with the notable exception of the City of Pawtucket, had their own POTWs. Although the Board attributed improved oyster and clam sets to the progress made on sewage treatment, these proved to be temporary, and when Governor Theodore F. Green abolished the existing system of Boards and Commissions in 1935, the Board was replaced by the Department of Health, which was given the responsibility for water quality management.

The first modern state pollution control plan was the 1946 Report on Pollution of the Waters of the State by Walter Shea of the DOH. Based on information gathered prior to WWII by investigation and analysis, the Shea Plan initiated water classification according to present condition, based on several parameters measured including dissolved oxygen and coliform levels. The planned future condition was also specified, based on industrial use and proposed abatement measures. Recommendations included; the creation of a Blackstone Valley District Commission (BVDC) and regional plant; a compact with other New England States to co-ordinate pollution control; the treatment of industrial waste on site or by connection with the sewage system for subsequent treatment. This plan, with a length of 14 pages and three maps, was the epitome of brevity and was perhaps a lesson, unfortunately seldom heeded, for future planners. Many of the plan's recommendations were implemented and were to have a profound affect on point source pollution over the next fifteen years. Shea's water quality classification scheme was to remain unchanged until 1967 when it was finally revised as a result of a 1965 amendment to the FWPCA, and accepted by the State and Federal Government.

### Changes in State Structure

Two important structural changes also took place in the early '70s. Firstly, in 1970 the Statewide Planning Program (SPP) was placed in the Department of Administration,

charged with the co-ordination of the comprehensive development of plans, including those relating to water quality management. The staff component of the Program was the Office of State Planning (OSP) and the work is guided by the State Planning Council, comprising State, local and other representatives and federal and other advisors.

Secondly, in 1971 the Coastal Resources Management Council (CRMC) was formed, and undertook the State's responsibilities under the CZMA. It consisted of representatives from public agencies and members representing the environment, business, research and local government and was charged with developing and implementing coastal management policies. The General Assembly required CRMC to employ a resource planning process and generate consensus of goals, conduct research, analyze alternative policies and produce plans that could be directly implemented by the Council or through coordination with other agencies.

The Sanitary Engineering and Water Pollution Control Divisions within DOH remained responsible for water pollution control from 1935 until 1977, when responsibility was transferred to the newly formed Department of Environmental Management (DEM) R.I. General Laws Ch 46 mandated DEM "to develop comprehensive programs for the prevention, control and abatement of new or existing pollution of the waters of the State." Within DEM, the divisions responsible for water quality management were the Divisions of Land Resources and Water Resources, but these responsibilities subsequently were transferred to the latter.

#### The Major State Planning Efforts

Expectations and initiatives expanded greatly in the 70s, leading to the creation of a variety of state plans and programs, whose implementing agencies were required to accommodate a greatly increased federal role, existing and newly created sister agencies, local concerns and greatly expanded involvement of the general public (Figure 3). The plans that were developed are not the result of a deliberate comprehensive approach, starting at the multi-state regional level, and moving into more detailed state watershed, river basin, and municipal plans, as envisioned in the 1972 Clean Water Act. States like Rhode Island reacted to shorter term priorities aimed at qualifying for its allocation of federal funds, and in fact already had a long standing pollution control agenda. In the following description of the more important individual plans, the chronological order will be maintained, but an attempt will be made to identify their association with federal policy.

Despite its focus on uniform national, industrial and municipal standards for wastewater treatment, the CWA of 1972 also mandated water quality management planning and provided federal funding in support of research, planning, construction and implementation. The intention was the production of a statewide regional plan as a first step, under section 208, then increasingly specific river basin plans and interim sub-basin plans, under section 303, to provide the foundation for local level municipal facilities plans, under section 201. In Rhode Island, the order was not followed as State officials first prepared the basin plans (1977), in order to qualify for federal funds, followed by municipal facilities plans (1977/78) and finally the statewide water quality management plan (208 Plan, 1979).

The Basin Plans were prepared jointly by the Statewide Planning Program and the DOH, covering seven major basins and were designed to provide the foundation for an orderly water quality management program. A simple rating scheme was devised to decide which areas of Narragansett Bay were most polluted and which point sources needed greatest attention. Of the 77 segments in the Narragansett Basin Plan the Seekonk and Providence Rivers ranked highest, based on agency judgement about the need for good water quality as well as the severity of pollution. Of the 70 distinct pollution sources the three leading



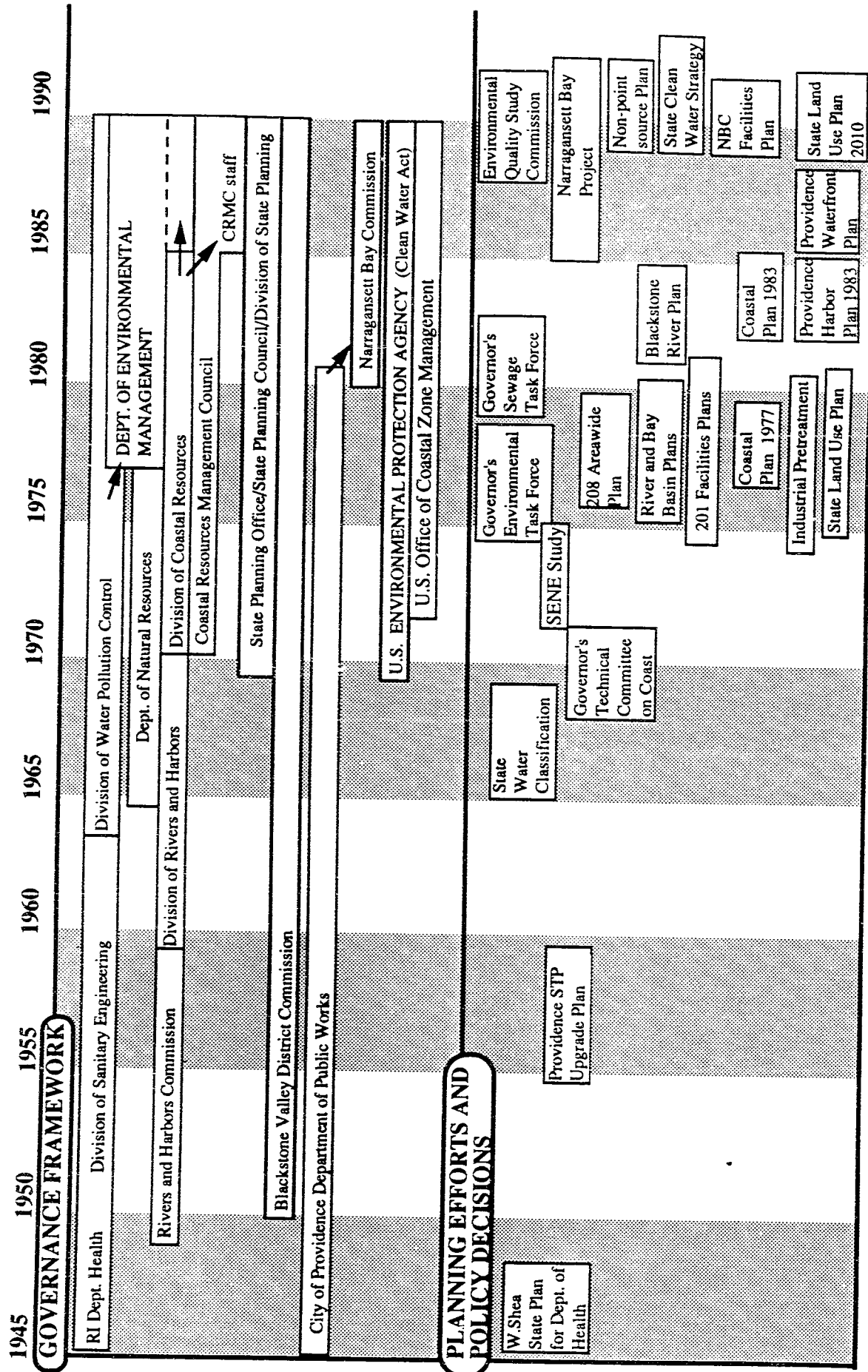


Figure 3. The Evolution of Water Pollution Control Policy in Narragansett Bay

contenders in order of severity were Field's Point POTW and CSOs, Fall River POTW and CSOs and BVDC's Bucklin Point POTW.<sup>(10)</sup>

These Phase I Basin Plans were consistent with federal and state goals and objectives, and relied on data already collected from other sources. It was intended to produce Phase II Plans which would update these management plans with revised assessments based on new data. But only one such Phase II plan was produced; the Blackstone Region Water Resources Plan, 1982; this being the result of joint planning by the Office of State Planning and the recently formed DEM, which had taken over responsibility for water pollution control from the DOH in 1977.

As part of the continuing planning process, in 1979 the Statewide Planning Program completed the areawide plan funded by Section 208 of the CWA; The Water Quality Management Plan for Rhode Island, also known as the 208 Plan. It was the culmination of three years of effort, costing \$2.3 million with a primary objective "to determine where water quality suitable for fishing and swimming could be attained and the actions necessary to achieve these water quality goals." Consideration was for the first time placed on non-point source pollution, including urban and rural runoff, erosion and sedimentation, landfills, ISDS systems, hydrologic modifications and marinas. The Plan also assessed the need for sewers and POTWs, reviewing the municipal facilities plans that had already been produced, and developing its own construction priority list.<sup>(11)</sup>

The primary means of public input into the 208 report was by the establishment of the Citizens' Policy Committee. The major pollution problems identified were not surprisingly: the Field's Point POTW and the CSOs from Central Falls, Pawtucket and Providence. The costs for improving these sources were estimated as high as \$257 million and even the proposed actions were not guaranteed to attain swimmable waters. The second priority of the 208 plan was point sources in the Pawtucket River but once again mitigation, at a cost of \$58 million, would not guarantee attainment of fishable-swimmable waters. An anticipated barrier to success was the probable impact of non-point source pollution, although this could not be quantified.<sup>(12)</sup> The 208 Plan was approved by EPA in 1980 and should be considered as Rhode Island's first comprehensive water pollution control plan since Shea's report of 1946. The 208 Plan was well written, supported by significantly updated information and with clearly identified recommendations and was to be the foundation for subsequent plans and actions in the 1980s. In 1982 the Statewide Planning Program published an assessment of the Status of Recommendations as a means of documenting progress in implementation. It was apparent that the cities were reluctant to carry out many of the high priority measures and their focus of point source planning was still at the local level.

#### Coastal Program Development

By 1972, the Rhode Island Coastal Resources Management Council (CRMC) was already operating a regulatory program. The introduction of the Federal CZMA, CWA and NEPA provided much needed additional financial, legal and administrative resources for pollution control and decision making in the Coastal Zone. In 1977, the CRMC adopted its first comprehensive coastal resources management program (CRMP), which was approved in 1978 by the Federal Office of Coastal Zone Management. This document clarified and expanded the regulatory jurisdiction of the CRMC. The program stressed the evaluation of individual development programs such as POTWs, and harbor development projects, in terms of the probable environmental impacts on the coastal zone. This contrasted with the CWA based programs which focused on imposing specific wastewater treatment technology based on economic factors rather than environmental impact. During the next four years, certain areas were identified as needing specific planning effort and Special

Area Management Plans (SAM Plans) were developed to involve a greater level of scientific knowledge and public discussion. The action oriented elements of the plans were designed to co-ordinate the activities at the local level and influence property owners and developers to restore or preserve specific portions of the coast. Four such SAM Plans have been adopted since 1983, for Providence Harbor, Newport Harbor, Salt Ponds Region and the Narrow River and two more are currently being prepared. These have been successful in affecting modifications in local zoning, expanding CRMC's involvement in sub-division review and coordinating permitting procedures. The 1983 Providence Harbor Plan called for a water quality based approach to pollution control and a focus on restoring specific uses in the upper reaches of Narragansett Bay.

In 1983, a major revision of the comprehensive CRMP combined a wealth of new information with the valuable experience gained by the CRMC in ten years of regulating the development of the coastal zone to develop new policies and decision making criteria for its implementing authority and coordinating responsibility. The waters of Narragansett Bay were classified into six use categories, linked to the characteristics and activities of the adjacent shoreline and having no physical, chemical or biological criteria. Land use restrictions were focused towards stormwater drainage and on-site construction impacts, and water uses dependent on associated water classification. This classification was designed as a planning and regulatory tool and is distinct from the system used by the Department of Environmental Management in certification for the U.S. Army Corps of Engineers, which is based on water quality criteria with particular emphasis on pollution limits related to shellfish harvesting.

#### Implications of Federal Policy Changes

As federal pollution control policy has changed, Rhode Island has had to adjust its own policies and or plans. The FWPCA (1965) required water quality standards to be established in each state, to be attained through controlling point source pollution. The implementation mechanism for this was a limited amount of federal funds, and a cooperative approach to major dischargers. The federal government rarely became involved in enforcement. The CWA of 1972 made it unlawful to discharge any unregulated pollutants and required permits under the National Pollution Discharge Elimination System. The system was designed to eliminate the environmental impacts from surface discharges by ensuring that discharges had specific pollutant limits, both for the amounts and kind of materials released, or used the best technology available to remove pollutants. Major municipal and industrial permittees are required to perform and report the results of analyses for pollutants in their discharges and the results of the monitoring are evaluated to determine whether permit criteria have been violated or should be changed.

The EPA performance standards for discharges, intended to be the foundation of the NPDES, took several years to develop and EPA was taken to court not only by industries resisting the regulations but on numerous occasions by environmental groups for failure to comply with the CWA. It was not until 1984 that RIDEM received sufficient pollution control authority from the Rhode Island General Assembly to win delegation of the NPDES from the EPA. In conjunction with the RIPDES, municipalities began to prepare and implement industrial pretreatment programs, which will be discussed further under the local governance section. The availability of wastewater sewers in the metropolitan Providence areas has limited the number of industrial firms which discharge directly to a waterbody. Today the RIPDES Major Industrial Permits are limited to sixteen (Figure 4).

In 1987 important amendments to the Federal Clean Water Quality Act were adopted. Section 319 specified an important new policy goal: "that the control of non-point sources of pollution be developed and implemented in an expeditious manner so as to enable the goals of this act to be met through the control of both point and non-point sources of

	Existing Permit Expiration Date	Scheduled Renewal Date (quarter of year)
American Hoechst	March 1987	3/1989
Bostitch	July 1991	3/1991
Bradford Dyeing	September 1986	3/1988
Brown and Sharp	July 1991	3/1991
Falvey Linen	terminated	
GTE	February 1991	1/1991
Imperial Wallpaper	August 1990	3/1990
Kenyon	September 1988	4/1988
Mobil Oil	June 1990	2/1990
Narragansett Electric (Manchester and South Street Plants)	April 1987	4/1987
Original Bradford Soap	September 1989	4/1989
Pearson	December 1990	4/1990
Raytheon	July 1990	3/1990
RI Forging Steel	April 1988	2/1988
S.A.B. NIFE	terminated	
Tupperware	December 1990	4/1990

Source: RI Department of Environmental Management. State of the State's Waters, 1988.

**Figure 4. Major Industrial Discharge Permits in Rhode Island**

pollution." The Act authorized federal financial assistance for the implementation of state Non-point source Pollution Programs (NPSPP) and encouraged development of State Clean Water Strategies (SCWS). This NPSPP and SCWS for Rhode Island is considered in the next section which deals with ongoing planning and policy developments in the last two years.

#### Related Planning Initiatives and Reports

The Greenhouse Compact of 1984 was an attempt to create a comprehensive long term industrial policy for Rhode Island, based on the concept of public/private sector partnerships. Funds would go to "greenhouses"; special projects and groups that would take the lead in commercializing new ideas. A massive public education campaign was undertaken to explain the implications and seek support for a far reaching policy, which had already been endorsed by state legislators. The sponsors insisted on obtaining a demonstration of public commitment through a referendum on the planning package, which among other aspects, would include special taxes to fund part of the proposals. Despite these efforts to promote what many considered to be a well thought out and innovative policy devised by an independent body, the proposal was narrowly defeated. A major issue was whether a state could or should carry out an industrial policy by investing in selected industries with high-growth potential. The compact was thought to be a planning model for the future, especially as a means of involving the public in an endorsement process. However the public had not been involved during the planning process, in contrast to the approach frequently used in Rhode Island to prepare environmental plans. Few people saw a clear link between the plan and a common economic future for the state. Although the plan placed little emphasis on environmental protection, the process involved was certainly a unique approach to planning, though it failed to achieve its goal.<sup>(13)</sup> Nevertheless, Rhode Island and other states have carried out some recommendations of the Greenhouse Compact.

The Blackstone River Valley National Heritage Corridor (NHC) is another example of a departure from traditional planning concepts. After several years of planning by the National Park Service and the States of Massachusetts and Rhode Island, in 1986 Congress established<sup>(14)</sup> the NHC, as recognition of the valley's historic past and national significance. The National Park Service was directed to work within existing state structures and with a nineteen member NHC Commission, to establish a new model for partnerships between federal, state agencies and local communities. The goal of this cooperative, multi-jurisdictional effort was to promote the conservation of significant resources along a greenlined corridor encompassing forty miles of river, twenty local communities and two states.

Although the Commission had no power, it is taking a leading role in guiding the project. Reports, plans and studies were called for and a public planning process was adopted to develop plans, designed to complement those of the states. An Action Agenda was included as an implementation tool of the project, supported by annual work plans and evaluations intended to integrate actions to achieve harmony between preservation, recreation and development. Actions are tied to funding availability provided by the federal government, state bond issues and private donations. The plan is still in the early stages of implementation and although improved water quality was not a specific goal, public involvement in planning has exerted indirect pressure to maintain water quality improvements. It is apparent that the integrity of the river system has been seen as the common link throughout the corridor, with the single river basin being an ideal unit for planning and management.

The State Guide Plan (SGP) is the responsibility of the Division of Planning and serves as a guide for the physical, social and economic development of the State and provides for its long range development. All planning studies are coordinated with this Guide Plan which is updated to provide an essential planning framework for the State. The water quality element of the Plan is designed to contain impacts from the most recently adopted studies and newly developed plans must be consistent with certain requirements of the State Guide Plan. The SGP thus represents a form of central repository for a full scope of State goals, policies and plans. Inter-agency differences of perspective and major decisions are resolved through the State Planning Council. Recommendations from the SGP reflect State policy to be acted upon, with legislative support if necessary.<sup>(15)</sup>

Many other reports and assessments relating to water quality have been produced by academics, agencies, Commissions and Task Forces in the past and are considered too numerous to be addressed individually in this paper. Of particular significance is the DEM's annual Water Pollution Control Program Plan and biannual report to Congress entitled *The State of the State's Water*, which are reviews of past accomplishments and future priorities relating to pollution abatement and monitoring programs, as well as indicating the current status of water quality. Such documents provide the planner or researcher with much valuable information and an inventory of those referred to in the production of this paper is contained at Appendix VI.

#### Governor's Task Forces, Commissions and other State Agencies

Another state arrangement which has had an important impact on state governance is the Governor's Commission or Task Force. These temporary organizations usually have been created as a result of problems becoming serious enough to be forced on the political agenda, requiring a special effort to study the problem and recommend solutions. Senior agency staff or consultants are assigned to prepare briefing papers or special reports. Direction is then given to state agencies to implement corrective actions, as well as to the General Assembly to enact legislation and provide for financing as appropriate. Recent

examples of such arrangements relating to water quality management are: The Governor's Technical Committee on Narragansett Bay and the Coastal Zone (1970) which led to the creation of the CRMC; the Environmental Task Force (1976) which resulted in the formation of RIDEM; the Sewage Facilities Task Force (1980) which was instrumental in accelerating construction and improving management of the Providence POTW at Field's Point; and the Environmental Quality Study Commission (1988) whose findings will be discussed later. These commissions appear to have had a positive impact, by assembling a diverse group of important actors in a setting away from the normal routine to give the discussions a broader focus and diminish political bias. Solutions are usually presented in the form of options prepared by staff which form the basis for discussion and debate. Negative aspects of this approach include the delay that is automatically introduced while the results of studies and findings are awaited, and the possible loss of continuing political and public impetus if the members lack the ability to get their proposal adopted.

Two State Commissions that are a permanent part of state governance, are the Blackstone Valley District Commission (BVDC) and the Narragansett Bay Commission (NBC) created respectively in 1948 and 1980 as semi-autonomous regional bodies, to manage and operate POTWs. The BVDC operates the Bucklin's Point POTW in East Providence and the NBC is responsible for Field's Point POTW in Providence as well as the intercepting sewers and CSOs. Both agencies were formed as a result of planning recommendations, which reflected the failure of municipalities to implement pollution abatement programs, generating crises which needed urgent resolution. Although regulated by the State, NBC is a public corporation which may generate revenue bonds to support capital improvements, and user fees for current operations, thus offering some flexibility in policymaking and planning. BVDC, on the other hand, being State funded, must rely on state bond issues for capital improvements and user fees for operations; thus limiting flexibility for long term planning, and encouraging short term crisis management.

Other agencies that have become involved in water quality management are the Resource Conservation and Development Council and the Soil Conservation Service under the U.S.D.A. As non-point source pollution became associated with land-use the responsibilities of these agencies for erosion and sedimentation control inevitably required integration with the work of DEM and CRMC. Subsequently the Soil Conservation Service and the Conservation Districts have played an active role with landowners and rural communities in addressing aspects of non point pollution.

### (3) Local Governance

At the local level, governance becomes the responsibility of the City and Town Councils who have traditionally been responsible for wastewater management. Although these municipalities possess police powers for protection of public health, safety and welfare and have significant site-specific knowledge of community problems and needs, they generally rely on the State for the establishment of environmental protection regulations. Within municipalities, State law permits the establishment of Conservation Commissions to advise the councils and boards on the wise use of the communities' natural resources. They do have a potential for focusing on pollution abatement and 36 of the 39 municipalities have established conservation commissions. These are voluntary in nature and a wide variation exists in their level of activity and influence. The major sources of pollution, such as POTWs, CSOs and certain non-point sources are often the direct responsibility of a municipality, which is in turn constrained, directed or guided primarily by State policy, plans, regulations and enforcement.

Publicly Owned Treatment Works	Date Submitted	Date Approved
Blackstone Valley District Commission (Bucklin Point)	March 1983	September 1983
Bristol	May 1983	February 1984
Cranston	March 1984	September 1984
East Providence	February 1982	September 1983
East Greenwich	September 1982	October 1984
Newport	July 1984	March 1985
Narragansett Bay Commission (Field's Point, Providence)	August 1983	September 1984
RI Port Authority (Quonset Point)	April 1986	September 1986
South Kingstown	January 1983	September 1984
Warwick	June 1983	February 1984
West Warwick	May 1983	September 1984
Westerly	January 1982	March 1985
Woonsocket	October 1983	March 1986

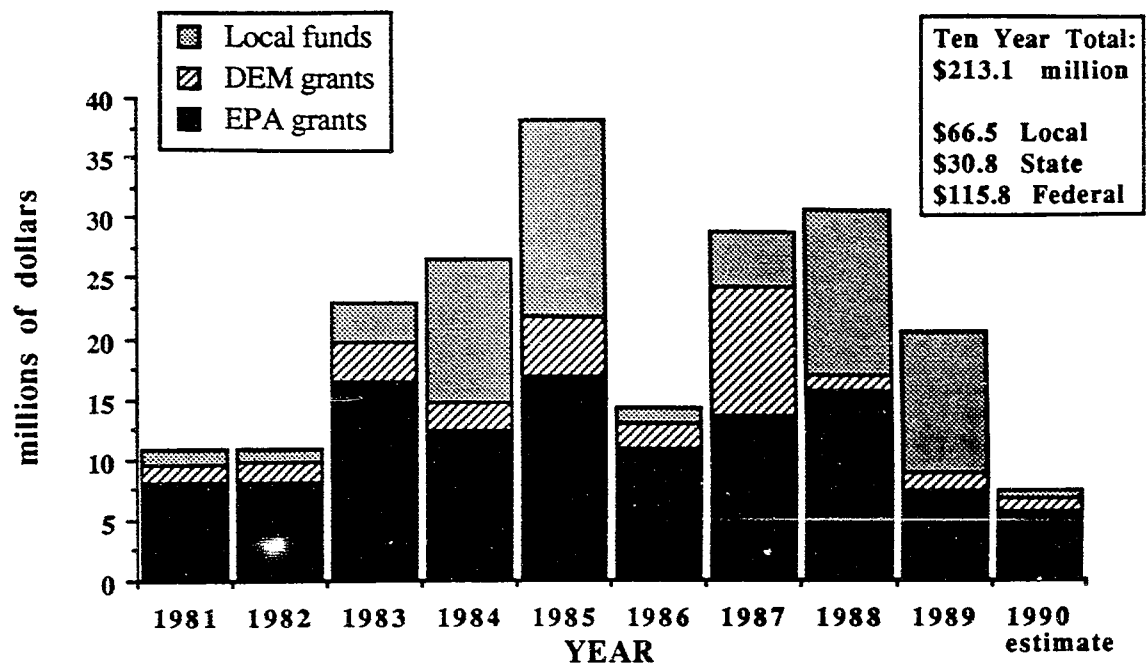
Source: RI Department of Environmental Management. State of the State's Waters, 1988.

**Figure 5. Approval of POTW Industrial Pretreatment Programs by the RI Department of Environmental Management**

The primary water quality planning effort at local level is directed towards facility planning and pretreatment programs. A municipality or regional authority requiring federal and state funding must first prepare a facilities plan, which is a preliminary engineering study. Detailed design plans and specifications are then forwarded to the state agency RIDEM (Division of Water Resources) for the assignment of priority for funding, once the plan is reviewed for constructability by the Army Corps of Engineers.

Pretreatment programs are derived from the NPDES and are required by regional or municipal POTWs having a capacity in excess of 5mgd; in order to regulate industrial discharges to the individual facilities. Without pretreatment, industrial discharges can harm the physical or biological workings of a plant and pollutants may well pass through untreated, into receiving waters. Thus POTWs may be delegated authority to implement and enforce the regulations developed by EPA and now incorporated in the State Pretreatment Plan. The first three POTW programs were granted approval in 1984. Subsequent legislation has been enacted to permit a further 10 programs to be initiated (Figure 5). RIDEM oversees the programs, conducts audits and inspections and assists with technical guidance or help as appropriate.

Local municipalities have always had a primary responsibility for constructing as well as controlling the installation for sewers and storm drains as part of their responsibility for regulating the use of land. This authority is granted to the cities and towns by the state zoning and subdivision enabling acts, which specify the purposes for land use controls and describe what actions are permissible. Zoning ordinances divide the land into districts and specify permitted uses. The subdivision enabling act provides the authority to adopt platting rules and regulations and to ensure compliance although a significant loophole exists relating to frontage lots, which can impact on water quality. Thus municipalities



Source: Alan Gates, RI Department of Environmental Management, Division of Water Resources

**Figure 6. Construction Grants Funding in Rhode Island, 1981-1990**

have had significant powers to influence pollution abatement, particularly relating to non-point sources, but until very recently, little has been done to approach land use planning from an environmental protection perspective. Recent innovations are discussed in the Ongoing Policy Development section of this paper, under Land Use 2010.

#### (4) Financial support to water quality management

It is estimated that since 1947 over \$300 million has been allocated on capital improvements of sewage systems and treatment projects in Rhode Island. The primary sources of funding for pollution abatement have been from federal construction grants, state bond issues and local funds. The proportions contributed in these cost-sharing ventures have varied over the years, depending on the level of federal involvement and willingness of voters to approve bonds (Figure 6). Past grants have been dedicated to the reduction of point source pollution, such as construction or updating of POTWs and sewers, and in the 70s the federal Clean Water Act (CWA) was the major funding source for planning, designing and construction of such facilities. A state priority determination system was developed for allocating available funds with resultant recommendations being forwarded to the EPA regional office for final decision.

The list at Appendix II includes all the Construction Grant Projects from 1977 to the present day. However, this program will be terminated in 1990 and all federal assistance for POTW construction will end in 1994. A transition program authorizes federal appropriations from FY'89 to FY'94 to capitalize a State Revolving Loan Fund to address construction needs in perpetuity, permitting federal and state funds to be set aside for low-interest rate loans.



Rhode Islanders have a long history of supporting state referenda for the sale of general obligation bonds for pollution control. Bond issues have been supported for funding pollution abatement measures in five of the last ten years. In contrast, referenda for funding of local pollution control measures, such as the extension of sewers, appear to be less successful. The success of the statewide initiatives is related to the public awareness of vocal environmental groups and their presentation of issues state and region wide. Specific local projects are more likely to impact only a relatively small group of residents who thus prefer to see state-aided pollution control projects where funding is shared by the larger state community.

(5) A case study of state-local relationships in bay pollution control: The Field's Point Wastewater Treatment Facility

State officials began observing operational difficulties at the Field's Point Wastewater Treatment Facility as early as 1970 but were unsuccessful in persuading Providence's Mayor Dorley to take corrective action. The city did agree to undertake a facility planning effort in 1973. However, it focused primarily on the problem of infiltration of surplus fresh water into the aging sewer system, and the problem of combined sewers, which discharged a mixture of raw sewage and street runoff to nearby rivers from 65 overflow relief points throughout the city.

The neglect of proper operation and maintenance at the Field's Point facility resulted in continued weak performance through 1975, the year newly elected mayor Vincent Cianci began his term. A city workers strike in February 1976 was followed almost immediately by consistent permit violations at Field's Point. This performance failure triggered enforcement action by the State. In August 1976, the State Department of Health notified the city of its intent to sue over the violations. Initially, the State was planning to take action under its own enforcement procedures, which required a demonstration that actual pollution to the estuary was occurring. But since making such a case was technically not possible, the State turned instead to the Environmental Protection Agency, which reluctantly agreed to take a Clean Water Act enforcement action against Providence. The City of Providence signed a consent decree with EPA and Rhode Island in 1977 which committed it to seeking funds immediately to restore normal operations to the wastewater treatment facility, to undertake a facilities planning study specifically addressing the need to upgrade the Field's Point station, and to complete remedial work by June, 1978. Moreover, city voters approved an \$8.5 million bond issue to finance the needed improvements in June 1977.

Early in 1978, the city hired the consulting engineering firm of Charles Krasnoff and Associates to oversee six separate contracts related to restoration of operations. It subsequently became apparent to all parties that the original deadline to complete repairs, restore normal operations and move ahead with a major rehabilitation by June 1978 was unrealistic. The State and EPA agreed to a revised consent decree in October 1978 which set a deadline of November 1979 for the City of Providence to begin complying with its federal wastewater discharge permit.

A series of events took place in early 1979 which transformed the situation at Field's Point from a confrontation between state and local authorities being handled according to the enforcement rules of the Clean Water Act and EPA regulations, into a major problem of statewide citizen concern and political salience.

In the early months of 1979 "Greaseballs" began appearing along the shore of the Seekonk and Providence Rivers and Upper Narragansett Bay. The deposits of greasy organic

material and sewage solids directly affected a large number of residents and received considerable publicity. These deposits were also seen along the shores of Mount Hope Bay. Suspicion existed that the greaseballs were caused by workers cleaning tanks at the Field's Point treatment facility, which had ceased treatment altogether during this procedure. State officials, on the other hand, believed that the greaseballs resulted from vigorous flushing of the combined sewers, and heavy rains, which resuspended a thick layer of deposits within the sewer that had accumulated during the previous dry years.

The greaseball episodes led to the rediscovery of the Field's Point situation by the press, rapidly expanding the number of people aware of the decade-old dispute between State and local officials. In addition, the episodes became important enough that the Director of the Department of Environmental Management prepared a special report for the Governor on March 20, 1979.

On August 7, Governor J. Joseph Garrahy announced that he would appoint a broad based task force of prominent leaders to study ways to speed the pace of upgrading wastewater treatment facilities in Providence. The panel was given a deadline of February 1, 1980 to report its findings in time for the next session of the State General Assembly. Tom Breukner, who was a principle author of the 208 Plan, led the effort of the Office of Statewide Planning to provide technical assessments of issues and options.

The Sewage Facility Task Force focused on identifying new sources of funding, and the question of how an accelerated project would be implemented. A detailed financial analysis carried out by the Governor's budget office determined that the state could afford to pre-finance the rehabilitation of the Field's Point wastewater treatment facility as well as construct two of the nine combined sewer overflow treatment facilities proposed in the Providence 201 Facilities Plan.

A management alternatives study prepared by the Office of Statewide Planning reviewed the five options it had originally identified in the 208 Areawide Water Quality Plan:

1. Retaining current city management under its Department of Public Works.
2. Creating an independent city authority.
3. Combine the sewage treatment operations with the successful Providence Water Supply Board.
4. Expand the Blackstone Valley District Commission to encompass Providence.
5. Create a new state level authority.

The Final Report of the Task Force recommended accelerating the construction of facilities at Field's Point and creation of a state/regional authority based on the model of the Blackstone Valley District Commission. This new agency would take responsibility for the combined sewer overflows and interceptions, but not lateral sewers, and implementing industrial pretreatment program. It also urged that additional municipalities be given the option to join the authority, and recommended that "future consideration be given to merging the Blackstone Valley District Commission and the proposed authority into a single Upper Bay sewer agency."

Although the Field's Point plant was put back on line at a ceremony attended by Mayor Cianci on November 19, 1979 it consistently failed to comply with its interim permit requirements until the following June. Joined by Save the Bay, the State and EPA returned to federal court. On May 2, 1980 the city was found in contempt of court and given a 90-day grace period to achieve compliance. This occurred just three days before Mayor Cianci formally announced his decision to run for Governor on May 5, which was followed on May 16 by the General Assembly's approval of the Sewage Facility Task Force proposal

by putting a referendum on the November ballot to create the Narragansett Bay Commission and provide it with \$87.7 million in bonding authority. On September 19, the U.S. Attorney announced a fine of \$882,500 against the City. Plant performance improved during the summer of 1980 but worsened just before the election. The result on November 2 was that Governor Garrahy won re-election by a 3:1 margin over Mayor Cianci and the Narragansett Bay Commission was approved by a 2:1 majority, winning in all but four of Rhode Island's 39 communities.

### C. ONGOING POLICY DEVELOPMENT (1988/1989)

The impact of federal policy as expressed in the Clean Water and Coastal Zone Management Acts and the resulting policy plans and programs created at the state and local levels have continued to highlight the depth of public concern for environmental quality. Many initiatives begun ten to fifteen years ago are only now bearing fruit. The concern about non-point source pollution has been given greater credibility by improved scientific knowledge and the realization that the success in controlling conventional pollutants from point sources is not always sufficient to achieve water quality standards. This historical review has so far concentrated on the major events, organization changes and policy development which occurred prior to 1988. This next section will attempt to review the recent policy and activities of the major agencies currently involved with water quality management and pollution abatement, and will include where possible a projection of actions slated to be taken within the next five years.

#### Rhode Island Department of Environmental Management

Major tasks confronting DEM during the past two years, originating from the requirements of the Continuing Planning Process of the WQA of 1987, were the production and implementation of the Non-Point Source Management Plan (NPS) and the State Clean Water Strategy (SCWS). A Water Quality Advisory Committee was organized by DEM as a tool to provide inter-agency coordination and public participation in the preparation of both NPS and the SCWS Plan.

Although relying primarily on existing state programs and resources, it is expected that federal funds will be available to support the implementation phase until at least 1992. The NPS Plan identifies non-point source categories requiring actions including urban and rural runoff, ISDS pollution, road de-icing practices, marinas and recreational boating; however it omits CSOs and landfills as being addressed by other State plans and programs. Control measures and management approaches are specified for these sources as well as the outline of a framework for State and local co-ordination. A procedure was developed prioritizing state water resources identified as threatened or impaired by NPS pollution, which is significantly more sophisticated than earlier systems such as the one used in the 208 Areawide Plan adopted in 1979. This NPS Management Plan included recommendations to co-operating agencies, a four year implementation schedule and a plan for supplemental state funding. The plan and associated program is considered to be one element of the State's Clean Water Strategy which is intended to integrate control of all sources of water pollution.

The State Clean Water Strategy has been drafted but has yet to be published or approved and is presently in the public notice stage. It is described in the Introduction as: "an open and integrated three stage process of waterbody/resource assessment, water resource targeting and strategies management planning, undertaken within the framework of the climate of rapid land development and tight fiscal budgets occurring at the present time in the State." The document covers three areas of environmental concern: toxics problems (mainly point source issues); non-point source problems; and groundwater issues; and the strategy is divided into three parts to reflect this. The same system of prioritization and targeting that was developed for the NPS Management Plan has been used for both point and non-point sources, and a preliminary schedule of expected future tasks/work plans over the next four years is included. The Water Quality Advisory Committee played a major role in the development of this Strategy, which is intended to provide continuity with the NPS Management Plan.

Major Permit Reviews are an ongoing responsibility of DEM. Greater emphasis is being placed on ensuring minimum environmental impact from discharges to surface water and

that where necessary more stringent water quality based limits are developed. The renewal of permits is providing the opportunity to upgrade the quality of wastewater discharges. A new policy is being implemented for all major POTWs with chlorination, which are now required to perform pre-and post-chlorination bioassays.<sup>(16)</sup> The requirement for dilution studies is being added where needed, especially for marine discharges, to permit site-specific permit limits and water quality criteria. Wasteload allocations have been developed for the Pawtuxet River and are being considered by the Narragansett Bay Commission for the Providence River.<sup>(17)</sup> A list of major permits and their expiration dates is contained in Appendix III and it is apparent that some of the major discharges are overdue for renewal. However, with the exception of Newport (due 1990), and R.I. Port Authority (due 1992); all POTWs in the State have been upgraded to secondary treatment.

State Revolving Loan Fund and Aquafund. As stated earlier, federal assistance for municipal POTW construction will terminate in 1994 and a transition program authorizes a State Revolving Loan Fund. Federal funds are to be set aside to provide low-interest rate loans for upgrading of facilities and the State is required to pay a share to participate in this federal program. The interest and pay-back of loans is expected to provide funding for future projects. A limited amount of these funds will also be eligible to support efforts to control NPS. Planning projections show \$67 million available for Rhode Island<sup>(18)</sup>, and although state bonds will still be required, the Revolving Fund could provide a greater element of state independence in the allocation of finances. Another recent source of funding is the Aquafund, which is based on a \$15 million R.I. State Bond approved in 1988. An Aquafund Council was formed in 1989 to advise the Director of DEM on the distribution of funds, which are available for water pollution control efforts. At present the majority of the fund has been allocated to wastewater treatment (\$8 million) and urban runoff control (\$3 million).

Land Use 2010. The Division of Planning has a very significant role to play in the coordination of all state planning and is one of five divisions of the Department of Administration. As concerns have shifted towards NPS pollution and connections made with local land-use planning, the Division's ongoing land use policy has become more relevant to water quality management planning. This policy has been recently updated under the title Land Use 2010, which was incorporated in the State Guide Plan in June 1989. The Plan's systematic data base provides a foundation for future planning and statewide patterns for comparison. In 1988 the Comprehensive Planning and Land Use Regulation Act was passed by the State legislature and required all communities to update their comprehensive plans by December 31, 1990. Land Use 2010 is designed to provide guidance to those communities and could have a major influence on local decisions. Its clearly presented material and excellent associated use of computer mapping could provide a framework for reinvigorated land-use planning and a heightened awareness of non-point sources of pollution, at the local level. The Act also gives authority to the State to impose planning on a non-conforming municipality, which may provide additional impetus for local level comprehensive land use planning.

Harbor Management Planning. In 1988, CRMC initiated the Rhode Island Harbor Management Project, calling for the establishment of Harbor Management Plans (HMPs) in each of the twenty-one coastal communities. The HMP was to be a comprehensive municipal program to include a management program for the most desirable uses of the individual harbors, consistent with CRMC's own Management Plan. It was originally intended that HMPs should be completed and approved by CRMC by January 1, 1990 and incorporated into the Comprehensive Land-Use Planning legislation and associated programs and funding. Several towns have submitted draft HMPs and await approval, but

it is unlikely that all coastal communities will be able to comply by the end of 1990 and little co-ordination appears to have taken place with the land-use planning efforts so far.

The Environmental Quality Study Commission (EQSC) was created in 1988 with the following powers and functions:

1. To study and make recommendations on the most effective staffing, budget and resource allocation, organization process and structure for managing and protecting Rhode Island's environment.
2. To study and make recommendations as the most effective structure and procedures for adjudicating environmental matters and for making decisions on contested permit cases.
3. To study and make recommendations as the most effective means of siting and permitting needed waste disposal and treatment facilities.
4. To make recommendations regarding the effective allocation of environmental regulatory functions within the various agencies and departments of state government.
5. To compile recommendations not later than January 15, 1989 (subsequently extended to November, 1989).

Twelve members were appointed, eight from government and four public members, and the final report was released in February 1990, after public review. The most important of its conclusions, in terms of Narragansett Bay governance, was the proposal to create a Department of the Environment, DOE, with six branches. The Director would control the activities of Policy and Planning, Administrative and the Information/Education Branches. Independent Commissioners would head the Environmental Protection (regulatory), Environmental Management (non-regulatory) and Coastal Resources Management Branches. A permanent Narragansett Bay Project office would be located within the Policy and Planning Branch. The Director's relationship to the three Protection and Management Branches would be as a coordinator, in developing new policies and as an advocate in regulatory and adjudicatory actions.

This proposal was being considered by the Rhode Island General Assembly in its 1990 season. Public, political and financial support will be required to ensure implementation of these recommendations, as well as those of the many other plans currently under preparation and the current state fiscal climate cannot be considered as a very optimistic signal.

Narragansett Bay Commission (NBC) CSO Policy Although in 1982 NBC inherited the well known problems relating to the Providence area CSO discharges, and parts of a CSO study initiated in the 70s, very little progress has been made in actually allocating the substantial sums of money required to carry out CSO mitigation. (See Construction Grants 1977-1988 at Appendix II.) NBC modified the recommendations made to the city of Providence by consultants in 1979. The preliminary reports for all sub regions of its service area are due for completion in 1990, at which time the results of the area studies will be given to a team at URI to evaluate; who will then carry out a major program of wet weather measurements of the effects and amounts of CSO pollution and develop a computer model of the entire combined sewer system. NBC's Capital Improvement Program has allocated over \$3 million to engineering studies and estimates for design and construction costs are in excess of \$100 million. The implementation of the results of this study, due to be completed in 1991, could have a dramatic impact on pollution abatement and help to mitigate CSOs, thought to contribute 1.7 billion gallons per year of raw sewage entering the streams and rivers that flow into the Bay.<sup>(19)</sup>

The Narragansett Bay Project (NBP) is sponsored by the US EPA and RI DEM, and was formed in 1985 to administer and finance a five year study of Narragansett Bay and its resources, with a mandate to assess trends in water quality, natural resources and uses of the Bay. The NBP relies on a variety of advisory committees, which represent federal and state agencies, the academic community and local special interest groups, to make decisions about research directions, budgets and management alternatives. Based on the results of research, it is to develop a Comprehensive Conservation and Management Plan (CCMP), by December 31, 1990, designed to improve and protect the Bay. The NBP has commissioned and financed over 70 reports, which should add an invaluable amount of information and scientific data, much of which is now being synthesized to assist in the refinement of assessments and trends in the water quality of Narragansett Bay, which in turn will provide a foundation for the CCMP.

As the results of reports and programs become publicly available, recommendations for corrective actions are made and a long-term Bay monitoring plan is being developed. Useful experience is also being gained on the use of a computer software mapping system, ARC/INFO, employed by the Rhode Island Geographic Information System (GIS), which is expected to have a significant role to play as a management tool for planning. What is not yet clear from the projections of state agency planning is how the CCMP will be integrated with other State and local planning efforts. In the current atmosphere of fiscal crisis, the timing and methodology of presentation may become critical if the window of opportunity is to remain open.

Save the Bay (STB) is an organization which should also be considered in ongoing policy development. As a non-profit organization representing the environmental concerns of the public since 1971, STB has grown increasingly powerful in both numbers and political influence. In the past year, membership has grown by over 20 percent to nearly 15,000 and since 1984 the budget has increased from \$150,000 to over \$900,000.<sup>(20)</sup> STB has instituted a number of environment-related projects, workshops, studies and in some cases law suits over the past few years and it is clear that the organization has the support of many influential persons and other citizens groups. Recent initiatives include a project for improved water quality conditions in Mount Hope Bay, a law suit against a developer who provided inadequate sewage treatment facilities for a community, public opposition to the method of funding of a Bay pipeline project contained in a bond issue referendum (which subsequently failed to receive voter approval) and regular and often vocal attendance at public issue hearings related to pollution abatement and water quality management. Projections for the future indicate increased vigilance and action by STB which has already become a political force that should be included into the decision making process where public participation is desired or mandated.

#### D. THE GOVERNANCE CHALLENGE FOR THE 1990S

The increased interest in evaluating and refining Bay Governance policies and institutions in the late 1980s is in part a natural response to the maturing of programs whose origins lie in the early 1970s. It also reflects the need to respond to the changed federal situation in pollution control funding, which will return the fiscal burden completely to state and local governments by 1995, just where it was prior to 1965. This is happening during a period of economic slow down and fiscal crisis in Rhode Island. As Part II of this report indicates, a great deal has been accomplished during this period, but some of the most difficult tasks remain, including combined sewer overflow collection and treatment, storm water and non-point source, controls and managing inputs from watersheds and rivers.

During the past five years, publicly funded pollution control projects have had to meet more stringent approval criteria in terms of demonstrating beneficial impact or receiving water quality. The implication for Bay governance is clear: the state must have the capability for accurately evaluating the beneficial impacts of proposed pollution control actions. The scientific and technical tools which will make this possible are currently being developed by the Narragansett Bay Project and other agencies and organizations. An important side effect from the public's perspective will be the increasing ease of knowing the status and accomplishments of pollution control decisions. This will place an even greater responsibility on State and local agencies to ensure that their pollution control strategies leading to measurable results. Public debate over the trade-offs which must be made in pollution control will probably be heightened during the 1990s as more information is made available on what it will take to solve certain problems or prevent others, as well as the high costs of achieving these desired results.

The Plan for restoring and protecting water quality in Narragansett Bay to be carried out over the next five to ten years is of vital interest to Rhode Islanders and Narragansett Bay users. Designing a pollution control strategy, securing financing and assuring that all vital elements are implemented in a timely manner will require an unprecedented degree of collaboration, coordination and participation by the large number of groups with an interest or responsibility for Bay pollution control as shown in Figure 7. This will not happen unless the energy, resources and capabilities of these agencies are focussed on Narragansett Bay. The Comprehensive Conservation and Management Plan now being prepared by the Narragansett Bay Project is the one remaining opportunity in this century for mapping out State and local efforts toward Bay pollution control and prevention. Without such a road map it is almost certain that pollution control efforts will remain fragmented, surrounded in confusion and uncertainty and embroiled in painful controversy.

The current effort to put Narragansett Bay in the spotlight as a major program area for the state over the next decade must assert its identity in a more complex and mature institutional setting than existed even as recently as a decade ago. This in contrast to Governor Garrahy's Sewage Facilities Task Force which operated for less than six months in 1979 in an atmosphere of urgency and controversy, built upon available data and proposals to set a solid course for the 1980s with the creation of the Narragansett Bay Commission. Indeed Governor Pastore accomplished an equally dramatic result in the late 1940s by his immediate follow up on the recommendation to create the Blackstone Valley District Commission in order to deal with the gross pollution of the Blackstone, Seekonk and Moshasuck Rivers.

The situation in the 1990s is very different. No single issue or crisis dominates the political agenda. The prospects for major new funding of pollution control are bleak and the remaining tasks on the pollution control agenda are complex to solve and implement. The Environmental Quality Study Commission recommends locating the Narragansett Bay



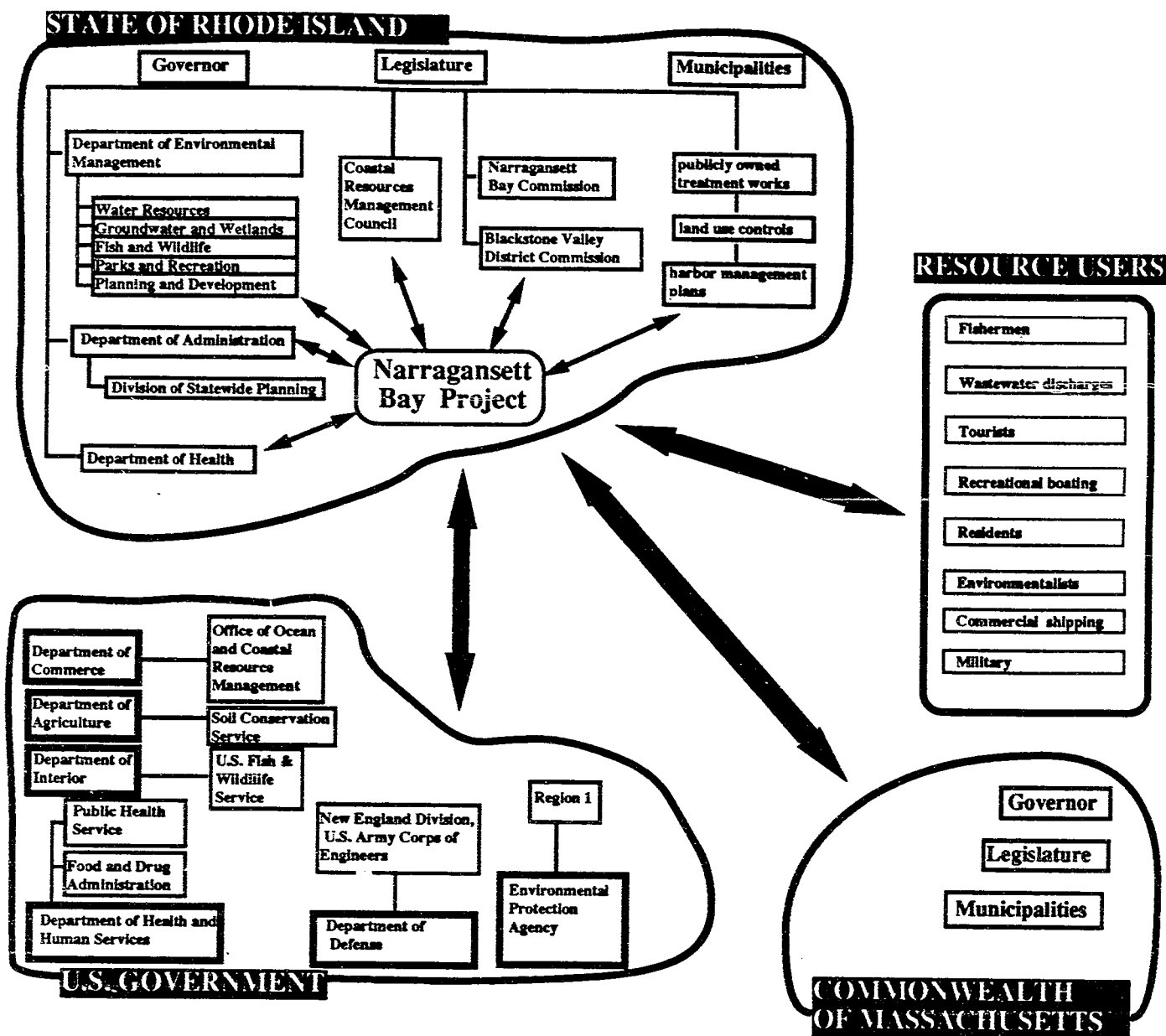


Figure 7 The Role of an Ongoing Narragansett Bay Pollution Control Policy and Program Within the Framework of Governance Institutions and Actors

Project within a newly created Policy Planning Branch of the proposed Department of Environment. This would make the Comprehensive Conservation and Management Plan one of the first efforts of the new branch to directly coordinate departmental policy development and planning functions across many agencies. As Figure 7 indicates, even in the absence of a complete reorganization of the Department of Environmental Management, a permanent Narragansett Bay Project has major roles to play in

- (1) setting the Narragansett Bay pollution control agenda for the 1990s and beyond,
- (2) shaping how government agencies respond to this agenda,
- (3) overseeing and evaluating its progress during implementation,
- (4) serving as a permanent channel for advice and help during the implementation of the plan.

It is essential that EPA and the State continue to fund the Narragansett Bay national estuary program, as has been the case in the Great Lakes and Chesapeake Bay, otherwise there will be no advocate or focal point for the plan within government, nor any Bay-focused evaluation of progress. Equally important is the need to work with resource users, the Commonwealth of Massachusetts and federal agencies to gain the financial resources and cooperation needed for plan implementation, as well as to keep up the pressure and enthusiasm for implementation on the Rhode Island agencies themselves. The stark fact that there is no guaranteed source of funds and the likelihood that many of the important elements of the Narragansett Bay Project will require behavioral as well as policy changes by federal, state and local agencies. This shifts the emphasis in the 1990s from one of administration and routine decision making to advocacy and entrepreneurship in order to increase the likelihood of implementation.

## II. ASSESSMENT OF THE IMPLEMENTATION OF POLLUTION CONTROL EFFORTS IN THREE REGIONS 1979-1995.

Throughout most of the twentieth century Narragansett Bay has served as a unifying symbol of public concern for environmental quality. However the specific programs to control pollution in fact have been designed to address problems specific to a particular part of the bay. For this analysis, the regions have been defined as the Providence River, Mount Hope Bay, and the Upper and Lower Bay. The major sources of pollution are identified in each region, along with; the policies, planning and associated implementation efforts. The outcomes to date of those efforts are then described and assessed for each region. The timescale selected for this analysis is from the introduction of the 208 Plan in 1979, which is believed to be accepted as the foundation for subsequent planning, until 1995, which is as far as most current plans have been projected.

### A. INTRODUCTION

The Providence River Region includes the Blackstone, Seekonk, Ten Mile and Pawtuxet Rivers, which are the major sources of pollution to the Providence River itself. Since records were first taken, it has consistently been the area of primary concern to water quality managers, containing as it does the majority of Rhode Island's population and industry and resultant point source pollution, CSOs, urban related NPS pollution and affected river systems. For the purpose of this regional division the Providence River Region terminates at the southern end at a line drawn between Conimicut and Nayatt Points, where it meets the Upper Narragansett Bay.

The Mount Hope Bay Region includes the area of Mount Hope Bay itself; 70 percent of which is situated in Rhode Island and 30 percent in Massachusetts; the major tributary of the Taunton River; and minor tributaries of the Quequechan, Lees and Cole Rivers. Over 90 percent of the waters entering Mount Hope Bay originate in Massachusetts and have been receiving discharges from POTWs and industries as diverse as textiles, leather, electroplating and speciality chemicals which are situated in Fall River and its surrounding area. Thus Rhode Island has been faced with managing the water quality of an area, whose pollution control policies are determined by another state. Mount Hope Bay is a valuable shellfish resource and spawning area for other fish but has been continuously closed to shellfishing since 1947 due to unacceptable levels of pollution. Mount Hope Bay Region is considered to extend west to the Mount Hope Bridge, where it joins Lower Narragansett Bay.

The Upper and Lower Bay Region includes the remainder of Narragansett Bay, where the transition of lower to higher water quality normally takes place as the distance from the major sources of pollution in the two other regions increases. It thus contains areas in the more northerly parts of the Bay whose water quality will be impacted by temporary increased discharges, such as wet weather CSOs, and thus becomes subject to conditional closure to shellfishing.

In the assessment of progress in water quality management and pollution abatement in these regions, it is essential to recognize the variety of factors which contribute, as well as frustrate implementation, often leading to outcomes that were less than optimal. If a pollution problem existed, was it recognized? If it was, did it reach the public agenda and have a solution that was supported by professional judgement and scientific data? Did it get adequate public, political and administrative support? Was the implementation process carried out on time, and were all the actions needed to solve the problem actually completed? Many of today's programs originated between ten and twenty years ago.

Priority actions were selected based upon the criteria for federal funding, and whether municipalities were ready to act, rather than an idealistic comprehensive, scientifically based program. It is thus difficult to describe and analyze the major actions in a clear and logical manner. In an attempt to establish an understandable framework, the following three criteria were employed in the process of assessment:

- (1) What was the length of time from planned to actual implementation?
- (2) How did scope of the policy compare to the size of the problem?
- (3) What links can be made between the actions taken and the results in terms of water quality improvements?

It is perhaps indicative of the overall situation in Narragansett Bay that simple comparisons of water quality changes over the past ten year period have proved impossible to make, due to the lack of consistent water quality monitoring data over this period of time, and the changes in parameters and methods used to assess conditions in the estuary.

## B. PROVIDENCE RIVER REGION

Since the first modern attempt at water quality classification and identification of problem areas, the Providence River has consistently been the major concern. In his 1946 Report on Pollution of the Waters of the State, Walter Shea wrote: "It is the considered view of this writer that the most vital and pressing pollution problem facing the State today is that involving the waters of Upper Narragansett Bay, the Providence River, and the rivers which enter these waters."<sup>(21)</sup> In 1979, the first major problem identified in the 208 Plan was: "the Providence Wastewater Treatment Facility and combined sewer overflows of Central Falls, Pawtucket and Providence, are the major sources of pollution to the Providence River and the Upper Narragansett Bay, preventing the attainment of fishable-swimmable waters there."<sup>(22)</sup> The worst examples of all four sources of pollution in the State are to be found in the rivers of this region, which provide over 80 percent of the fresh water entering the Upper Bay. Included are the 2 largest POTWs (Field's Point and BVDC), 95 CSOs, the major urban runoff and the most polluted river in the State (Pawtuxet) (Figure 8).

### (1) Point Sources

The major point sources of pollution discussed will be the three major POTWs and industrial discharges. It should be remembered that the vast majority of the early planning and subsequent funding for pollution abatement was dedicated to point sources, in particular for the construction of wastewater treatment facilities.

(a) The Providence POTW at Field's Point (operated by The Narragansett Bay Commission) As described in Section IB5 of this paper, at the time of publication of the 208 Plan, the Field's Point Plant was so inefficient due to years of neglect, that it was virtually closed for a two year period in order for much needed repairs and improvements to take place. In the 208 Plan the major recommendations for Field's Point were:

- to complete the 201 Facilities Plan, which included alternatives of sewer system separation and treatment of stormwater overflows (see the assessment of CSOs below)
- to upgrade the POTW to secondary treatment (estimated cost \$85 million)
- revision of sewer use charges to support operating costs
- development of a pretreatment program
- creation of a new agency that would have responsibility for the Providence treatment facilities.

The 208 Recommendations highlighted the crisis situation and lack of effective administration at the facility.

In 1982 the semi-autonomous NBC finally acquired the Field's Point POTW, still under consent decree, from the City of Providence plus 75 miles of intercepting sewers, 5 pump stations and 65 CSOs serving the cities of Providence, North Providence, Johnston and portions of Cranston and Lincoln. In 1983, after reexamination of the facilities plan, construction began on the further upgrading and rehabilitation of Field's Point POTW and a year later an Industrial Pretreatment Program was initiated. The Pretreatment Program encompassed some 130 electroplating firms and over 100 other industries. The regulations introduced included standards more rigorous than EPA requirements and enforcement and monitoring action was initiated.<sup>(23)</sup> A program review in 1987 led to improved standards and encouraged recycling and re-use of process waters which in turn has helped to produce a significant reduction in overall metal loadings. An important innovation by NBC at the

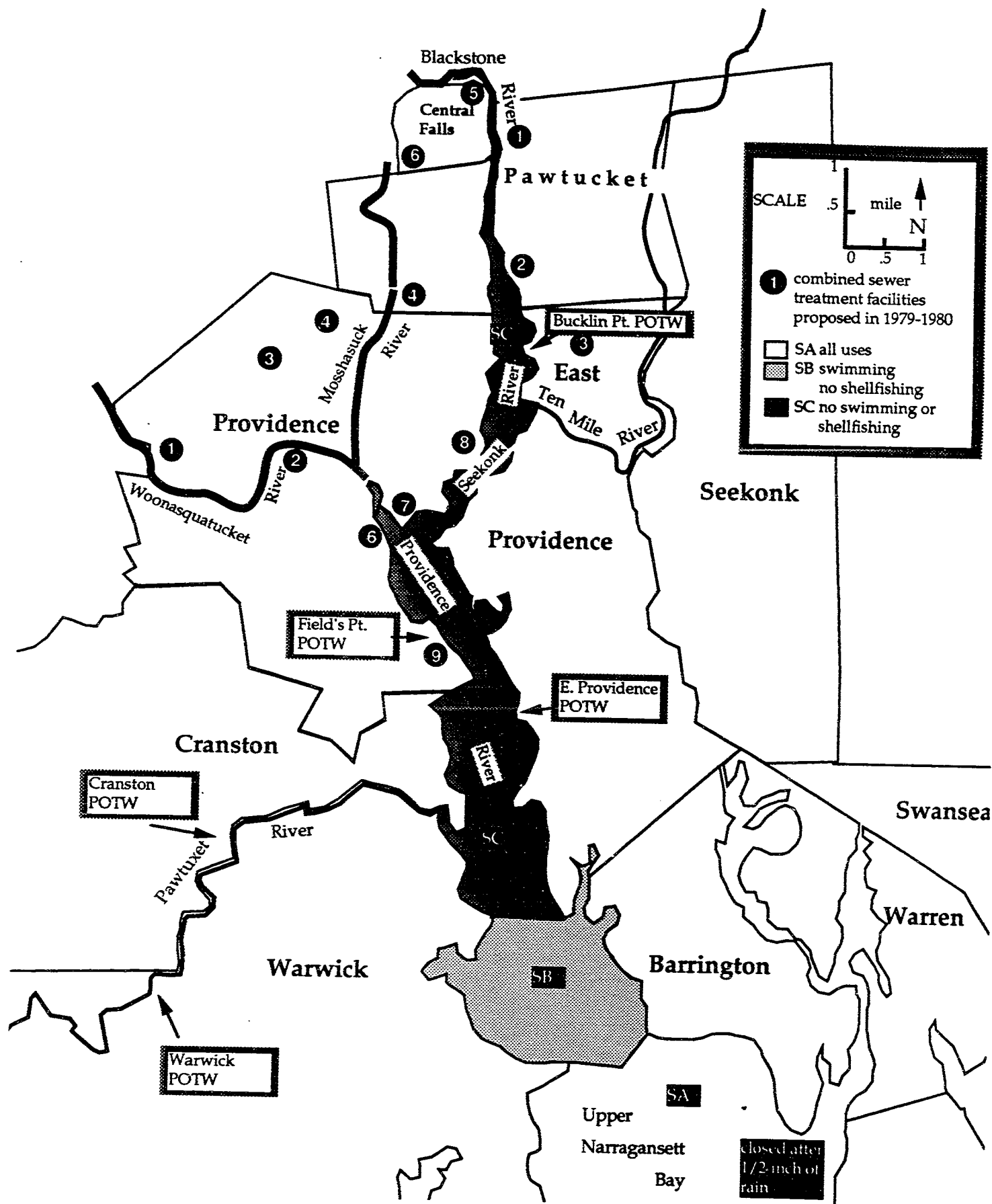


Figure 8. Providence River

same time was the introduction of a Water Conservation Program, which made the link between water supply and sewage disposal. The program was based upon a public outreach initiative and was supported by the Providence Water Supply Board, reflecting an interesting change of policy by the supply authority, who in the past had been more interested in selling rather than saving water. The end of 1987 saw the completion of the \$40.5 rehabilitation and new treatment equipment went on-line, followed a year later by the Plant meeting its interim permit criteria, for the first time in many years. However, those criteria related to a permit due to expire in 1984, which has not yet been renewed. A revised permit is currently under consideration, including the more demanding criteria imposed on other POTWs in Rhode Island and a requirement for effluent bioassay, but results of an ongoing study of bioassay limits is being awaited before EPA will approve the new permit. Recent performance indicated that NBC is capable of meeting the new criteria of 30 mg per liter of total suspended solids and five day Biological Oxygen Demand<sup>(24)</sup>.

**Sludge Disposal** Another problem associated with sewage treatment is the disposal of the residue from the processed solids settling and biological treatment; called sludge. This sludge contains organic matter, nutrients, pathogens, heavy metals and other toxins depending on the efficiency of the wastewater treatment process and plant influent characteristics. The standard disposal method in Rhode Island has been to truck sludge to landfills, but concern has increasingly been expressed over possible leachate contamination of groundwater. The 208 Plan dealt with the subject in some detail, and made recommendations that were specific to each facility. In the case of Fields Point the alternative of incineration or composting was proposed. Subsequent restrictions to landfill use imposed by the Department of Environmental Management persuaded NBC to adopt incineration as the preferred method of disposal and an interim solids handling facility for dewatering sludge was completed in 1988. The modified incinerator met required air quality standards in 1989, having been under consent decree to do so since 1982. This will permit the NBC to incinerate its sludge in the immediate future but there will still be a requirement to dispose of the ash. This option is considered by NBC as only an interim solution as more innovative ways to dispose of sludge are being studied, in the belief that better use can be made of this highly enriched material. The studies are to be prepared by six selected contractors who have submitted qualification statements and are due to present proposals in February 1990. Emphasis will be on recycling and re-use.

(b) The Bucklin Point POTW (operated by the Blackstone Valley District Commission) Consideration of BVDC must begin with its creation in 1948 as a result of the Shea Report. Large amounts of money were spent on the plant both in the early 1950s and 1970s, resulting in secondary treatment facilities in full operation in 1973, with a significant improvement in wasteload reduction and water quality improvement shortly thereafter (Figure 9).

At the time of the 208 Plan, BVDC was having problems meeting federal performance standards. In 1980 the plant failed to meet the criteria for eight months of the year and untreated wastewater was regularly being bypassed during rain events (estimated at 263 million gallon in 1983, when the severity of pollution rankings gave BVDC third position).<sup>(25)</sup>

The major 208 Recommendations were:

- to continue efforts to upgrade treatment facilities
- development of a pre-treatment program
- studies relating to CSOs and the combined sewer problems of Pawtucket and Central Falls.

BVDC initiated a pretreatment program in 1981, the regulations for which received approval in 1983. Funding for major upgrading of the POTW was subject to availability and although \$5 million was allocated in 1983 to correct existing problems, subsequently no further construction grant money was allocated until 1987 (\$5.6 million). The resultant upgrade is due to be completed in 1990, but the plant is under consent decree for not meeting the criteria of its current NPD's permit which expired in 1988 and BVDC has thus remained under a consent decree since July 1988 when the CWA deadline for secondary treatment ran out. A new discharge permit was received on October 23, 1989 and is currently undergoing the draft review process. The new permit includes a compliance schedule for elimination of CSOs, which will be discussed later in this paper.

Sludge disposal by BVDC had been carried out on-site but 208 Plan recommendations proposed the investigation of the alternative of regional incineration or composting, as well as more frequent analysis for heavy metals and toxins. A review of sludge composting indicated unacceptably high capital costs and on-site disposal has continued to this day. However, the on-site dump will reach its limit within a year and other options must now be considered. At present, the most likely solution appears to be disposal by incineration off-site, by a private contractor, but initial liaison has taken place with NBC to maintain an interest in the results of the ongoing studies.

(c) East Providence Municipal POTW: is the second plant discharging directly to the Providence River but has never appeared very high in the severity of pollution rankings, despite concern relating to heavy metals and other toxins produced by the many jewelry, electroplating and other industries in the area. In 1979, the facility was operating adequately, but failing to meet its EPA secondary treatment criteria consistently. 208 Recommendations included:

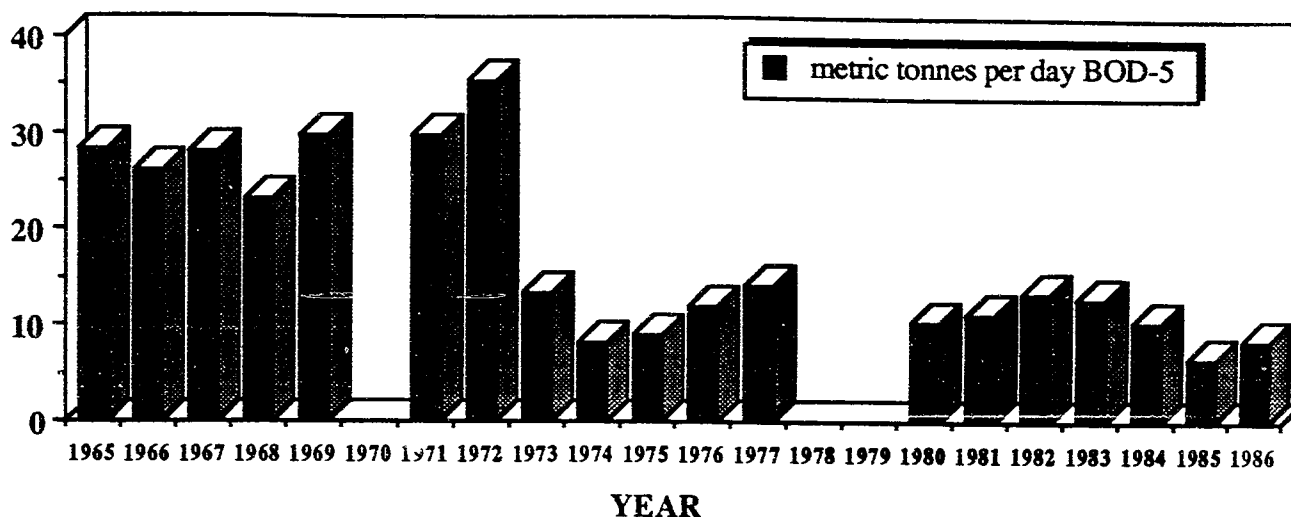
- completion of current sewerage plans to support the entire community, including Barrington, by the year 2000 (85 percent complete at the time)
- development of a pretreatment program
- modify sewer use ordinance to require industry and others to monitor wastewater prior to tie-in to the sewage system
- increased sludge analysis.

A successful pretreatment program was instituted, and although sewer expansion was dependent on fund availability, the sewer system for East Providence is 99 percent complete and sewers for the town of Barrington were completed and now discharge to the East Providence POTW. Sludge monitoring was increased to the required frequency and the sewer use ordinance was subsequently modified.

In the 208 Plan, East Providence had been included in a list of cities that should consider the process of sludge composting and utilization as a cost effective method of disposal. The town of Barrington, which was planned to be joined to the East Providence sewer system, initiated a pilot composting system using sludge from the plant, with technical assistance from the Office of State Planning. After some initial odor problems, and vocal public opposition, Barrington discontinued operation of the composting pilot scheme and sludge is currently disposed of off-site by incineration by commercial contractor.

(d) Chlorination of POTW effluents is another problem common to most treatment plants. In 1979, the addition of chlorine was normally part of the secondary treatment as a disinfection process, but recent studies had indicated that the toxicity of the residual chlorine may have a detrimental affect on aquatic organisms in the receiving waters. The 208 Plan recommended: that POTWs consistently meeting coliform standards should





**Figure 9. Loading of Organic Pollutants (Five Day Biological Oxygen Demand) from wastewater treatment facilities to the Providence River**

reduce chlorine residual to the minimum required; that a test case be established; and that six existing POTWs discharging to fresh waters install dechlorination equipment for Summer use. The proposed test case was never carried out for fear of infesting shellfish, but a study to determine toxicity of chlorinated effluent was funded in 1988 by NBP. At the same time, DEM completed, and is now implementing a draft chlorine policy which would include chlorine toxicity considerations in the re-issue of permits. Four of the six towns discharging to freshwater bodies implemented Summer dechlorination programs and the remaining two, Woonsocket and Smithfield, will be required to comply when their current permits are due for renewal in December 1990.

(e) Major Industrial Discharges represent the other major point source pollution and in 1979 no less than 3,100 industries in Rhode Island were identified<sup>(26)</sup> as affected by the pretreatment standards promulgated by EPA. The 208 Plan recommendation was that each community with a POTW flow of over 5 million gallons per day, should amend sewer use ordinances to include pretreatment requirements, which was to become a criteria for NPDES permit renewal. The first authorities developed pretreatment programs in 1983 and '84. In 1987 the State Wastewater Pretreatment Program<sup>(27)</sup> was passed, authorizing municipalities to implement and enforce their own programs.

The issue of pretreatment over the past ten years has seen the transfer of responsibility from federal to state and local level, but it is still in transition. In 1984 DEM inherited the responsibility for permit issuance to direct dischargers; development and enforcement of the State Pretreatment Program; and act with EPA to oversee local programs. Local authorities have been developing their own programs with site specific standards and although all POTWs in this region now have pretreatment programs, their quality and level of enforcement is varied, making the outcome difficult to assess at this early stage. There are relatively few direct industrial discharges to the Providence and Seekonk Rivers and their tributaries, since wastewater collection systems have been in existence in this part of the State for many years, thus the major problem of industrial discharges still relates to the POTWs, and becomes particularly acute when rain events cause discharges through CSOs.

(f) Summary

At the time of introduction of the State of Rhode Island Water Quality Plan (208 Plan) in 1979, the Providence POTW was in a crisis situation, despite its recognition as the major point source of pollution to the Bay for over forty years. The formation of a semi-autonomous commission (NPC) combined with political and financial support, gave the POTW a new lease of life which has resulted in significantly improved treatment and operations of this major source of pollution.

BVDC appears to have experienced a period of success in the mid 1970s when the results of the Shea Plan, which had been backed by financial and political support, became evident in improved water quality; nearly thirty years later. But aging and obsolete equipment, combined with lack of investment, inhibited the ability of BVDC to maintain the pace of expansion required. It appears that the success stage of the mid 1970s, which was restricted to point source pollution, has been eclipsed by the recent inability to maintain consistent treatment standards. In contrast, the East Providence POTW has been a success story, maintaining consistently high standards. But it should be remembered that the plant is considerably smaller and does not have any associated CSOs.

(2) CSOs

CSOs have been known as a major source of pollution for many years and the majority of the State's CSOs are contained in the Providence River Region (65 in Providence, 22 in Pawtucket and 8 in Central Falls). In addition to known pollutants such as raw sewage, others derived from urban runoff and untreated industrial wastes are also contained in CSO discharges. Data contained in the 208 Plan estimated the range of concentration of various pollutants contained in the effluent of CSOs. Average annual CSO discharge rates were estimated for Providence and for Pawtucket and Central Falls and the bacteria laden stormwater/sewage mixture was identified as the cause for closure of conditionally approved shellfishing areas in the Upper Bay.

The major recommendations of the 208 Plan were:

- conduct a detailed sampling and analysis program of CSOs to coincide with a combined sewage management program
- to determine the optimum mix of sewage separation and CSO treatment as mitigation options, based on a previous 201 Facilities Plan
- give priority to CSO treatment construction above Fox Point Hurricane Barrier.

In its priority list of pollution sources, the 208 Plan identified CSOs in this region as the major problem, along with Field's Point POTW, and recommended federal funding to support further studies. A series of studies and surveys were commissioned over the next

few years, while construction grant monies continued to be spent on treatment plant improvements. The major studies were related to the Providence CSOs which were the responsibility of the NBC. In 1982 the new Blackstone Region Water Resources Management Plan, (the only Phase II Plan) ranked the CSOs of Providence, Pawtucket and Central Falls as 2nd, 5th and 7th out of 66 point sources in severity of pollution ranking statewide. At the same time, ongoing studies had recommended construction of fifteen primary treatment and disinfection facilities for CSOs. (Providence:9, Pawtucket and Central Falls:6). As these NBC CSO studies were progressing, some minor engineering improvements and maintenance to CSOs took place, but the final outcome of the six area studies is awaited. In addition NBC did receive federal funding (\$4.6 million) for the rehabilitation of its old primary treatment tanks, that will lead to better handling of overflows at the facility from 1990 onwards.

Meanwhile the studies conducted for Pawtucket and Central Falls, which recommended satellite treatment facility construction, were being held in abeyance until the Providence studies were completed. In addition the two cities were disputing their responsibilities for mitigation of CSOs, suggesting that they should be accepted by BVDC. This state of inaction has remained, despite the CWA mandate for CSOs to meet water quality standards by March 31, 1989 and a recent legislation change<sup>(28)</sup> allocating responsibility for solving the CSO problems to the BVDC.

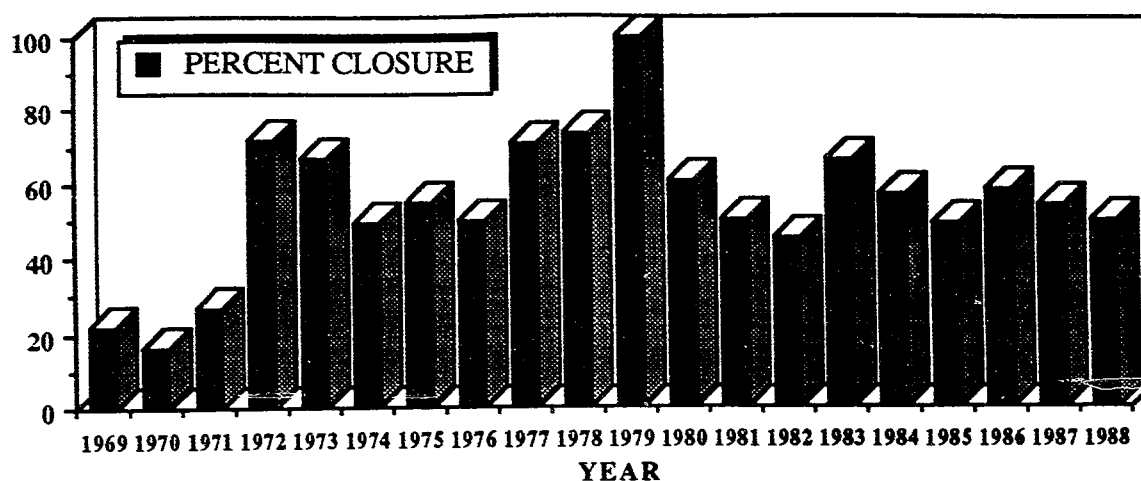
BVDC accepts that as a regional agency, it is responsible for CSOs, but a major funding problem is likely to exist. BVDC obtains user fees from six communities, which by law must all share the same fee burdens. However, only two communities contain CSOs and the remaining municipalities are objecting to cost sharing, to the extent of preparing law suits to support their case<sup>(29)</sup>. In addition the earlier CSO studies carried out by Nichols/Waterman Engineers in 1980 are now considered obsolete and new studies will thus be required. BVDC has begun the process of procuring funds to finance these studies but this combination of delays is likely to inhibit practical abatement action for several years to come in the cities of Central Falls and Pawtucket.

### Summary

It can be seen that a serious problem, first addressed over 40 years ago, remains a high priority within the region today. The need for more detailed studies of CSOs was identified in the mid 1970s, and are still being undertaken, but funding has been made available and the major NBC study could be completed within two years. An end has recently been put to the disagreements between BVDC and the towns of Pawtucket and Central Falls, which should enable progress to be made on the further studies required. Meanwhile the CSOs continue to discharge an estimated 1.7 billion gallons a year of untreated wastewater into the Upper Bay during rain events, prompting the closure of conditional shellfishing grounds for over 50 percent of the year for the last four years (Figure 10). The recommendations from the forthcoming studies will inevitably be expensive to implement, but urgent action will be required to mitigate CSO pollution. The alternative is to accept a permanently polluted Upper Bay and decreased levels of water quality for the foreseeable future. Recent progress has been made by DEM towards production of a State CSO Policy, which has been drafted and is due to be forwarded to EPA in January 1990.<sup>(30)</sup>

### (3) Non-point source pollution

It is extremely difficult to separate NPS from CSOs and River Systems in the case of the Providence River, but for the purpose of this paper, the major NPS pollution considered in the Providence River Region will be: urban runoff, and sediment deposits. Consideration of ISDS, erosion and sedimentation, rural runoff and marine activities will be included in



Source: Department of Environmental Management

**Figure 10. Frequency of Closure of Shellfish Beds in Upper Narragansett Bay**

the regional assessment of the Upper and Lower Bay. The 208 Plan was the first State Plan to attempt to address NPS in a comprehensive manner although the environmental impact of urban land development had been understood for some time. But very little was actually known about the impact of NPS on the water quality of the Bay and the 208 Plan clearly identified the need for further study.

(a) Urban Runoff Although difficult to quantify, urban runoff was recognized as an important NPS pollutant and the majority of the 208 Plan recommendations related to the control of land development by non-structural means such as zoning, setbacks and land purchase; while mitigation of CSOs, creation of buffer zones and the need for a stormwater management plan was also recognized. The 208 Plan also acknowledged the importance of reducing the use of lawn chemicals, reducing lead in gasoline and protecting drinking water from the effects of runoff. Some important field studies were carried out in the 1980s by Eva Hoffman, who identified urban runoff as the major source of NPS in Narragansett Bay, and quantified the contribution of various pollutants.<sup>(31)</sup> In 1988, the Stormwater Management and Erosion Control Committee, created by DEM, provided recommendations for stormwater management control which were proposed as guidance for the Rhode Island Non-point Source Management Plan, although these have not been formally adopted by DEM. This plan also recommended best management practices to reduce the water quality impacts associated with urban development and proposed implementation approaches for both state and local agencies, supported by recommendations and an implementation schedule. The Coastal Resources Management Council routinely examines coastal development projects to minimize impact of storm drainage and ISDS systems on coastal water quality.

(b) Sediment deposits containing high concentrations of heavy metals, toxins and organics, is a NPS problem associated with the Providence River Region. U.S. Army Corps of Engineers studies referred to in the 208 Plan indicated that the levels of toxics and sediments decreased with the distance from the Field's Point POTW towards the Upper Bay. The sources of these contaminants were estimated to be the untreated and partially treated discharges from CSOs and municipal treatment facilities, from previous decades of urban and industrial growth, however once again the 208 Plan indicated that the effect of these contaminated sediments were unknown and recommended a more detailed analysis. It also recommended the use of funds for a feasibility study for removing and managing the disposal of in place toxic pollutants in the Providence River north of the Fox Point Hurricane Barrier. Although subsequent effort appears to have been devoted to the study of bottom sediments, no action has been taken to remove and dispose of toxic pollutants. Their presence, however, has posed a major problem for marina and port development where dredging and disposal of the resulting material remains controversial.

#### Summary

When the first efforts to address NPS in the context of water quality were introduced into the 208 Plan, it was assumed that any pollution lacking a discrete source was NPS. Today NPS has an identity and describes a wide group of activities and processes which contribute pollutants to receiving waters. The control of NPS involves many different agencies and approaches and it is only recently that the specific impacts of these sources are being understood. It has become apparent that the prevention of NPS is far more cost effective than the cure and the presently emerging plans and strategy will need to ensure a continuing effort to monitor implementation of the control measures. An added complication is the fact that implementation of NPS control measures is most frequently carried out at the local level, which has traditionally been slow to adopt new point source control measures, and is likely to experience greater difficulty with the diffuse, hard-to-quantify policies needed for effective NPS control.

#### (4) River Systems

There are several river systems flowing into the Providence River, that all contribute in some way to the pollution of Narragansett Bay. However, the data needed to assess the impact of this pollution can only be attained by comprehensive monitoring and so far only three of these rivers have been given significant monitoring coverage (Blackstone, Pawtuxet and Ten Mile Rivers). In addition, it often takes several years for trends in water quality to become apparent, due to the length of time taken to implement recommendations and for them to have an impact on the river system. This section focuses on those three river systems.

##### (a) Blackstone River

The Blackstone River has a drainage area of 478 square miles, of which 373 are in Massachusetts and 105 in Rhode Island. The river is 89 miles long, originating in Worcester and flowing through the Rhode Island towns of Woonsocket, Lincoln, Cumberland, Central Falls and Pawtucket where it enters the tidal Seekonk River. In 1980, the 25 miles of the river within the state were classified Class C and were not expected to meet the CWA criteria of fishable/swimmable waters (Class B) by the deadline of 1983. The main sources of pollution from within Rhode Island were the Woonsocket POTW, CSOs from Pawtucket and Central Falls and urban runoff, which produced water quality problems relating to dissolved oxygen and coliform. The relevant recommendations from the 208 Plan have been discussed earlier but of particular importance to this river were those relating to monitoring, CSO abatement, pretreatment programs and urban runoff. Subsequently, monitoring took place from nine stations commencing in 1985 and the city of Woonsocket instituted a pretreatment program in 1986. However, no progress has been

made on CSO abatement in Pawtucket and Central Falls; which is fundamental to water quality improvement. The impact of urban runoff has not yet been quantified. Some water quality improvements have been attributed to the completion of the upgrade at Woonsocket POTW in 1979, but the attainment of fishable/swimmable goals still appears remote.

Current estimates<sup>(32)</sup> of water quality for the Rhode Island segments of the Blackstone River are: 7.2 miles in compliance with standards and 18.8 miles not meeting standards. A combined total of 18.8 miles are not expected to attain CWA goals of fishable/swimmable waters. (This includes all segments classified as type C.) NPS is held accountable for 90 percent of pollution, mainly attributed to sources in Massachusetts.

(b) Pawtuxet River

The river has two branches, nearly 15 miles long: the North Branch whose headwaters comprise the Scituate Reservoir; and the South Branch, which originates in the Flat River Reservoir in Coventry. From the confluence, the river runs through urban West Warwick, then forms the border between Cranston and Warwick before emptying into the Providence River, some 25 miles further downstream. This lower part of the river is the only water quality limited river in the State and has developed the reputation of being the most polluted. In 1979 the North and South Branches met their Class B or C standards and the main stem varied from Class C to D, with Class E (nuisance condition) existing at the mouth where it discharges to the Providence River. Major point sources were identified as the POTWs of West Warwick, Warwick and Cranston, plus discharges from American Hoechst (South Branch), Falvey Linen and Hope Sanitation (North Branch) and Ciba Geigy (Main Stem). Calculations carried out at the time of the 208 Plan demonstrated that more pollution in the form of oxygen demanding material and nutrients was added from point sources over a year, than from stormwater runoff, which was considered the major NPS<sup>(33)</sup>. In addition, it was known that the large number of dams, which had been constructed much earlier for mechanical hydropower, contained oxygen depleting sediments which might also contain toxics.

The 208 Plan considered the Pawtuxet River in some detail and proposed a number of alternatives to improve water quality, but admitted that their effectiveness could not be assessed without further study, and at the same time acknowledged that the impacts of NPS had not been well quantified. The major supporting recommendations were:

- amendment to American Hoechst permits to eliminate chlorination;
- eliminate both North Branch point source discharges by tying them into the West Warwick treatment system;
- East Coventry to be sewered and tied into West Warwick;
- expand and upgrade West Warwick to 11.0 mgd;
- Cranston should proceed with a facility plan to construct an advanced treatment capability of 23 mgd and investigate further expansion to a regional POTW;
- a detailed study of effects of impoundment removal at the Pontiac and Broad Street dams; and
- feasibility study of in stream aeration for future application.

During the ensuing ten years there was a significant monitoring effort, commencing in 1983, which helped to identify more clearly the sources of pollution. American Hoechst (now Hoechst Celanese) was issued a new permit which was due to expire in March 1989; Falvey Linen terminated its discharge and Ciba Geigy tied into sewers but subsequently left the State in 1983. A total in excess of \$70 million was devoted to the POTW expansion, with Cranston expanded to 23 mgd and by 1984 and Warwick meeting secondary treatment criteria by July 1988. West Warwick continues to be unable to meet its permit criteria for secondary treatment and is not expected to do so until construction is completed in 1993.

No further progress has been made to sewer East Coventry and the regionalization of the Cranston Plant has not taken place. In 1987 DEM published the Pawtuxet River Basin Non-point Water Quality Standards Review and Management Plan for which it had to rely on the best professional judgement of its biological and engineering staff to estimate water quality conditions in some of the tributaries, in the absence of monitored data. In the 1988 State of the State's Waters Report, DEM estimated the sources of pollution in the North and South Branches to be mainly due to NPS (100 percent and 80 percent respectively), whereas 80 percent of the problems in the main stem were judged to be caused by point source pollution. The report also drew an encouraging picture from the results of monitoring of some effluent dominated sections of the river, that showed the ability of toxic tolerant populations to sustain themselves. However, it also estimated that at critical periods, low dissolved oxygen would prevent the establishment of healthier biological communities.

In 1979, the Pawtuxet River was considered to be the second most serious problem identified statewide as preventing water quality goals. Despite the collection of much needed data and many studies as well as the expenditure of large sums to mitigate point source and better understand NPS pollution; the mainstream of the Pawtuxet River has remained a high priority water body for reclamation and the water quality classification remains substantially unchanged in 1989. A plan to use aerators in the river was recently rejected by EPA and the most recent action by DEM was to introduce more stringent wastewater discharge criteria, requiring tertiary treatment in the renewed permits to the Cranston, West Warwick and Warwick municipal POTWs.

(c) Ten Mile River

Twenty-two miles long and containing fifteen impoundments, just under two-thirds of this river is in Massachusetts and is dominated by point sources of pollution; the major two being the North Attelboro and Attelboro POTWs, which also provide a very significant flow volume to the river. A broad program of abatement had been instituted by Massachusetts in the '60s to improve the obnoxious conditions in ponds and over the next two decades the river showed significant improvements in water quality, particularly as improved treatment of wastewater was introduced.

The Rhode Island section of the Ten Mile River is nearly eight miles long and starts just below the Attleboro POTW and flows through Pawtucket and the Turner Reservoir before it empties into the Seekonk River in East Providence. The condition of the river is entirely dependent on point source control measures imposed by Massachusetts. In 1975, the upper three mile section above the Turner Reservoir was categorized in agreement with the New England Interstate Water Pollution Control Commission as Class C, and the remainder as Class B, however a survey at the time indicated that the river and reservoir were out of compliance due to low dissolved oxygen levels and high bacterial counts.

In 1984, a survey of the river was undertaken which indicated improving trends in acid levels and suspended solids but also revealed problems in downstream impoundments due to excessive nutrients and biological communities under toxic stress due to excessive amounts of metals.<sup>(34)</sup> As a result it was recommended that:

- a. more stringent discharge permits be issued to the two POTWs and improved implementation of pretreatment programs;
- b. rehabilitation of impoundments and removal of sediments containing high concentrations of metals;
- c. creation of a Ten Mile River Commission which should investigate the cost effectiveness of the methods of sediment removal; and,
- d. the introduction of land use control measures to contain roadway and urban

runoff.<sup>(35)</sup>

By 1986, both POTWs had approved pretreatment programs and introduced significantly more stringent limits to discharge permits, and twenty-two industrial dischargers were in the process of being tied into the two plants. To date there has been no progress on plans for sediment removal. In the latest estimate by RIDEM<sup>(36)</sup> some 4.47 miles of the river and Turner Reservoir are fully supporting their categorization of Class C, while the remaining three miles, although not supporting Class B could attain that standard. It is estimated that 80 percent of pollution is point source due primarily to POTWs and industrial discharges in Massachusetts, with surface runoff and in place sediments contributing the NPS.

#### Summary

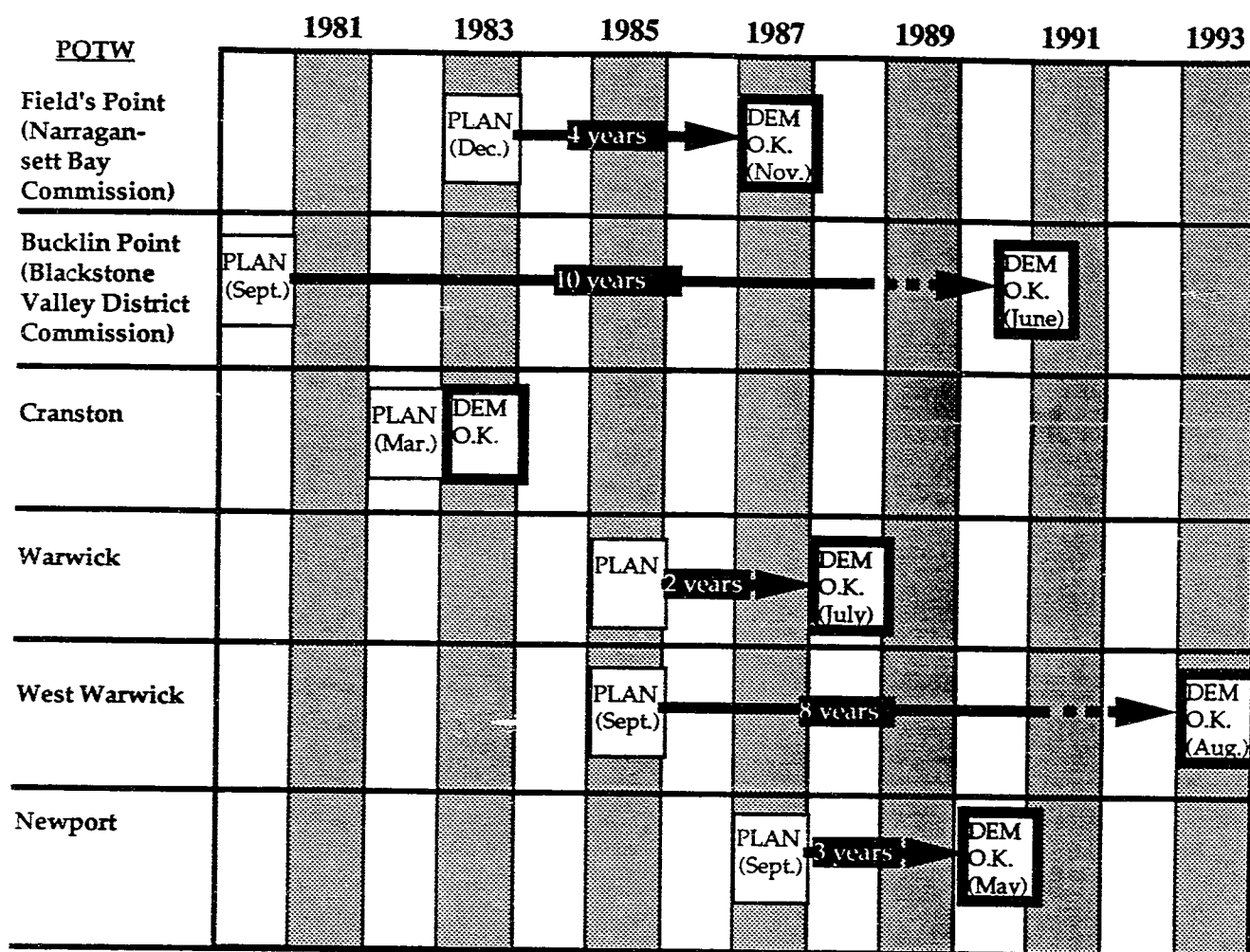
The three river systems chosen for analysis in this section are different in character and the sources of pollution vary considerably. As more information becomes available from monitoring and further studies, a more objective assessment can be made. However, until such data is consistently available, over a period of time, it has been necessary to compare water quality estimates, often based on the best professional judgement of the past, with the more scientific information currently available. This may be akin to comparing apples and oranges. Thus the apparent lack of dramatic change in the water quality of the three rivers addressed is probably not surprising. Evidence of an improving trend exists and the sources of pollution have been more clearly identified, but the continued effort and expense required to mitigate pollution in the future, remains a serious challenge for the next ten years.

#### (5) Assessment of Progress in Pollution Control for the Providence River

In terms of water quality, the Providence River region has experienced little change over the past ten years. The central effort has been to maintain conditions as they were once the BVDC switched to secondary treatment in 1972. Although declining trends can be shown in metal loadings, BOD loadings and DO concentrations, the area of water unable to meet water quality criteria remains much the same, as well as the amount of time the Upper Bay shellfish area remains closed each year. However, simple comparisons of water quality are difficult to make, as today's monitoring approaches and measurement technology is superior and more complete than that of ten years ago. In addition, the State's assessment criteria and the areas subject to monitoring have recently changed, further complicating the prospect of true comparative analysis.<sup>(37)</sup>

The major policy and planning efforts to reduce pollution has been clearly directed towards the introduction and maintenance of secondary treatment at POTWs. The period between the intended completion date of the facility plan and state permit approval, shows a consistent underestimate of time required to complete modifications (Figure 11). Associated delays due to aging equipment and lack of maintenance reflect a need for a long term concern about the quality of routine administration of POTWs. The actions to introduce a regional authority (the NBC) to take control of the Field's Point POTW in order to overcome the inertia of the City of Providence did lead to voter approval of an unprecedented \$87.7 million bond issue; the first POTW water conservation program in the State; and some innovative policy making and planning for the future. The fact that such an extraordinary effort was needed just to ensure that the Field's Point plant would reach interim permit criteria in 1988 should be taken as a stern warning for the future. The fact that the BVDC will not meet secondary criteria before June 1990; and West Warwick is currently estimated to meet secondary criteria no sooner than 1993 gives no reason for complacency over the future importance of POTWs as point sources of pollution. The introduction of pretreatment programs has undoubtedly resulted in reduced metal loadings to POTWs in the region and all programs have been approved and audited since 1983.





POTW: publicly owned treatment works

Source: Municipal wastewater treatment facility plans and DEM files.

**Figure 11. Time delay between planned completion and date of permit approval for upgraded POTWs (Facilities Plan Schedules and DEM approval of operations)**

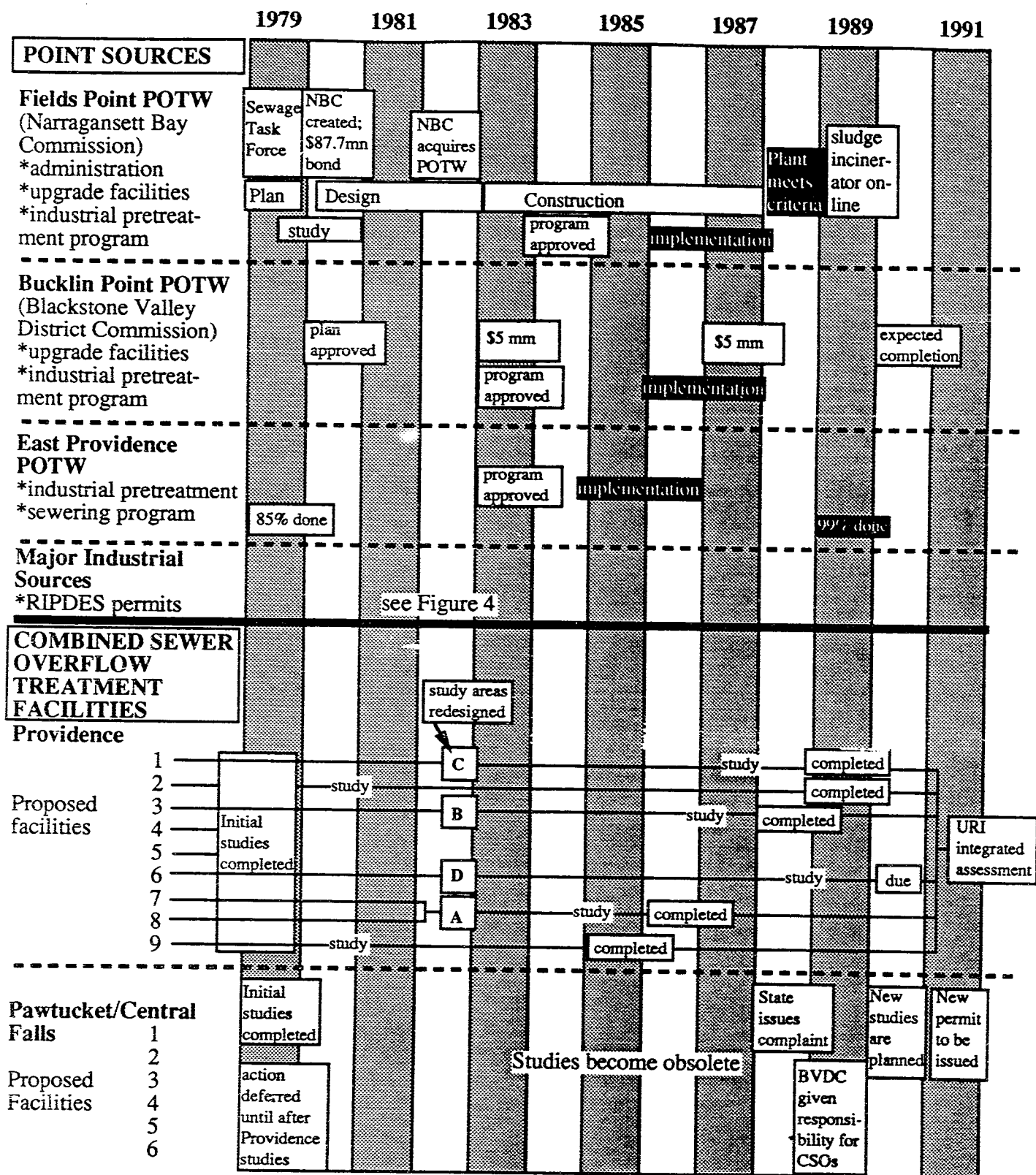
Some litigation has been concluded, but due to lack of continuity of personnel and staff limits, enforcement remains a problem.

CSOs are now well recognized by the public as making a major negative contribution to the health of the Upper Bay. The failure to take any significant measures to abate CSO discharges has resulted in continuing closures of conditional shellfishing areas. Shortage of funding, lack of consistent data, long lasting and fragmented studies and the absence of a clear abatement policy have all combined to inhibit progress, and little effort has been made to link CSOs with water quality changes. However, CSOs are now clearly on the public agenda and State planning priority has shifted towards them. Recent funds have been made available to coordinate and model the NBC CSO studies and the first attempt at a State CSO policy is being made. But progress towards improvement in the Central Falls-Pawtucket area has been very limited and it is thus likely that CSOs will remain a major source of pollution in the Providence River region for many years to come.

NPS is another source that has reached the public agenda in this region, due largely to the impact of urban runoff. It is now recognized as linked with CSOs and land-use practices but resultant governance structure is both complicated and subject to overlap. Efforts to quantify NPS have been initiated by increased monitoring and State policy and plans were recently introduced; but more information is urgently needed if NPS problems are to be addressed. There also exists a lack of coordination between State policy level and the local authority level where implementation of best management practices must take place.

In the river systems of the region which have been discussed, no dramatic water quality improvements are evident and it is assessed by the State that some stretches will never comply with the fishable-swimmable criteria of the CWA. POTWs continue to play an important part in maintaining the health of the rivers and pretreatment programs have also had a very positive effect. Impounded sediments remain a source of pollution of unknown quantity, and little effort has been made to determine the impact. Interstate cooperation has been established as a necessary function in water quality management and underlines the growing awareness of the linkage between the upper reaches of the watershed and the health of Narragansett Bay.

In summary, the indications from some improving trends in the Providence River region is counterbalanced by the absence of upgrading in water quality standards and the enormous effort which has been required to maintain or improve existing conditions. In particular, major financial resources and effort must be applied to CSO mitigation, improved treatment of POTWs and increased data collection to quantify and demonstrate the need for non-point source controls (Figure 12).



**Figure 12. Status of Major Water Pollution Control Initiatives in the Providence River, 1979-1990**

### C. MOUNT HOPE BAY

Mount Hope Bay is the recipient of the waters of the Taunton River Basin, which covers 530 square miles of southeastern Massachusetts, although more than two thirds of the Mount Hope Bay's area is situated in Rhode Island (Figure 13). The resultant division of responsibility inevitably leads to complications as the two states follow their own policies and plans, but it is apparent that the vast majority of water pollution control measures affecting Mount Hope Bay, originate in Massachusetts; which underlines the need for careful coordination and cooperation. This process is not helped by dissimilar water quality classifications in immediately adjacent areas, which have existed since 1967 when the states adopted separate policies <sup>(38)</sup>

(1) Point Sources. The major point source discharge to Mount Hope Bay has been clearly identified as the Fall River POTW which is by far the largest in the area; having an average flow of 23 mgd<sup>(39)</sup>. Other major point source discharges will be considered in the subsequent Taunton River discussion. In 1979, the Fall River POTW was being upgraded to secondary treatment and the process was completed in 1983. Earlier plans<sup>(40)</sup> had recommended that the sewer system be extended to service W. Freeport (Mass) and Tiverton (RI) and that sludge be incinerated on-site. Waste Load Allocations were made for effluent limits of 30.9 mgd flow and 30.0 mg/L BOD. The plant has consistently met its limits to the present day, but the effectiveness of its pretreatment program was brought into question in 1987 in a law suit brought against the City of Fall River <sup>(41)</sup>, when accused of having no procedure for the enforcement of pretreatment regulations. No progress has been made to extend sewers and regionalize the Fall River POTW, and sludge has consistently been incinerated on-site.

By far the largest user of the waters of Mount Hope Bay, to the extent of over one billion gallons a day, is the New England Power Company's Brayton Point facility in Somerset. In the past, thermal pollution from the plant was a major problem, but modifications of the cooling processes have reduced that impact to an acceptable level, as reflected in NPDES permit limits <sup>(42)</sup>.

(2) CSOs. In the immediate vicinity of Fall River, there are 16 CSOs discharging into Mount Hope Bay, the Taunton and Quequechan Rivers, and there were 9 discharge locations overflowing into the Taunton and Mill Rivers in the city of Taunton. In 1987 a NBP funded study performed by FDA suggested that over 95 percent of the contamination entering Mount Hope Bay, as indexed by fecal coliform source strength, was from combined sewer effluents.

The severity of the CSO pollution was described in the Taunton Basin Plan of 1973 which presented results of a CSO study carried out by the Massachusetts Division of Water Pollution Control, indicating problems with both wet and dry weather discharges. When the Basin Plan was reviewed, eight years later, the City of Fall River was entering into the initial phase of a study to evaluate the CSO problem and prepare alternative abatement strategies. In Taunton, some action had been taken in the late '70s to separate some storm and sanitary sewers but additional CSO work was deemed to be warranted. In 1982, EPA issued a permit to Fall River, requiring a two phase study of CSOs and a year later EPA and Massachusetts Department of Environmental Quality Engineering (DEQE) approved the scope of the study and awarded funds for a contract <sup>(43)</sup>. A series of delays ensued and it was not until November 1987 that a Phase I study was submitted, and a further year before EPA and DEQE completed their reviews. This initial study was primarily concerned with dry weather overflows and produced some simple solutions to mitigate the flow; such as cleaning sewer lines and erecting a temporary weir wall. Sources in the City suggested that

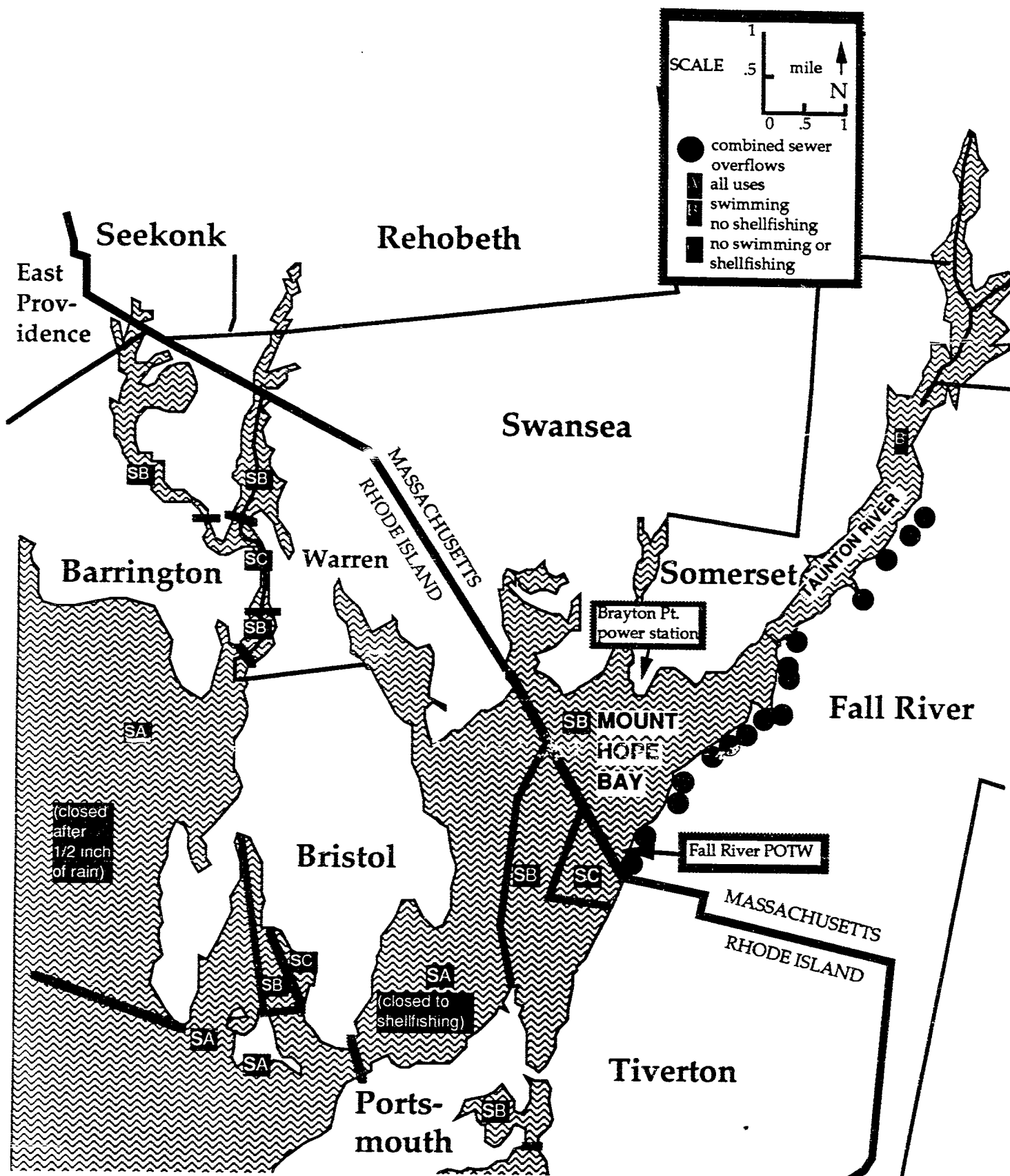


Figure 13. Mount Hope Bay

these actions have eliminated dry weather overflows but that continued maintenance will be required and \$286k has been requested from the State<sup>(44)</sup> for that purpose

Phase II of the Study, to investigate wet weather overflows, is estimated by DEQE to take 2 years and was authorized in October 1989, with a due date of November 1990<sup>(45)</sup>. But the City of Fall River recently announced the initiation of a separate feasibility study, with the limited goal of eliminating flow of its worst wet weather CSOs, and is due for completion in January 1990. Meanwhile in 1987 the Conservation Law Foundation of New England initiated action against the City of Fall River in Federal District Court for violating the conditions of its NPDES Permit, specifically relating to CSOs and failure to meet established water quality standards. The action is currently pending in court. Recent information confirmed that all CSOs in Taunton have been eliminated, with the exception of one immediately adjacent to the POTW, which has a monitoring capability.

Another recent initiative relating to CSOs has been made by Save The Bay, subsequent to the publication of its own special report on Mount Hope Bay<sup>(46)</sup>. Their intention is to seek cooperation of political leaders, key agencies and environmental activists from both states, to make a collaborative effort to target CSOs as the major source of pollution and carry out mitigation actions. The reported response has been encouraging, but the current severe fiscal crisis in Massachusetts does not support optimism for the early resolution of the CSO problem. In conjunction with this initiative, Save The Bay has also made recommendations for the re-opening of some shellfish beds in Mount Hope Bay, on a conditional basis. This is founded on the perception of some generally cleaner portions of the waterbody and the recent FDA study<sup>(47)</sup>. However, recent dye testing has shown that wet weather transport of CSO related sewage from Fall River to Mount Hope Bay disperses so rapidly that declaration of conditional shellfish areas would be impracticable.<sup>(48)</sup>

(3) Non-point Source. The presence of CSOs and their association with storm water runoff, tends to overshadow the other non-point sources of pollution. In this region, due to large areas of wetlands and high ground water levels, poorly functioning ISDS are considered the most pervasive NPS problems. Recent fish kills in both the Lees and Cole Rivers are thought to be caused by ISDS problems, but insufficient data exists to clearly establish this linkage<sup>(49)</sup>.

Contaminated sediment deposits are known to exist in Mount Hope Bay and thought to be from cumulative discharges of former and present textile manufacturers and electroplating plants. Of particular concern is the residual mercury concentration, and a recent study<sup>(44)</sup> showed that these concentrations are reduced with increased distance from original source. By the time Mount Hope Bay is reached, the levels are well below the EPA criteria for mercury and the study assessed that shellfish in the Rhode Island portion of Mount Hope Bay are safe for human consumption.

In the 1981 update of the Taunton River Basin Plan, the Massachusetts DEQE stressed the need for further intensive water quality surveys, timed to coincide with construction schedules of some important POTWs (Brockton, Mansfield and Fall River). The need for additional sampling "to verify the presence of pollutants and delineate their sources" <sup>(51)</sup> was also recommended as a means of identifying and defining more clearly NPS pollution, prior to designing a NPS Program. Unfortunately very little further monitoring has been carried out due to financial constraints, but a NPS Management Program was introduced in 1989.

#### (4) River Systems

Several river systems flow into Mount Hope Bay, bringing waters of varying quality, from the pristine Class A waters of the Kickamuit to the pollution ridden waters of the Quequechan which carries discharges from three CSOs in Fall River. Within Massachusetts, all freshwater rivers in the Taunton River Basin were classified as Class B in the 1967 revision of Water Quality Standards. In 1975, survey data indicated that all of the significant rivers were in violation of their classification, based upon the goals to be achieved<sup>(52)</sup>. The two rivers discussed here will be the largest (Taunton) and probably the most polluted (Quequechan).

(a) Taunton River. Although by far the longest (40 miles), and largest river by volume, it has been estimated that the Taunton River contributes less than 5 percent of the fecal contamination entering Mount Hope Bay.<sup>(53)</sup> In 1981, the major point source discharges listed were from the Somerset and Taunton POTWs and six individual, permitted industrial discharges; plus the Brockton, Middlesborough and Bridgewater POTWs which discharge to headwater tributaries.<sup>(54)</sup> CSOs in Taunton and undefined NPS in the upper reaches combined to ensure that the river failed to reach either Class B for its fresh water standard or Class SB in its lower reaches. However, DEQE expected water quality to improve as POTWs were upgraded, industrial discharges were eliminated or met improved criteria, and action taken to mitigate CSOs as the result of further study.

Upgrading of all POTWs to secondary treatment has taken place since 1981 and at present only Somerset is failing to meet permit limits, due to flow in excess of capacity. However, reconstruction is taking place to increase capacity to 4.2 mgd<sup>(55)</sup> and is expected to be completed by 1990. The most recent review of water quality standards took place in 1981 and resulted in the Taunton River still failing to meet Class B/SB classification.

(b) Quequechan River. This two and a half-mile river originates in South Watuppa Pond and flows directly through the industrial city of Fall River before discharging to Mount Hope Bay; having received discharges from a variety of sources en route. By far the greatest pollution impact is derived from the three CSOs, although two minor industrial point source discharges were noted as being permitted in 1981. In the 1987 FDA study of CSOs the river was "consistently ranked as the major source of contamination to the estuary. The Quequechan can best be characterized as a river of sewage." It was also noted that flow rates ranged from 13.2 to 73.3 mgd and frequent discharges occurred in dry weather.

Included in the CSO discharges received by the river will be various NPS pollutants such as stormwater runoff, in addition to the natural discharges direct from land to the stream. It is not surprising that the Quequechan River has never met its Class B goal. In 1988 the 9.3 square miles of Mount Hope Bay within R.I., were classified either SA, SB or SC; but none of the waters currently support these classification standards, although 6 square miles are supporting CWA standards of fishable/swimmable waters and only 0.6 sq. miles are considered unable to attain that standard<sup>(56)</sup>. It is evaluated that 70 percent of impairment is due to point source; 30 percent NPS, with the industrial discharges, combined and storm sewers in Massachusetts making the major contribution.

(5) Assessment of Progress in Pollution Control in Mount Hope Bay

Mount Hope Bay receives pollution from all four sources discussed in this paper. Progress has been made to upgrade POTWs and their associated pretreatment programs have improved metal loadings, but as yet there has been no significant improvement in water quality. Funding for maintenance and operations must be continued to sustain that progress and longer term planning is needed to reach water quality goals. The problem of CSOs has clearly reached the public agenda and remains the major concern as the largest source of pollution to the Mount Hope Bay. Mitigation efforts over the past 15-20 years have been very limited. Studies of the Fall River CSOs carried out over the same period have not yet progressed past Phase I and it will take intense public and political pressure, supported by appropriate funds, to achieve meaningful abatement action. Meanwhile, the impact of CSOs is likely to overshadow considerations of pollution from other sources for some time to come. Control remedies are bound to be expensive and effective cooperation between the states and other agencies will be necessary. However an exceptional effort will be required to find appropriate funding given the current pessimistic fiscal atmosphere in Massachusetts, which has clearly constrained state agencies from carrying even simple steps such as the badly needed intensive monitoring and survey of the Taunton River Basin.

Plans have also been announced by state senators from both states to set up a Bay State/Ocean State initiative to solicit increased funds to address problems relating to sewage treatment. It was reported<sup>(57)</sup> that Massachusetts is shortly expecting a \$1 billion state bond issue to provide for pollution abatement activities such as CSO elimination. This compact is supported by EPA and Save The Bay and related public hearings began during December 1989.



#### D. UPPER AND LOWER NARAGANSETT BAY

This region encompasses the remainder of Narragansett Bay and is characterized by high quality salt water with a limited number of small localized areas failing to meet the CWA criteria of fishable swimmable waters (Figure 14). The Upper Narragansett Bay is the transition area between the historically polluted waters entering from the major industrial and commercial areas in the Providence River and the broad expanse of well flushed, clean waters of the lower Bay; and provides a good indication of the trends in the quality of waters entering the Bay. Surrounding this region are less densely developed towns, many small harbors mainly devoted to fishing and recreational boating; areas of agricultural land and wetlands, and two industrial complexes of significance (Quonset Point and the Naval Base); all of which contribute pollution in some form to the Bay.

(1) Point Source and CSOs. The major point sources of pollution to this region are the six POTWs and four major industrial discharges (Bristol, East Greenwich, Jamestown, Newport, Warren, Quonset Point/Davisville, Bostitch, Brown & Sharpe, Pearson Yachts, Raytheon). Of these, the source of major concern is the Newport POTW, which has a flow rate in excess of 5.0 mgd. and is the only one with associated CSOs. In 1979 the Newport POTW was providing only primary treatment to its wastewater and the City was in the process of separating the combined sewers as money became available. The recommendations from the 208 plan were:

- upgrade to secondary treatment facility
- develop an industrial pretreatment program
- monitor effluent for heavy metals and other toxics
- U.S. Navy to upgrade its sewerage system.
- continue separation of combined sewers.

Despite an already completed design for plant improvement, the City of Newport sought a waiver to construct under Section 301h of the Clean Water Act, in 1983 and again in 1985, which was subsequently denied by EPA. Construction on new secondary facilities commenced and is due for completion in 1990. In 1988, following a recommendation by RIDEM to combine the two CSOs into one and feed them into a holding tank for subsequent discharge to the POTW for primary treatment and chlorination, the City applied for and received federal funds available for mitigation of Marine CSOs. This construction work is due for completion in October 1990 and could see the first successful attempt in the State to overcome the CSO problem. In 1985, Newport received approval for its pretreatment program and effluents from the POTW are being monitored and a program for sludge monitoring was introduced by DEM. The upgrade of the Navy sewerage system was funded in 1984 and is reported as now complete.<sup>(58)</sup>

#### (2) Non-point Sources

Many examples of NPS are to be found entering this large area of salt water and the first attempts to quantify them was contained in the 208 Plan. However, it has not been possible to identify a consistent NPS of pollution having a profound permanent impact on water quality in this part of the Bay. Those NPS considered to have the greatest effect in the region are: Erosion and Sedimentation; ISDS failures and marinas. In coastal areas within its jurisdiction, the Coastal Resources Management Council requires mitigation measures for small and large construction projects, as well as subdivisions of land.

#### (3) Erosion and Sedimentation

The primary source of erosion and sedimentation in R.I. is from the construction industry and this is concentrated in the urban areas surrounding the Northern part of the Bay.

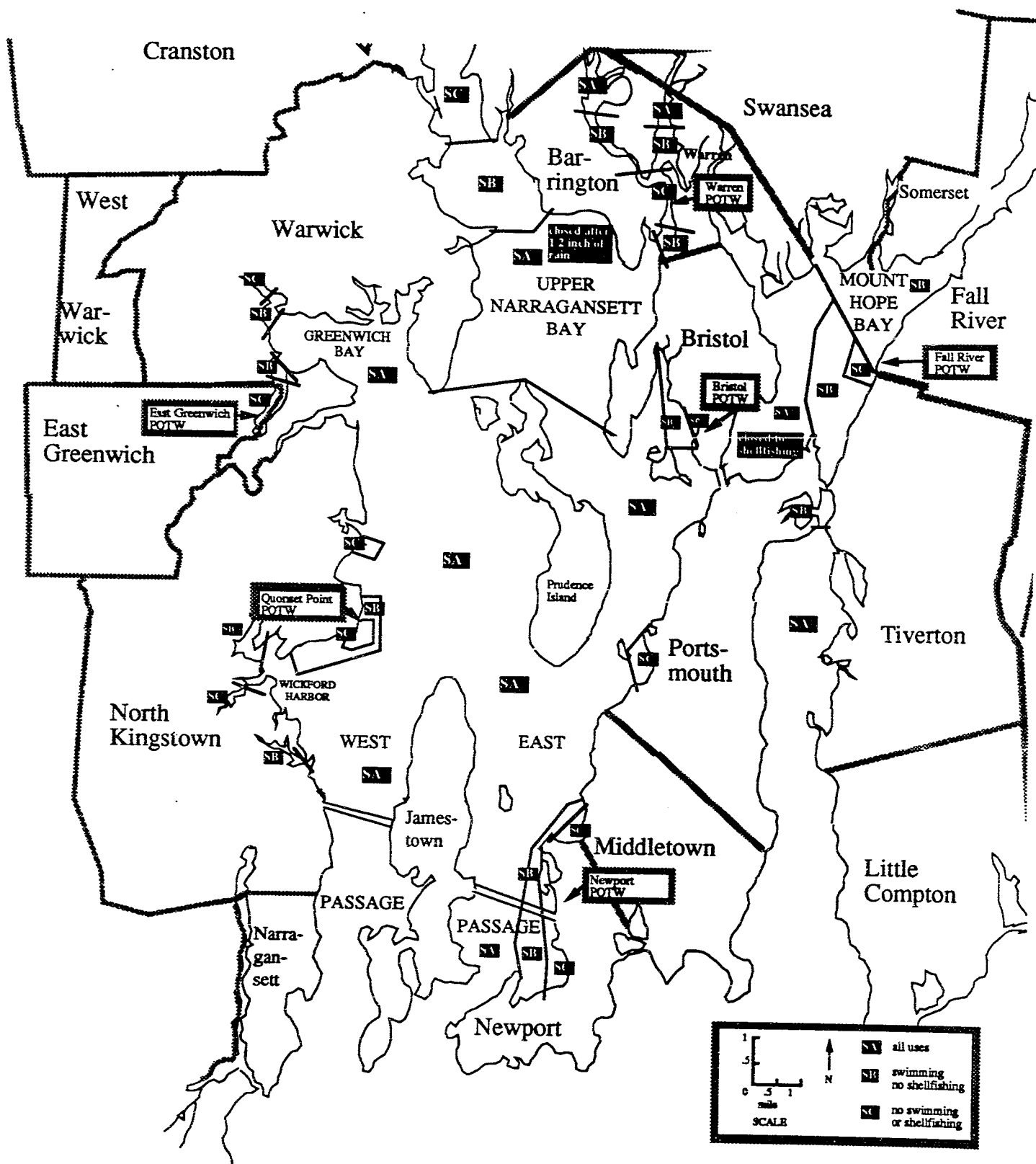


Figure 14. Upper and Lower Narragansett Bay

Agriculture, although occupying a rather small portion of the total area in the State, was shown in the 208 Plan to produce erosion and sediment problems in this region, the most critical of which are to be found in Newport County (Aquidneck Island)<sup>(59)</sup>. It was estimated that sediment loss from untreated croplands was 11.2 tons per acre per year and was likely to carry pollutant such as nutrients, pesticides and bacterial contamination from animal wastes. The more important recommendations from the 208 Plan were:

- establishment of local erosion and sediment control ordinances.
- Soil Conservation Districts should be designated as management agencies for agricultural runoff control with administration of the program by the Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service.(AS&CS).
- Early application for funding under the Rural Clean Water Program.
- Priority for funding to Newport County.
- Best management practices (BMP) be applied on a voluntary basis with application of tax-exempt provisions for installation.

In 1980 the SCS released a R.I. Erosion and Sediment Control Handbook which established minimum guidelines for BMPs during development and was subsequently updated in 1989. In 1982, enabling legislation was introduced (An Act Related to Soil Erosion Sect. 45-46) permitting municipalities to adopt sediment and erosion control ordinances. DEM is currently working with the RI Resource and Development Council to offer assistance to RI Cities to adopt new ordinances or revise current sediment control ordinances.

The SCS and the ASCS agreed to administer a management program and two applications were made for funding under the Rural Clean Water Program to initiate best management practices in the East Bay area. However, funding was not forthcoming and it was not until 1984 that the Eastern Rhode Island Conservation District initiated a Watershed Protection Program.<sup>(60)</sup>

Voluntary compliance of BMPs have been shown to be rather ineffective where inspection frequency is low as is the case in Rhode Island where an annual visit to individual sites is normally the maximum achieved. DEM's FY 1990 Budget included \$60,000 to establish a regional site inspection program for soil erosion and sediment control, but this has been dropped due to the current fiscal crisis and no tax advantages relating to installation of BMP have been introduced to date.<sup>(61)</sup> In a further allocation of \$80,000 from FY'1990 funds, DEM will be providing the three Conservation Districts seed money to establish a pilot regional site plan review and inspection program, intended to enhance the effectiveness of local soil erosion and sediment control programs governing construction sites. The R.I. NPS Management Plan of 1988 addresses the issue of erosion and sedimentation, detailing more comprehensive BMPs and offering broadly sketched implementation plan.

Although much progress has been made in understanding the problems associated with erosion and sedimentation and BMP have been extensively documented, enforcement has been shown to be a serious weakness. This appears to be due to lack of staff and money and the difficulties experienced by poorly qualified building officials who do not have the time or capability to carry out the sometimes complex technical requirements<sup>(62)</sup>. Once again the primary means of mitigation, as with all NPS, is prevention and it is thus very difficult to correlate control measures with specific changes in water quality standards, within a water body as expansive as the region being considered.

#### (4) ISDS

In the late '70s it was estimated that in R.I., 30 to 40 percent of the population <sup>(63)</sup> were dependent on ISDS, many of which were in place before state regulations and modern zoning practices were implemented. Such systems are simple and effective, costing less than sewerage <sup>(64)</sup> and under normal conditions remove the suspended solids, oil, grease, pathogens and toxic chemicals included in the normal household discharge. However, failed systems can create significant detriment to human health, degrade potable water and in the coastal region cause eutrophication with associated loss of fish habitat and closure of recreational areas. In the Upper and Lower Bay region, there has long been a significant dependence on ISDS and among the towns identified as having severe contamination problems were: North and South Kingstown, Narragansett, East Greenwich, Tiverton, Bristol, Warren and the Aquidneck Island Communities. <sup>(65)</sup>

The 208 Plan made the following recommendations.

- ISDS should be used wherever possible.
- Local communities should: develop sewer plans as part of their comprehensive planning; review ISDS permits awarded by RI DEM; and voluntarily contribute to an ISDS maintenance program.
- increase the minimum lot sized for future installations.
- local building inspectors should notify DEM regarding conversions of houses from seasonal to year round property use.
- DEM should institute a system for recording of failed ISDS.

In 1978, a Governor's task force was appointed to review the State's regulations for ISDS installations. It made recommendations which supported the 208 Plan and led to revised regulations which went into effect in 1980. By 1982 DEM had installed an ISDS data collection system and many municipalities had increased minimum lot sizes; but a bill to require community sewer planning had not been acted upon by the General Assembly <sup>(66)</sup>. In 1986 a technical advisory group was formed, consisting of engineers, planners and researchers; known as the ISDS Task Force; was charged with investigating alternative solutions to older systems and developing criteria for new systems. The findings of the Task Force were presented to DEM the following year and a number of recommendations were adopted into the 1989 revision of the ISDS regulations. In addition there has been frequent subsequent endorsement in other plans addressing ISDS problems <sup>(67)</sup>. Also in 1987, legislation was passed to permit communities to establish Wastewater Management Districts (WMD), aimed at improving ISDS maintenance, and supporting guidance was provided by the Division of Planning. <sup>(68)</sup>

Two other important documents were published in 1988, which both addressed ISDS: The R.I. NPS Management Plan outlined BMPs to minimize water quality degradation caused by improperly functioning septic systems; while a Plan for Coordinated Action provided more specific recommendations relating to the coastal area: such as setback specifications; groundwater separation; and variance granting procedures. An added complication exists at local level, in that DEM, CRMC and DOH have authority over ISDS in the coastal zone. DEM regulates under State Rules and Regulations Establishing Minimum Standards, while CRMC regulates location and construction characteristics through its own program <sup>(69)</sup>. Thus an applicant must satisfy separate authorities: DEM for the permit and CRMC for approval. DOH is responsible for identification of failed septic systems.

When relating such problems back to the waters of Narragansett Bay, it is again difficult to quantify impacts. Data currently available is derived from limited sampling surveys and due to the high levels of sewage related inputs to the Bay from CSOs and POTWs, the

loadings attributable to ISDS cannot be distinguished<sup>(70)</sup>. In its latest assessment of water quality in this region, DEM finds ISDS to make only a slight contribution to pollution, compared to other NPS sources; limited to one area of the East Passage<sup>(71)</sup>.

#### (5) Marine Activities

This region is the focal point for marine activities such as commercial transportation, commercial and recreational fishing, and recreational boating; containing as it does the high intensity boating areas of the State. Apart from attention attracted by the occasional past oil spill, for many years such uses of the waters of the Bay were not seriously considered as a source of pollution worthy of planning consideration. In the 208 Plan, the increase in recreational boating was identified and the resultant demand for marinas with their impact on water quality was discussed. The most significant form of pollution noted was the bacteriological contamination of shellfish by raw sewage discharges from boats. However, the plan concluded that the impact from marinas and recreational boating was minor compared with other sources of pollution. The plan went on to make the following recommendations:

- increasing boat slip demand should be met by expanding existing marinas or building new marinas in the vicinity of established marinas.
- US Coast Guard continue to enforce regulations for marine sanitation devices (MSD).
- the water quality impact of boat flow-through waste should be evaluated.
- pump out facilities to be installed in marinas as demand arises with a second state facility to be sited in Greenwich Bay.
- implementation of an educational program for boaters relating to sanitary wastes.

In 1983 a major revision and updating of the Coastal Resources Management Program addressed the issues of marina expansion. Until 1987, quantitative measurements of the severity of pollution impacts had been limited, dealing primarily with the effects of specific contaminants. More recently other studies have been initiated into water quality aspects<sup>(72)</sup>, but so far without conclusions suitable for improving regulatory policies. At present the state program is in transition as attempts are being made by CRMC and DEM to resolve differences relating to the criteria used for water uses and classification. Ongoing development of Harbor Management Plans have encouraged some communities to consider the requirement to mandate installation of pump out stations as part of the renewal of marina license or lease, and DEM has the power to require new or significantly expanding marinas to include pumpouts as part of their water quality certification program. However, over the past ten years the number of such stations has remained stable at two but it has been confirmed that there are presently applications pending with DEM for a further eight stations. The RI NPS Management Plan includes appropriate BMP which reflect the concerns first expressed in the 208 Plan while Myers sees the need for an inter-agency study program to develop policies and plans to control sewage discharge from boats<sup>(73)</sup>.

Marine activity was not considered to be a major source of NPS pollution in 1979, but since then the number and size of boats on this region of the Bay has significantly increased. Sufficient scientific information on the impacts of boat sewage on water quality is still awaited, and agencies are still disputing the criteria which should be applied in evaluating their impact. However, boat sewage is certainly recognized as a source of pollution having an impact on shellfishing in poorly flushed waters and in the most recent DEM assessment of Greenwich Bay, a highly intensive boating and fishing area, 100 percent of pollution is attributed to three NPS: storm sewers, surface runoff and marinas<sup>(74)</sup>. Other sources of NPS relating to marine activity, which have not been included in earlier plans, are the discharges from non recreational vessels, both commercial and publicly owned. These range from the overboard sewage or plastics discharge from a

non-conforming fishing vessel, to a major oil spill that has the potential to nullify the results of many years of pollution abatement measures.

(6) Assessment of Progress in Pollution Control in Upper and Lower Narragansett Bay

The water quality standards in this well flushed area are characterized by fishable-swimmable waters and have remained largely unchanged over the past ten years. The small pockets that do not meet these standards are generally affected by the limited number of point sources; apart from the conditional areas in the Upper Bay, whose closure is attributable to wet weather CSO discharges from the Providence River. The Newport POTW and associated CSOs have represented a major point source, but construction scheduled for completion in 1990 should bring positive improvements to the local water quality, after many years of delay.

NPS is not assessed as having a major impact on this region and it is not possible to correlate prevention control measures with improvements. NPS issues have been addressed in the R.I. NPS Management Plan and BMPs have been developed for control of erosion and sedimentation and ICDS mitigation. More information is needed to determine the impact of boat sewage on water quality but in this well flushed portion of the Bay, it is unlikely to present the same problems as found in high density marina areas with limited flushing. Overall, this region meets high water quality standards and it will be the reduction of pollution in the Providence River that is most likely to have a beneficial impact in the future.

## E. CONCLUSIONS

(1) The Nature of the Problem. Since the turn of the century, point source pollution has been recognized as a major problem in Narragansett Bay and subsequent efforts in pollution abatement and water quality management have been almost entirely devoted to its reduction. A great deal of effort and money has been dedicated to the construction of sewers and treatment plants as a definable and readily visible means of addressing the pollution problem. In 1990 the last major POTW should achieve secondary treatment and the introduction of pretreatment programs have clearly mitigated much point source pollution. All direct industrial dischargers have been permitted and efforts to improve discharge criteria are being maintained. The post war changes in the distribution of the population and the growing awareness of the linkage of upstream pollution with the need to conserve and protect the resources of the Bay, has provoked the demand for more information, in order to better understand the complexities of the estuary. The results of subsequent surveys and monitoring in the 1970s and 1980s confirmed the existence of more pollutants than previously thought and the realization of the importance of other sources of pollution, now recognized as non-point sources, CSOs and River Systems, which are much more difficult to quantify, and more expensive or difficult to rectify. Action on the many proposals to resolve these pollution problems has so far been largely postponed, as the officials await the results of further scientific investigation to quantify and define the sources and impacts. Thus today, the more difficult problem of mitigating the remaining sources of pollution must be squarely faced in addition to the need to maintain the progress already made over the past fifty years in combatting point source pollution. In retrospect these past achievements may be considered to have been accomplished with relative ease compared to the effort that will be required to complete the unfinished pollution control agenda.

(2) The Policy Framework. Since the introduction of the federal environmental legislation in the early '70s, state policy and the governance structure to support it has been primarily directed at implementing federal goals and policy and has been tied to the availability of funding or the emergence of crises. Until now, there has been no clear State policy focused specifically on Narragansett Bay and supported by comprehensive planning as a result of a long-term strategy. A complex governance structure has developed, involving many different authorities which sometimes lack the necessary interrelationships, but which has also created some overlapping responsibilities. Although much of the unfinished pollution control agenda for the state depends on local action, local authorities in turn have almost always tended to await State initiatives. In both the 1950s and 1980s, State Government was forced to take on the lion's share of burden for pollution control in the Providence metropolitan areas. Key decisions and the need to address other major problem such as the combined sewer overflow, have often been postponed while funds or more information have been awaited.

(3) Planning. The major planning efforts of the '70s led both to success and disappointment. Federal funding was available at a time when political and public support made the development of the 208 Plan an important event. The inclusion of the issue of non-point source pollution with clear recommendations backed by technical information and supported by public involvement provided the foundation for a unique comprehensive planning effort. Many of the most important recommendations were quickly implemented, while others, requiring further investigation into the newly defined pollution sources, demanded increased future expenditures at a time when pollution control was rapidly dropping of the federal fiscal priority list and the burden for environmental activities was being shifted back to the State. Funding constraints and lack of a longer term implementation framework led to many recommendations remaining outstanding to this day (Appendix IV). Most of the effort of the past decade has been devoted to those

recommendations relating to point source pollution, culminating in the achievement of secondary treatment capability for all major POTWs discharging to the Bay, by 1990.

The 208 Plan undoubtedly focused attention on pollution abatement and the '80s saw several other planning initiatives by the end of the decade. The State has produced a completely revised Coastal Resources Management Program, a NPS Management Plan, and a Clean Water Strategy, which can make a major contribution to future governance of the Bay. The Environmental Quality Study Commission has completed an important review of environmental governance and the Narragansett Bay Project is completing a five year study of the Bay, while at the same time developing a Comprehensive Conservation and Management Plan, due for completion at the end of 1990. At the local level, major initiatives are ongoing in comprehensive land use planning and harbor management planning. Thus it can be seen that the results of several pollution abatement initiatives and the Continuing Planning Process are coming together in the near future, creating a unique opportunity to lay the groundwork for a coordinated attack on remaining pollution problems during the decade of the 1990s.

(4) Assessment. Much has been done to mitigate point source pollution and more recent efforts are being devoted to the quantification of pollution associated with NPS, CSOs and River Systems. Public awareness and enthusiasm for a cleaner Bay is undiminished but needs to be supported by comprehensive longer term planning approaches and a willingness to devote funds to abatement measures. Over the past ten years, the change in water quality has been positive but certainly not as dramatic as other U.S. estuaries. Expectations have usually been greater than accomplishments, particularly in terms of the slow speed at which programs have been able to produce results. Significant progress has been made to improve water quality by introducing pretreatment programs and tightening discharge permit criteria; which have resulted in some measurable reductions in pollutant loadings. But some areas of the Bay are acknowledged by DEM as unable to attain the fishable/swimmable criteria of the CWA, while others are classified to standards they are unlikely ever to meet. Much vigilance will be required to maintain the gains achieved, and greater efforts will be needed to address the outstanding problems still with us.

A window of opportunity appears to be developing in 1990 as the result of the convergence of several important planning initiatives, and it is important to take advantage of the occasion. The need certainly exists for a clear pollution abatement policy for the next decade which can build realistic expectations about likely progress in restoration efforts, and the merits of preventive measures within the context of ongoing initiatives. It is precisely during the next decade when the more difficult steps to reach water quality goals must receive political and financial support. It will require careful timing and an imaginative effort to bring them together. The greatest challenge to be faced is the current fiscal crisis, which casts a long shadow on new initiatives, and could deter progress on important agenda items for some years to come. Innovative ways of overcoming this obstacle must be found if the window of opportunity is to remain open long enough to put a functioning, long-term estuary protection program in place.



## F. THE ROLE OF THE NARRAGANSETT BAY PROJECT

1. The Comprehensive Conservation and Management Plan being developed by the Narragansett Bay Project should be used as the basic water pollution control for the estuary into the year 2000. The CCMP should consist of the following elements:

- a. A realistic implementable plan contained in a single document with supporting, but separate scientific studies and reports.
- b. Review of relevant recommendations from previous plans(see APPENDIX IV).
- c. Identification of economic burdens and sources of funding, including continued maintenance of facilities and reserve estimates. Innovative ways to shift funding from other areas needs investigation.
- d. Consideration of conservation, re-use and recycling in planning approaches.
- e. A longer term perspective strategy (20 years).
- f. Coordination with State Clean Water Strategy and Non Point Source Management Plan and consideration of inclusion into State Guide Plan.
- g. Consideration as complementary document to Land Use 2010 (perhaps with the title Water Use 2010).
- h. A set of evaluative criteria and a monitoring program.
- i. A set of interagency agreements and policy statements to assure that every essential policy has a committed lead agency, sufficient personnel and funds to carry out the specific task.

2. The Narragansett Bay Project should be established on a permanent basis to provide clear leadership and wherever possible develop a policy consensus between Bay users, political and public interest groups and agencies to support the CCMP. Program office efforts should be directed towards:

- a. Creation of a core of interested individuals to maintain continuity in the plan development process both in the form of: (1)a working group internal to state agencies at an appointed level and (2) with the public and resource users, similar to the current Management/Policy Committee for the Narragansett Bay Project. Responsibilities would include review of progress in the planning process and identification of areas requiring coordination. Meetings should be supported with appropriate funding of expenses to compensate for continued involvement.
- b. Further development of a public educational program to clearly explain the problems still to be faced relating to the improvement of water quality in the Bay; and the costs involved.
- c. Implementation of much of the CCMP will depend upon the actions of existing regulatory and management agencies. The proposal to create the Department of Environment is aimed at facilitating interagency coordination, but even with these changes it will be vital to maintain the support of agency chiefs and participation of staff members. A more difficult challenge is to strengthen joint state-local efforts in the areas of facility planning and construction as well as in implementing policies to control non-point sources.
- d. Review water quality classification to reflect current and future uses in conjunction with the Coastal Resources Management Council.

3. A successful program will be dependent on: a plan which is both complete enough to fully address the problems and capable of being implemented; which translates into political and public support; appropriate funding; and careful timing. If these elements can be brought together at the appropriate time, the chances of success will be greater.

## FOOTNOTES

- (1) Public Law 1920 Ch 1914 "An Act to prohibit and regulate the Pollution of the Waters of the State."
- (2) Board of Purification of Waters 1934: Statement relating to proposed Metropolitan Sewage Plan p.22.
- (3) Closed as a result of a 1935 Survey carried out by the Board of Purification.
- (4) Providence Journal Nov. 4: 1941. "Interest Mounts on Bay Clean Up."
- (5) Walter Shea Report on Pollution of the Waters of the State, 1946 RI DOH.
- (6) RIDEM maintained 12 monthly river monitoring stations, 4 Upper Bay and 7 shoreline monitoring stations.
- (7) The problems associated with CSOs were considered in the Taunton River Basin Plan, 1973; the Blackstone River Basin Plan, 1976; and the 208 Areawide Water Quality Management Plan, 1979.
- (8) Federal Coastal Zone Management Act, 1972.
- (9) Statement by Board of Purification relating to proposed sewer plan, 1934, op cit.
- (10) Narragansett Bay Basin Water Quality Management Plan, 1977 Table IV-1 and IV-2.
- (11) 208 Plan, Areawide Water Quality Management Plan. Tables 3-12, p. xvii
- (12) Ibid.
- (13) Interview with Staff of Statewide Planning Program involved with Greenhouse Compact.
- (14) Public Law 99.647-9186 Congress recognized the Blackstone Valley as a National Heritage Corridor.
- (15) For further details see State Guide Plan overview, Division of Planning Report No.48 (Amended June 1989).
- (16) Interview with Staff Member RI Department of Environmental Management.
- (17) Interview with Staff Member Narragansett Bay Commission.
- (18) Department of Environmental Management, State Clean Water Strategy, Part 1, p. 12.
- (19) Save the Bay Special Report, A Raw Deal: CSO Pollution in Rhode Island, 1988.
- (20) Save The Bay Journal NOV/DEC 1989 p.5.
- (21) Report on Pollution of the Waters of the State, 1946.
- (22) 208 Plan, Areawide Water Quality Management Plan, op cit., p. xviii.
- (23) Narragansett Bay Commission. Industrial Pretreatment Program, Annual Report 88/89 p.4.
- (24) Interview with Staff Member Narragansett Bay Commission 9.
- (25) Blackstone Region Water Resources Management Plan 1981, Table 711-04(1).
- (26) 208 Plan op cit., p.169.
- (27) Public Law R.I. 1987:45.6.23.
- (28) R.I. House Bill 89-H-5037.
- (29) Interview Staff Member Blackstone Valley District Commission.
- (30) Interview Staff Member Department of Environmental Management
- (31) See series of field studies by Hoffman E.J.,1983/84.
- (32) Department of Environmental Management, State of the State's Waters 1988 p.III H-12.
- (33) 208 Areawide Water Quality Management Plan, op cit., p. 231.

- (34) Towards a Cleaner Ten Mile River, Public Report by Rumford Laboratories 1985 p.15.
- (35) Ibid p.8.
- (36) State of the State's Waters 1988 p. III-f-22 DEM biannual Report to Congress.
- (37) Ibid p. IIIA-3 para 2.
- (38) See Glen Kumehana; Towards the management of Narragansett Bay, 1987, p 111-125.
- (39) Taunton River Basin Water Quality Management Plan Update, 1981, p 24.
- (40) Ibid 1973
- (41) Conservation Law Foundation of N.E. vs Fall River related primarily to CSO issue.
- (42) Taunton River Basin Plan Update '81, p 71.
- (43) C.E. Maguire, Inc. was selected as contractor.
- (44) Save The Bay Special Report, Hope for Mount Hope Bay, 1989.
- (45) Personal Communication with the Staff of Fall River POTW.
- (46) Providence Journal-Bulletin, Saturday, December 2., 1989.
- (47) Rippey, S.R. and Watkins, W.D. 1987-Report carried out by FDA, funded by the Narragansett Bay Project.
- (48) Providence Journal Bulletin, December 11 1989.
- (49) Save The Bay Special Report-see Note (44).
- (50) Pratt, S.D., 1988, Status of Hard Clams in the Providence River and Mount Hope Bay.
- (51) Taunton River Basin Plan Update, op cit. p 45.
- (52) Rippey and Watkins-see Note (47).
- (53) STB Report op cit., p All- see Note (44).
- (54) Taunton River Basin Plan Update, op cit.,p23.
- (55) STB Special Report op cit., p.A11
- (56) 1988 State of State's Waters, p. III H-58.
- (57) Providence Journal, Saturday Dec. 2nd
- (58) Telecom with staff of Newport POTW
- (59) 208 Plan p. 416
- (60) Myers, J.C. Governance of NPS Inputs to Narragansett Bay, p. 108 and p. 255.
- (61) Personal communication with RIDEM.
- (62) Personal communication with Office of State Planning.
- (63) 208 Plan, p 84.
- (64) Ibid. Cost Comparison Table 3-10, p. 99.
- (65) Myers, J.C. Governance of NPS Inputs to Narragansett Bay p. 47.
- (66) 208 Plan Status of Recommendations 1981. p 4.27-28.
- (67) DEM Non-point Source Management Plan, see also J. Myers. Governance of NPS Inputs to Narragansett Bay, p. 108 and p. 255.
- (68) Div. of Planning Report No 62: "Waste Management Districts: A Starting Point."
- (69) RI Coastal Resources Management Program, Sec. 300.6, Update 1983.
- (70) Myers, op cit., p.48-see Note (60).
- (71) State of the State's Waters 1988 RIDEM.
- (72) Separate research confirmed by International Marina Institute, Wickford, RI.
- (73) Myers op cit., p.175.
- (74) State of the State's Waters 1988 RIDEM.

## APPENDIX I

### Bibliography

In the process of writing this paper reference was made to a number of plans, reports and planning documents which for convenience is contained in a separate chronological inventory at Appendix VI. Other documents referred to are listed in this Bibliography.

Blackstone River Park Master Plan. 1986, RIDEM.

Blackstone River Valley National Heritage Corridor Plan. 1989, National Heritage Corridor Commission.

Countrywide Stewardship. Research Bulletin No. 720/March 1988, University of Massachusetts at Amherst, College of Food and Natural Resources.

Environmental Quality Study Commission. Interim Report, November 1989.

Everett, D. and Kiernan, S. Where the Land Meets the Water, A Citizen's Guide to Land Use, Save the Bay, Inc., 1987.

Gruber, J. Narragansett Bay Study Project, Translating Science into Management, Thesis, Brown University, May 1986.

Hall, J., Risetto, C. and Santarella, Jr., J. Control Strategies for Combined Sewer Overflow, Journal WPCF, Vol. 61, No. 8, August 1989.

Kumekawa, G. Towards the Management of Narragansett Bay: An Institutional Analysis, The Intergovernmental Policy Analysis Program, U.R.I., January 1987.

Narragansett Bay Project. Progress Report 1985-1986.

Narragansett Bay Project. Progress Report 1987.

- Olsen, S., Robadue, Jr., D. and Lee, V. An Interpretive Atlas of Narragansett Bay, 1984, CRC Marine Bulletin 40, U.R.I.
- Oviatt, C. The Health of Narragansett Bay: An Overview of Recent Studies, Maritimes, Vol. 33, No. 4, November 1989.
- Robadue, Jr., D. The Growth and Distribution of Population Around Narragansett Bay, 1986, CRC, U.R.I.
- Robadue, Jr., D. The Coastal Resources Management Experiment in Rhode Island, 1971-1986: A Progress Report, CRC, U.R.I.
- Save the Bay Special Report. Hope for Mount Hope Bay, July 1989.
- Save the Bay Special Report. A Raw Deal: CSO Pollution in Rhode Island, December 1988.
- State Guide Plan Overview. Element 010 Report No. 48, R.I. SPP.
- Taunton River Basin Water Quality Management Plan Update 1981. Mass. DEQE.
- Ten Mile River Basin 1984 Water Quality Program and NPDES Permit Development. EPA Region 1 and Mass. Division of Water Quality Control, December 1985.
- The Ten Mile River Basin Water Quality Management Plan 1975. Water Quality Section of Mass. Division of Water Pollution Control.
- Towards a Cleaner Ten Mile River. A Public Report, September 1985, Rumford Laboratories, Foxboro, Mass.
- Water Resources Strategy for R.I. 1990-1995, USDA-Soil Conservation Service.

## APPENDIX II

### Construction Grants Projects With Work in Operation Dates from 1977 to Present

Works in Operation Date	Location	Project	Total Project Cost (S x 10 <sup>6</sup> )
1977	E. Providence	STP Upgrade	10.547
1978	Block Island	STP and Sewers	4.192
1978	S. Kingstown	STP and Sewers	26.151
1979	Smithfield	STP and Interceptor	10.216
1979	Woonsocket	STP Upgrade	23.263
1981	Burrillville	STP and Interceptor	6.256
1981	Warwick	Oakland Beach Interceptor	1.533
1981	Westerly	STP and Sewers	9.787
1982	Jamestown	STP and Interceptor	5.838
1982	W. Warwick	Natick Interceptor	1.025
1983	Barrington	Interceptor and PS	20.380
1983	Cranston	STP Primary Upgrade	34.777
1983	Narragansett	STP Upgrade	2.958
1983	Warren	STP and Interceptor	5.838
1984	Bristol	Sewers	0.263
1985	E. Providence	Sewers	2.226
1985	E. Greenwich	STP Final Clarifiers	0.998
1986	Narr. Bay Comm.	Pleasant Valley Pkwy. Sewers	1.328
1987	Cranston	STP Chlorine Contact Tanks	1.617
1987	Cranston	STP Solids handling	24.007
1987	BVDC	STP Upgrade	5.628
1987	Bristol	STP Primary Upgrade	2.936
1987	Narragansett	Ocean Outfall	1.603
1987	NBC	STP Upgrade	35.123
1987	Warwick	STP Chlorination, Septage	5.986
1987	W. Warwick	STP Upgrade	3.477
1988	NBC	STP Sludge Dewatering	1.677

STP: Sewage Treatment Plant  
 PS: Pump Station

Source: State Clean Water Strategy Part 1.

## Active Construction Projects

<u>Responsibilities</u>		<u>Inspection</u>
<u>Project</u>	<u>DEM</u>	<u>US Army Corps of Engineers</u>
BVDC Contract 101 (WWTF)	X	X
BVDC Contract 102 (WWTF)	X	X
Bristol Contract 13B (WTF)	X	X
Bristol Contract 12B (PS)	X	X
Cranston Contract IIA (WWTF)	X	X
East Greenwith Contract 2 (WWTF)	X	X
Lincoln Waterlines, Old Great Rd.	X	
Lincoln Lonsdale East Sewers	X	
Narr. Bay Comm. Fields Point WWTF		
Contract 1 and 6 (WWTF)	X	X
Contracts 2A, (PS)	X	X
Narr. Envine Estates Sewers	X	
Newport Contract 22 (WWTF)	X	X
Newport Contract 23 (WWTF)	X	X
Newport Contract 25 (CSO)	X	X
Tiverton Water Lines Stonebridge	X	
Warwick Brookwood Sewers	X	
Warwick Phase I Contract 39A WWTF	X	X
Warwick Phases I, Contract 39B/C		
(WWTF)	X	X
West Warwick Contract 2 (WWTF)	X	X

WWTF: Wastewater Treatment Facility

PS: Pump Station

CSO: Combined Sewer Overflow

### APPENDIX III

The following is a list of the major municipal permits issued by RI DEM:

POTW	EXISTING PERMIT EXPIRATION
BVDC	November 1988
Bristol	December 1988
Burrillville	December 1990
Central Falls (CSO)	October 1988
Cranston	May 1994
East Greenwich	March 1994
East Providence	October 1990
Jamestown	August 1993
Narragansett	August 1993
Newport	April 1992
New Shoreham	December 1990
NBWQMDC	April 1984
Pawtucket (CSO)	October 1988
RIPA/Quonset Point	January 1988
Smithfield	December 1990
South Kingstown	August 1990
Warren	October 1990
Warwick	May 1994
Westerly	August 1990
West Warwick	May 1994
Woonsocket	December 1990

Source: State Clean Water Strategy Part 1.



## APPENDIX IV

### SIGNIFICANT UNIMPLEMENTED RECOMMENDATIONS

Recommendations will be presented in this appendix with a notation indicating from which plans the recommendation arises. These unfulfilled recommendations are not prioritized and come from a number of sources reviewed by the author. In addition, account has not been taken of recent ongoing planning, implementation and monitoring efforts; thus this cannot be considered a definitive list but rather a summary of recommendations, the implementation of which has not been clearly established.

### POINT SOURCE AND GENERAL RECOMMENDATIONS

1. Implement an Upper Narragansett Bay Plan (Providence Harbor SAM Plan; RIDEM Work Plan, FY88) as the Providence and Seekonk Rivers have the highest abatement priority ranking (Narragansett Bay Basin Plan, 1977).
2. Assign Waste Load Allocations and Total Maximum Daily Loads to water quality segments (RIDOH Annual Report, 1967; RIDEM Work Plans).
3. Include nonpoint loadings into Waste Load Allocations (SENE 1975).
4. Integrate point and nonpoint solutions in water pollution control (Phase II Basin Plan, 1982).
5. Provide more funding for the Hazardous Waste Reduction Project (HWRP) in order for municipalities to exert more effort in instituting pretreatment programs beyond the assistance available from RIDEM; and to provide increased staff and auditing capability. (RIDEM State of the State's Waters, 1988)
6. Consider instituting other technical assistance programs like the HWRP to assist municipal plants in setting up realistic fiscal rate structures and separate operation and maintenance funds (208 Report).
7. Continue to expand the chemical constituents for monitoring in discharges (RIDEM Work Plan, FY85).
8. Ensure (make sure funding is provided) that municipalities update their Facilities Plans as part of their Comprehensive Plans (208 Plan).
9. Institute regional sludge composting facilities and provide technical and financial assistance (208 Plan, 1979).
10. Existing treatment facilities discharging to fresh waters should install dechlorination equipment and use it during the summer. (208 Plan, 1979).
11. Alternatives to chlorination should be considered for new plants or expanding existing plants (208 Plan, 1979). Alternatives should be evaluated in order to be considered for incorporation in RIDEM's Effluent Disinfection Policy.

## CSO MANAGEMENT CONTROL RECOMMENDATIONS

Implementation of controls for CSO Management have progressed very slowly. Only Newport has CSO control structures in place, while studies in connection with the Field's Point plant have been going on for a decade and new studies will be required for Pawtucket and Central Falls.

1. Make sure that Cities in the state (Pawtucket and Central Falls, Providence, Newport) apply for MCSO monies. (RIDEM Work Plan FY85).
2. Review/prioritize and monitor the implementation of Phase I recommendations from Providence CSO studies (CSO Area Reports and RIDEM's State of the State's Waters Report, 1988).
3. Review the prioritization of Phase II recommendations once all the reports from studies conducted in the Providence area are complete (State of the State's Waters Report, 1988).
4. Use current models to predict the allocation of oxygen demanding loadings (BOD and TSS). Assess whether CSO treatment will improve DO levels in the Providence River if better BOD and TSS loadings data are available, taking into consideration that the Field's Point plant has been renovated (Urban Runoff Task Reports, 1978; Robadue, 1981; Deason, 1982, CSO Area 2 Report, 1985).

## NONPOINT SOURCE CONTROL MANAGEMENT RECOMMENDATIONS

Rhode Island's Nonpoint Source Control Program was recently instituted with the support of federal funds. The control of nonpoint pollution problems has primarily been carried out through the U.S. Department of Agriculture programs, the CRMC and RIDEM. Some recommendations from the past planning process are relevant to these state agencies, however, other recommendations apply to numerous communities, some of which have initiated actions, whilst in others they remain unimplemented. The recommendations described below have been summarized in either RIDEM's Nonpoint Source Management Plan; the Governance of Nonpoint Source Inputs to Narragansett Bay: A Plan for Coordinated Action (Myers '88); or the Division of Planning's Land Use 2010.

### Nonstructural Guidance of Development

1. The state should establish guidelines or pass legislation delineating critical areas to guide local planning (SENE Reports, 1975).
2. Pass Critical Areas Legislation (SENE Reports, 1975; 208 Plan, 1979; State Guide Plan, 1984).
3. Base planning on resource analysis (SENE Report, 1975; 208 Plan, 1979, State Guide Plan, 1975; Land Capability Analysis, 1982).
4. Zoning should be based on resource analysis (SENE Reports, 1975).
5. Amend zoning enabling legislation to reflect modern planning techniques (208 Plan, 1979).
6. Use soils as a criteria to regulate zoning (208 Plan, 1979).
7. Solve pollution problems based on point and nonpoint solutions (Blackstone Region - Phase II Plan, 1982; RIDEM Work Plan).
8. Enforce existing land use legislation to mitigate impacts on water quality (208 Plan, 1979).

### Erosion and Sedimentation Control

1. Continue the implementation of local ordinances for stormwater management and erosion and sedimentation (SENE Reports, 1975; 208 Report, 1979).
2. Use BMPs in state and local development projects (208 Plan)

### Stormwater Management Control

1. Implement a comprehensive stormwater management program (SENE Reports, 1975; 208 Plan, 1979).
2. Stormwater management controls should be incorporated into zoning regulations and subdivision ordinances (208 Plan, 1979).

### Flood Hazard and Hurricane Management

1. Incorporate flood plain management into zoning regulations by using the 100 year storm (Land Capability Analysis, 1982).
2. Acquire key wetlands and flood plains for human safety (SENE Reports, 1975).
3. Establish forest buffers as a flood plain management tool (SENE Reports, 1975).
4. Acquire key coastal areas prone to hurricanes for human safety (RI Shore, 1956).
5. Implement existing flood control and hurricane management plans as nonpoint source pollution management measures (Myers, 1988).
6. Restrict or prohibit development in flood-prone areas (SENE Reports, 1975).

### ISDS Problem Mitigation

1. Use soils to limit use of ISDS (SENE Reports, 1975; SGP, 1984; ISDS Task Force, 1987).
2. Establish ISDS standards for critical areas (ISDS Task Force, 1987).
3. Allow innovative technology when replacing ISDS systems (ISDS Task Force, 1987).
4. Establish a Task Force to solve the septage management problem (NPSMP, 1988).

### Agricultural Runoff

1. Institute a tax break for installation of agricultural BMPs (208 Plan, 1979).
2. Establish a program for critical areas (Rural Runoff Task, 1978).

### Marine Activities

1. Evaluate the feasibility of implementing "no-discharge" zones for boat MSDs (208 Plan, 1979; West, 1982).
2. Boater safety courses should incorporate a section on boater pollution (208 Plan, 1979).
3. Provide pumpout facilities at coastal treatment plants (SENE Reports, 1975).
4. Incorporate pumpout facilities into marinas as required (208 Plan, 1979).

### River Systems

1. Monitor the implementation of RIDEM's Pawtuxet River Program (SENE Reports, 1975; 208 Plan, 1979; RIDEM Work Plan FY 89).
2. Increase RIDEM's capability to monitor for water quality improvement/degradation on smaller tributaries (RIDEM State of the State's Waters 1986).

3. Evaluate the feasibility of removing dams from the Pawtuxet River in order to improve water quality (208 Plan, 1979).

## APPENDIX V

### E. WATER QUALITY CLASSIFICATION AND STANDARDS

Water quality standards are organized in the following way: the first way is termed a water use classification standard (designated use). Each water body is defined by the most sensitive, and therefore governing, designated goal for a water body's uses as noted in the RI Water Quality Regulations:

#### FRESH WATER CLASSIFICATION STANDARDS

- Class A    Suitable for public drinking water supply; character uniformly excellent.
- Class B    Suitable for bathing, other primary contact recreational activities; agricultural uses; excellent fish and wildlife habitat; good aesthetic value; acceptable for public water supply with appropriate treatment.
- Class C    Suitable for boating and other secondary contact recreational activities; industrial processes and cooling; good fish and wildlife habitat; good aesthetic value.

#### SALT WATER CLASSIFICATION STANDARDS

- Class SA    Suitable for bathing and other primary contact recreation; shellfish harvesting for direct human consumption; and excellent fish and wildlife habitat.
- Class SB    Suitable for shellfish harvesting for human consumption after depuration; bathing and other primary contact recreational activities; and excellent fish and wildlife habitat.
- Class SC    Suitable for boating and other secondary contact recreational activities; good fish and wildlife habitat; industrial cooling; good aesthetic value.

Once the classification or designated use for waterbodies has been established, the second aspect of water quality standards involves water quality criteria. Class-specific criteria are described (concerning coliform, DO, turbidity, etc.) for each of these waterbody classes (A,B,C. etc.) in the RI Water Quality Regulations. These spell out specific numerical requirements which are parameters of minimum water quality necessary to support the designated water use classification of a waterbody. The numbers vary according to the classification they are associated with (i.e., A/SA waters have more stringent limits than C/SC waters).

Finally, water quality criteria (which override all classifications) for such things as trace metals, pesticides, PCB's, etc., must be considered. These numerical acute and chronic limits are constant and do not vary according to designated use.

## APPENDIX VI

### CHRONOLOGICAL INVENTORY OF PLANS/REPORTS

Prepared by Melissa Hughes, Narragansett Bay Project

- 1920-32 Annual Reports, RI DOH
- 1934 Statement by Board of Purification relating to proposed sewer plan.
- 1935-40 Annual Reports, RIDOH
- 1946 Report to Governor Pastore on Pollution of the Waters of the State by Walter Shea, RIDOH.
- 1948 Summary Report to Blackstone Valley Sewer District Commission upon Abatement of Water Pollution by Metcalf & Eddy, Engineers, Boston.
- 1955 The Rhode Island Shore--A Regional Guide Plan Study 1955-70 by RI Development Council.
- 1960 Effects of Proposed Hurricane Barriers on water quality of Narragansett Bay, U.S. Army Corps of Engineers.
- 1962 Present Use and Economic Classification of non-urban Land in RI, A. Jeffrey, Dept. of Agricultural Economics, URI. Consultant
- 1969-76 Annual Reports, RI DOH
- 1975 Report of Southeastern New England Study (SENE) - Summary  
by New England River Basins Commission  
As above--Blackstone Planning Area Report.  
As above--Pawtuxet Planning Area Report.  
As above--Narragansett Bay and Block Island Area Report.
- 1976 Blackstone River Basin Water Quality Management Plan by RI State Planning Program (SPP) & DOH.
- 1977 Narragansett Bay Basin Water Quality Management Plan Report No. 26D by RI State Planning Program (SPP) and RI DOH.
- 1977 Moshassuck River Water Quality Management Plan, SPP :& DOH.
- 1978 Urban Runoff Task. Development of Alternatives Report for 208 Plan by Raytheon (Consultant).
- 1978 Rural Runoff Task. Erosion and sedimentation. Development of alternatives for 208 Plan; by RI State Conservation Committee.
- 1978 Final Urban Stormwater Evaluation Report for 208 Plan, by D.S. Graber (Consultant).
- 1978 Development of Alternative Solutions for improving water quality in the Pawtuxet River Basin for 208 Plan by RI SPP.
- 1979 208 Water Quality Management Plan for RI by SPP.
- 1979 Governor's Sewage Facilities Task Force.
- 1980 Upper Narragansett Bay--Urban Estuary in Transition by Robadue & Lee, CRC-URI.
- 1981 Pollution loads to the Providence River, Data and estimates by Robadue, CRC-URI.
- 1981 Interim Report on Studies in CSO Site No. 2 Area by CE Maguire, Inc. (Consultant).
- 1982 A Land Capability Analysis for RI--Inventory of Land Uses for Zoning Control and Environmental Protection by SPP.
- 1982 Blackstone Region Water Resources Management Plan by RI Office of State Planning (OSP) and DEM.
- 1982 CSO No. 9 Drainage District Dry Discharge Report by Catelucci, Galli, Hayden, Harding & Buchanan (Consultants).
- 1982 Planning for Water Quality Improvements in Upper Narragansett Bay and its tributaries by E.Deason, CRC.

- 1983      Setting Industrial Discharge limits for the Providence Sewage System by R. Robadue and B. Martin, CRC.
- 1983      RI Coastal Resources Program as amended 1983 by Olsen and Seavey, CRC.
- 1983      CSO Abatement: A local issue of national importance by B. Knowles, Environmental Studies Dept. Brown University.
- 1983      Providence Harbor: A Special Area Management Plan by D. Robadue, CRC-URI.
- 1984      Setting Pollutant Discharge limits in an estuary: using mathematical models by B. Martin, CRC.
- 1984      State Guide Plan Overview. State Guide Plan Element 010 Report No. 48 by RI SPP.
- 1984      Final Report, Ch. 1-5 for CSO No. 9 by Hayden-Castelucci (Consultant)
- 1985      CSO Mitigation Study--CSO Area B Moshassuck River by O'Brien & Gere, Engineers, Inc. (Consultant).
- 1985-89    RI DEM Water Resources Control Program Plan
- 1986/88    The State of the State's Water--RI. A report to Congress by RI DEM, Division of Water Resources.
- 1987      Pawtuxet River Basin Non-point Water Quality Standards and Management Plan by RIDEM.
- 1988      Assessment of Non-point Pollution in RI by RI DEM.
- 1988      Governance to Non-point source Inputs to Narragansett Bay: A Plan for Coordinated Action by Jennie Myers, (Consultant).
- 1988      RI's Non-point Source Management Plan by RI DEM.
- 1989      Land Use 2010 Division of Planning, Department of Administration.



**TITLE** Reports made to His Excellency the Governor for the Years 1920, 1921, 1922, 1928, 1929, 1931 and 1932.

**AUTHOR** Board of Purification of Waters.

**AFFILIATION** State agency

**AGENCIES INVOLVED**

**IMPETUS FOR PLAN** State legislation passed in 1920--"An Act to Prohibit and Regulate the Pollution of the Waters of the State"

**TARGET AUDIENCE** The Governor, general public

**SCOPE OF PLAN** Geographic area--State of Rhode Island, Topic--Water pollution control.

**DESCRIPTION OF DATA USED** Engineering reports, interviews, agency water quality surveys.

**MANAGEMENT PLAN FORMAT** Implementation of state law and agency regulation.

**APPENDICES: TECHNICAL REPORTS. MAPS. COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Annual progress report on measures taken to abate pollution by building treatment plants, eliminating industrial dischargers and sewerage, primarily through voluntary compliance by local officials and industries.

**TITLE** Statement by the Board of Purification of Waters in Relation to the Proposed Metropolitan Sewer Plan (1934).

**AUTHOR** Board of Purification of Waters

**AFFILIATION** State agency.

**AGENCIES INVOLVED** Metropolitan Sewer Commission.

**IMPETUS FOR PLAN** Response to Metropolitan Sewer Plan (1933).

**TARGET AUDIENCE** Metropolitan Sewer Commission, Governor's Office

**SCOPE OF PLAN** Geographic area--State of Rhode Island, Topic--Water pollution control.

**DESCRIPTION OF DATA USED** Engineering reports, interviews, agency water quality surveys.

**MANAGEMENT PLAN FORMAT** Implementation of state law and agency regulation.

**APPENDICES: TECHNICAL REPORTS. MAPS. COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Annual progress report on measures taken to abate pollution by building treatment plants, eliminating industrial dischargers and sewerage, primarily through voluntary compliance by local officials and industries

**TITLE** Statement by the Board of Purification of Waters in Relation to the Proposed Metropolitan Sewer Plan (1934)

**AUTHOR** Board of Purification of Waters

**AFFILIATION** State agency

**AGENCIES INVOLVED** Metropolitan Sewer Commission

**IMPETUS FOR PLAN** Response to Metropolitan Sewer Plan (1933)

**TARGET AUDIENCE** Metropolitan Sewer Commission, Governor's Office

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--Water pollution control

**DESCRIPTION OF DATA USED** Metropolitan Sewer Commission Report

**MANAGEMENT PLAN FORMAT** Maintain pollution abatement program of Board of Purification of waters.

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Response of Board of Purification of Waters condemning a plan to channel all sewage and some industrial wastes from the Blackstone Valley and Cranston to a treatment plant on Prudence Island.

**TITLE** Annual Reports. Rhode Island Department of Health (1935), 1936, 1937, 1938, 1939, 1940)

**AUTHOR** Division of Purification of Waters (1935-1938); Sewerage and Shellfish Section (1939, 1940)

**AFFILIATION** Division of RI Department of Health, a state agency

**AGENCIES INVOLVED**

**IMPETUS FOR PLAN** Continuation of Annual Reports started in 1921

**TARGET AUDIENCE** State agencies, Governor

**SCOPE OF PLAN** Geographic area--State of Rhode Island, Topic--Water pollution control

**DESCRIPTION OF DATA USED** Internal material, Facilities Plans

**MANAGEMENT PLAN FORMAT** Implementation of agency regulations and state law

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Annual progress report on measures taken to abate water pollution by construction and upgrading of treatment plants, extending sewers and connecting industrial dischargers to sewer plants.

**TITLE** Report to His Excellency John O. Pastore Governor of RI on Pollution of the Waters of the State (1946)

**AUTHOR** Walter J. Shea, Chief, Division of Sanitary Engineering

**AFFILIATION** Rhode Island Department of Health (RIDOH)

**AGENCIES INVOLVED** RIDOH

**IMPETUS FOR PLAN** A pollution control program prepared at the direction of the Governor to:  
1) meet present needs; 2) adapt to future needs

**TARGET AUDIENCE** Governor, legislators, public

**SCOPE OF PLAN** Geographic Area--Blackstone Valley and Narragansett Bay--Topic--Water Quality

**DESCRIPTION OF DATA USED** Recommendations

**MANAGEMENT PLAN FORMAT** Recommendations to Governor

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Classification of present and future use of State's waters

**SUMMARY OF INFORMATION COLLECTED** Recommendations on pollution control in Narragansett Bay watershed, primarily in the most critical area of Upper Narragansett Bay.

**TITLE** Sum. Report to Blackstone Valley Sewer Dist. Com. upon Abatement of Water Pollution (1948).

**AUTHOR** Metcalf & Eddy, Engineers, Boston, MA (Forward by Blackstone Valley Sewer District Commission)

**AFFILIATION** Consultant

**AGENCIES INVOLVED** Blackstone Valley Sewer District Commission (BVSDC)

**IMPETUS FOR PLAN** Walter Shea's report. Public and gubernatorial pressure moved the General Assembly to pass legislation creating a Blackstone Valley District Commission to oversee construction of a Blackstone Valley plant

**TARGET AUDIENCE** Blackstone Valley Sewer District Commission

**SCOPE OF PLAN** Geographic Area--Blackstone Valley Sewer District cities of Pawtucket and Central Falls; towns of Cumberland, Lincoln, and East Providence, Topic--Water Quality Improvement

**DESCRIPTION OF DATA USED**

1. Water consumption measurement interceptor and analyses of wastes
2. Field surveys of routes and treatment plant sites
3. Population from 1890-1940

**MANAGEMENT PLAN FORMAT** Recommendations to BVSDC for bond referendum funds

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Map of Blackstone Valley Sewer District

**SUMMARY OF INFORMATION COLLECTED** Summary of recommendations for pollution abatement in the Blackstone Valley region based on field surveys and population trends.

**TITLE** The Rhode Island Shore--A Regional Guide Plan Study 1955-1970

**AUTHOR** RI Development Council

**AFFILIATION** State agency

**AGENCIES INVOLVED** RI Development Council, Governor's Office

**IMPETUS FOR PLAN**

1. Urban Planning Grant from Housing and Home Finance Agency for comprehensive study of the needs of long range planning for the shore region.
2. Detailed information prerequisite for community and regional planning, special study of measures to minimize damage from future storms after 1954.
3. Governor directed the RI Development Council to conduct a special study of measures to minimize damage from future storms after 1954.

**TARGET AUDIENCE** State and local officials; civic and business leaders

**SCOPE OF PLAN** Geographic area--RI Shore, Topic--Trends on highways, recreation, housing development trends, framework for action

**DESCRIPTION OF DATA USED** Population data and projections

**MANAGEMENT PLAN FORMAT** Draft hurricane zoning and building regulations

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Maps on land use of Bay watershed, maps on water use and population

**SUMMARY OF INFORMATION COLLECTED** Communities use information to develop Master Plan.

**TITLE** Effects of Proposed Hurricane Barriers on Water Quality of Narragansett Bay (1960)

**AUTHOR** US Department of Health, Education and Welfare, Public Health Service

**AFFILIATION** Federal agency

**AGENCIES INVOLVED** US Army Corps of Engineers, New England Division

**IMPETUS FOR PLAN** Hurricanes of 1938 and 1954

**TARGET AUDIENCE** US Army Corps of Engineers, New England Division

**SCOPE OF PLAN** Geographic area--Narragansett Bay, Topic--Hurricane Mitigation

**DESCRIPTION OF DATA USED** Water Quality surveys measuring conductivity, temperature and MPN (mean probable number) of fecal coliforms/100 ml

**MANAGEMENT PLAN FORMAT** conclusions based on field surveys

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Map indicating position of proposed hurricane barriers, data, appendices

**SUMMARY OF INFORMATION COLLECTED** The water quality of Narragansett Bay, measured by dissolved oxygen and fecal coliform levels, would not be impacted by hurricane barriers built across the upper and lower Bay.

**TITLE** Present Use and Economic Classification of Non-Urban Land in Rhode Island.  
Publication No. 4 (1962)

**AUTHOR** Arthur D. Jeffrey, Dept. of Agricultural Economics, University of Rhode Island

**AFFILIATION** Consultant

**AGENCIES INVOLVED** Planning Division RI Development Council--State Planning Section

**IMPETUS FOR PLAN**

1. Statewide program for urban planning assistance
2. Consider state's land resource from the point of view of maximum social benefit.
3. Urban planning grant from the Housing and Home Finance Agency, under Section 701 of Housing Act of 1954, as amended.

**TARGET AUDIENCE** RI Development Council

**SCOPE OF PLAN** Geographic Area--RI 1962--63.5% Woodland  
Topic

**DESCRIPTION OF DATA USED** (aerial photos, census) 1950 aerial photos by USDA--driver survey by road code land use on photos--see changes over past decade

**MANAGEMENT PLAN FORMAT** State law, agency regulation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Economic classification of non-urban land, land use of State of Rhode Island

**SUMMARY OF INFORMATION COLLECTED** Land classes by average plan more profitable use of RI's land resources.

**TITLE** Annual Report (FY'69, FY'70, FY'71, FY'73, FY'74, FY'75, FY'76)

**AUTHOR** Division of Water Pollution Control, Rhode Island Department of Health

**AFFILIATION** State agency

**AGENCIES INVOLVED**

**IMPETUS FOR PLAN** Annual progress report for the water pollution control agency as first started in the 1920's.

**TARGET AUDIENCE** Governor, state agencies, general public

**SCOPE OF PLAN** Geographic area--Rhode Island, Topic--water pollution control

**DESCRIPTION OF DATA USED** RIDOH statistics and memoranda

**MANAGEMENT PLAN FORMAT**

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Update on progress of water pollution control activities for a fiscal year.

**TITLE** Report of the Southeastern New England Study--Summary (1975)

**AUTHOR** New England River Basins Commission

**AFFILIATION** Federally funded agency

**AGENCIES INVOLVED** Representatives of local, state and federal agencies in New England Scientific and Citizens Advisory Committees.

**IMPETUS FOR PLAN** Authorized and funded by Congress

**TARGET AUDIENCE** State and local governments

**SCOPE OF PLAN** Southeastern New England

**DESCRIPTION OF DATA USED** Recommendations distilled from inventory reports and other primary sources.

**MANAGEMENT PLAN FORMAT** Recommendations for state and local governments to implement on a priority basis.

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Summary of most important recommendations from all the reports compiled for Southeastern New England. Recommendations to guide growth in an environmentally sound manner, while enhancing the economy.

**TITLE** Report of the Southeastern New England Study, Blackstone Planning Area Report (1975)

**AUTHOR** New England River Basins Commission

**AFFILIATION** Federal agency

**AGENCIES INVOLVED** Representatives of local, state and federal agencies in New England. Scientific and citizen's advisory committee.

**IMPETUS FOR PLAN** Authorized by NE Governor's Conference Funded by Congress

**TARGET AUDIENCE** State and local governments

**SCOPE OF PLAN** Geographic area--Blackstone River Valley, Topic--a strategy for balancing protection of water and related land resources with development

**DESCRIPTION OF DATA USED** Summary of recommendations distilled from inventory reports prepared by River Basins Commission Staff.

**MANAGEMENT PLAN FORMAT** Recommendations for agency implementation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Recommendations to accommodate growth in an environmentally acceptable way, while enhancing economic growth. Recommendations were in several areas: water supply, water quality, flood and erosion control, guiding growth, recreational needs and marine management.



**TITLE** Report of the Southeastern New England Study 8, Pawtuxet Planning Area Report (1975)

**AUTHOR** New England River Basins Commission

**AFFILIATION** Federally funded agency

**AGENCIES INVOLVED** Representatives of local, state and federal agencies in New England. Scientific and citizen's advisory committee.

**IMPETUS FOR PLAN** Connect actions at local level with policy framework at state and federal levels. Long history of local autonomy in New England; place decision-making at level closest to problems. Authorized and funded by Congress with approval of Conference of Governors.

**TARGET AUDIENCE** State and local level officials

**SCOPE OF PLAN** Geographic area--Pawtuxet River Basin, Topic--a strategy for balancing development and protection of water and related land resources with development

**DESCRIPTION OF DATA USED** Summary of recommendations distilled from inventory reports prepared by River Basins Commission Staff.

**MANAGEMENT PLAN FORMAT** state law, agency regulation, recommendations for state and local governments to implement on priority basis

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Recommendations to accommodate growth in an environmentally acceptable way, while enhancing economic growth. Recommendations were in topic areas: water supply, water quality, flooding and erosion control, guiding growth, recreational needs and marine management.

**TITLE** Report of the Southeastern NE Study 9, Narr. Bay and Block Island Planning Area Report (1975)

**AUTHOR** New England River Basins Commission

**AFFILIATION** Federally funded agency

**AGENCIES INVOLVED** Representatives of local, state and federal agencies in New England. Scientific and citizen's advisory committee.

**IMPETUS FOR PLAN** Authorized and funded by Congress--SENE Southeastern NE Water and Related Land Resources Study

**TARGET AUDIENCE** State and local governments

**SCOPE OF PLAN** Geographic area--Narragansett Bay Basin, Topic--a strategy for balancing protection of water and related land resources with development

**DESCRIPTION OF DATA USED** Summary of recommendations distilled from inventory reports prepared by River Basins Commission Staff.

**MANAGEMENT PLAN FORMAT** Using the recommendations for water, sewers, electric power & outdoor recreation, investigate more efficient use of existing facilities, legal authorities and institutional designs.

**APPENDICES: TECHNICAL REPORTS. MAPS. COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Recommendations to accommodate growth in an environmentally acceptable way, while enhancing economic growth. Recommendations were in several areas: water supply, water quality, flood and erosion control, guiding growth, recreational needs and marine management.

**TITLE** Blackstone River Water Quality Management Plan (1976)

**AUTHOR** RI Statewide Planning Program and RI Department of Health

**AFFILIATION** State agencies

**AGENCIES INVOLVED** RI Statewide Planning Program, RI Department of Health, local governments

**IMPETUS FOR PLAN** Federal funding under Federal Water Pollution Control Act for water quality planning (Title III, Section 303.e)

**TARGET AUDIENCE** State and local regulatory officials

**SCOPE OF PLAN** Geographic area--Blackstone Valley, Topic--water pollution control

**DESCRIPTION OF DATA USED** Census, land uses, population projections, facilities plans and engineering reports from treatment plants

**MANAGEMENT PLAN FORMAT** Recommendations for state and local implementation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Sources of pollution and future land use in 1990. Prioritization of areas in need of sewerage.

**SUMMARY OF INFORMATION COLLECTED** Recommendations to set priorities for point source control by building and upgrading treatment plants and extension of sewers.

**TITLE** Narragansett Bay Basin Water Quality Management Plan Report, Number 26D  
(1977)

**AUTHOR** RI Statewide Planning Program and RI DOH

**AFFILIATION** State agency

**AGENCIES INVOLVED** RIDEM, DOH, OSP

**IMPETUS FOR PLAN** Title III Section 303e FWPCA Amendments of 1972

**TARGET AUDIENCE** State--adopted as part of State Guide Plan on August 11, 1977

**SCOPE OF PLAN** Geographic Area--Narragansett Bay Basin, Topic--Water pollution control

**DESCRIPTION OF DATA USED**

Water quality--DO sampling stations, Census, population trends, point sources

**MANAGEMENT PLAN FORMAT** Recommendations in area of point source control for state and local implementation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

Maps--transportation system, CSOs

Sources of pollution and future land use projected for 1990

Sewer service area

**SUMMARY OF INFORMATION COLLECTED** Recommendations on point source control: 1) build or upgrade treatment plants; 2) sewer high density areas; 3) sewer areas with failing septic systems.

**TITLE** Moshassuck River Water Quality Management Plan (1977)

**AUTHOR** RI Statewide Planning Program

**AFFILIATION** State agency

**AGENCIES INVOLVED** RI Statewide Planning Program and RI Department of Health

**IMPETUS FOR PLAN**

1. Federal Water Pollution Control Act 1972 Amendments (Title III, Section 303e)
2. Federal funds provided for water quality planning.

**TARGET AUDIENCE** State and local regulatory officials

**SCOPE OF PLAN** Geographic area--Moshassuck River watershed, Topic--Water pollution control

**DESCRIPTION OF DATA USED** Census, land uses, population trends, facilities plans, engineering reports from treatment plants.

**MANAGEMENT PLAN FORMAT** Recommendations for state and local implementation.

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Maps indicating areas in need of sewerage

**SUMMARY OF INFORMATION COLLECTED** Recommendations to set priorities for point source control by building and upgrading treatment plants and extension of sewers. Status of water quality segments were assessed.

**TITLE** Urban Runoff Task. Development of Alternatives Report, 208 Areawide Water Quality Management Plan (1978)

**AUTHOR** Raytheon

**AFFILIATION** Consultant

**AGENCIES INVOLVED** Statewide Planning Program

**IMPETUS FOR PLAN**

1. Federal monies granted under section 208 of Federal Water Pollution Control Act for water quality planning.
2. Development of alternative solution to mitigate urban runoff.
- 3 Evaluate alternatives and incorporate recommendations into Final 208 Areawide Water Quality Management Plan.

**TARGET AUDIENCE** 208 Planning staff, Statewide Planning Program

**SCOPE OF PLAN** Geographic Area--208 Planning Area, Topic--stormwater abatement

**DESCRIPTION OF DATA USED**

1. wet weather surveys
2. predictions of levels of nitrogen, phosphorous, suspended solids and BOD in 20 years

**MANAGEMENT PLAN FORMAT** Recommendations for agency use; to be included in 208 report

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Cost estimates on installation of stormwater management facilities in developments

**SUMMARY OF INFORMATION COLLECTED** Prediction of water quality problems in 1990 and measures to correct.

**TITLE** Rural Runoff Task. Erosion and Sedimentation. Development of Alternatives. Areawide Water Quality Management Plan (1978).

**AUTHOR**

**AFFILIATION** Consultant

**AGENCIES INVOLVED** RI State Conservation Committee

**IMPETUS FOR PLAN** Title II, Section 208 Federal Water Pollution Control Act Amendments of 1972

**TARGET AUDIENCE** RI Statewide Planning Program

**SCOPE OF PLAN** Geographic Area--Rhode Island, Topic

**DESCRIPTION OF DATA USED** Inventory of erosion and sediment problems across state; economic losses due to loss of nutrients and soils

**MANAGEMENT PLAN FORMAT** List of alternatives to be incorporated into 208 plan as basis for future decision

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** List of alternatives for mitigation of rural runoff problems in some or all parts of the state.

**TITLE** Final Urban Stormwater Evaluation Report, Areawide Water Quality Management Plan (1978)

**AUTHOR** D.S. Graber

**AFFILIATION** Consultant

**AGENCIES INVOLVED** RI Statewide Planning Program

**IMPETUS FOR PLAN**

1. Federal monies granted under Title II, Section 208, of Federal Water Pollution Control Act for water quality planning
2. Evaluation of alternatives for mitigating of urban runoff

**TARGET AUDIENCE** 208 Planning staff, Statewide Planning Program

**SCOPE OF PLAN** Geographic area--State of Rhode Island, Topic--Stormwater abatement

**DESCRIPTION OF DATA USED** Recommendations and results from Urban Runoff Task Development of Alternatives Report

**MANAGEMENT PLAN FORMAT** Recommendations for incorporation into Final 208 Plan

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Cost estimates for installation of stormwater runoff controls

**SUMMARY OF INFORMATION COLLECTED** Recommendations on how to mitigate urban stormwater runoff through structural and non-structural means.

**TITLE** Development of Alternative Solutions for Improving Water Quality in the Pawtuxet River Basin. Areawide Water Quality Management Plan (1978)

**AUTHOR** Rhode Island Statewide Planning Program

**AFFILIATION** State agency

**AGENCIES INVOLVED** RI Statewide Planning Program

**IMPETUS FOR PLAN**

1. Federal money under Title II Section 208 of the Federal Water Pollution Control Act.
2. Special study as part of 208 Planning process

**TARGET AUDIENCE** 208 Planning Staff, RI Statewide Planning Program

**SCOPE OF PLAN** Geographic area--Pawtuxet River Basin, Topic--Water quality; pollution abatement

**DESCRIPTION OF DATA USED** Facilities plans, field surveys

**MANAGEMENT PLAN FORMAT** Alternatives for pollution abatement

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** List of alternatives to be studied and evaluated for pollution abatement in the Pawtuxet River Basin. Final recommendations from alternatives to be incorporated into Final Draft of the 208 Areawide Water Quality Management Plan.

**TITLE** 208 Water Quality; Management Plan for Rhode Island (1979)

**AUTHOR** Statewide Planning Program

**AFFILIATION** State agency

**AGENCIES INVOLVED** Official from state agencies, representative from each municipality, citizens on advisory committees.

**IMPETUS FOR PLAN** Federal Water Pollution Control Act Amendments of 1972, Title II, Section 208. \$2.3 million granted to state to study and prepare plan for improvement of water quality to fishable-swimmable status by 1983.

**TARGET AUDIENCE** state agencies, municipal governments

**SCOPE OF PLAN** Geographic area--State of Rhode Island, Topic--Pollution abatement planning for state

**DESCRIPTION OF DATA USED** Facilities plans, urban runoff measurements, Pawtuxet River survey, summary of data from other studies funded with 208 money

**MANAGEMENT PLAN FORMAT** Recommendations proposed by topic for stat and local implementation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** List of technical reports prepared; ordinances and legislation proposed; maps of areas in most need of sewerage; cost estimates of various recommendations.

**SUMMARY OF INFORMATION COLLECTED** Recommendations for abatement of point and nonpoint pollution distilled from alternatives listed in project reports funded by 208 monies.



**TITLE** Reports of the Governor's Sewage Facilities Task Force

**AUTHOR** Tom Breukner and others

**AFFILIATION** State of Rhode Island

**AGENCIES INVOLVED** Statewide Planning Program and Department of Administration

**IMPETUS FOR PLAN** To solve the crisis at the Fird's Point Wastewater Treatment Facility

**TARGET AUDIENCE** RI Governor's Office, General Assembly

**SCOPE OF PLAN** Providence Wastewater Treatment Facility, combined sewer overflows and industrial discharges

**DATA USED** Information from 208 Plan, City of Providence facility plans, financial data on the cost of priority profile

**MANAGEMENT PLAN FORMAT** Background reports and draft legislation creating the Narragansett Bay Commission.

**APPENDICIES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Detailed financial analysis of implementing facilities improvements in Providence

**SUMMARY OF INFORMATION COLLECTED** Construction of upgraded secondary treatment and two combined sewer overflow treatment facilities could be achieved by a combination of federal and special state funds (\$87.7 million bond issue) with beneficial effects on Narragansett Bay Water Quality.

**TITLE** Upper Narragansett Bay--An Urban Estuary in Transition, 1980.

**AUTHOR** D. Robadue & V. Lee

**AFFILIATION** Coastal Resources Center

**AGENCIES INVOLVED** Coastal Resources Management Council

**IMPETUS FOR PLAN** Purpose was as background material for CRMC's Providence Harbor Special Area Management Plan.

**TARGET AUDIENCE** Users and citizens on Upper Narragansett Bay

**SCOPE OF PLAN**

**DESCRIPTION OF DATA USED** (aerial photos, Census) compilation of available data on fisheries, water quality and shoreline development.

**MANAGEMENT PLAN FORMAT** State law, agency regulation

**APPENDICES: TECHNICAL REPORTS. MAPS. COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED**

**TITLE** Pollution loads to the Providence River: Data and Estimates (1981)

**AUTHOR** Donald D. Robadue, Jr.

**AFFILIATION** Coastal Resources Center

**AGENCIES INVOLVED**

**IMPETUS FOR PLAN** Release of 208 Water Quality Management Plan for Rhode Island

**TARGET AUDIENCE** General public, RIDEM

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--Water quality in Upper Narragansett Bay

**DESCRIPTION OF DATA USED** Analysis of NPDES permit data to assess loadings

**MANAGEMENT PLAN FORMAT** Recommendations

**APPENDICES: TECHNICAL REPORTS. MAPS. COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Loadings of BOD and TSS calculated from NPDES permits differ from those calculated from data from studies funded with 208 monies. Therefore, good loadings data are not available. Good loadings data are necessary to assess the contributions of BOD and TSS from the CSOs, especially as loadings from the Field's Point plant decrease.

**TITLE** Interim Report on Studies in CSO Site Number 2 Area (1981)

**AUTHOR** CE Maguire, Inc.

**AFFILIATION** Consulting Firm

**AGENCIES INVOLVED** City of Providence, RIDEM, USEPA, Narragansett Bay; Commission

**IMPETUS FOR PLAN** The recommendations of 1977 Anderson-Nichols-Waterman Engineering  
Combined Sewer Management Report

**TARGET AUDIENCE** Narragansett Bay Commission

**SCOPE OF PLAN** Geographic Area--Providence Sewage System, Topic--Field Study of flow of Sewage  
System

**DESCRIPTION OF DATA USED** Field Investigation of Sewers

**MANAGEMENT PLAN FORMAT** Cost estimates and maps for further study

**APPENDICES: TECHNICAL REPORTS. MAPS. COST ESTIMATES**

Study Area "B"	\$180,000
Study Area "C"	200,000
Structural analysis	23,000

**SUMMARY OF INFORMATION COLLECTED** Findings of CSO survey in Area 2 and  
recommendations for further study. Recommendations for CSO management could not be made  
until the upstream and downstream impacts were known.

**TITLE** A Land Capability Analysis for RI Inventory of Land Uses for Zoning Control  
and Environmental Protection (1982)

**AUTHOR** Rhode Island Statewide Planning Program

**AFFILIATION** State agency

**AGENCIES INVOLVED** Funded by SENE River Basins Commission, Water and Related Land Resources  
Mapping Resources

**IMPETUS FOR PLAN** Resource evaluation incorporated into comprehensive plans and used as a basis for  
zoning

**TARGET AUDIENCE**

**SCOPE OF PLAN** Geographic area--RI, Topic--Land Use Analysis

**DESCRIPTION OF DATA USED** (aerial photos, census)

**MANAGEMENT PLAN FORMAT**

**APPENDICES: TECHNICAL REPORTS. MAPS. COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Use of resource analysis as a basis for planning and  
suggested use of zoning as a tool to protect resources

**TITLE** Blackstone Region Water Resources Management Report. Report No. 42.  
(1982)

**AUTHOR** RI Statewide Planning Program and RI Department of Environmental Management

**AFFILIATION** State agency

**AGENCIES INVOLVED** Local governments, RI Statewide Planning and RI Department of Environmental Management

**IMPETUS FOR PLAN**

1. Federal Water Pollution Control Act 1972 Amendments (Title III, Section 303e)
2. Federal funds provided for Water Quality Planning

**TARGET AUDIENCE** State and local regulatory officials

**SCOPE OF PLAN** Geographic area--Blackstone River region, Topic--Water pollution control

**DESCRIPTION OF DATA USED** Census, land uses, population projections facilities plans and engineering reports from treatment plants

**MANAGEMENT PLAN FORMAT** Recommendations for state and local implementation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Sources of pollution, maps showing areas in need of sewerage

**SUMMARY OF INFORMATION COLLECTED** Recommendations to set priorities for point source control by building and upgrading treatment plants and extension of sewers. Assessment of status of water quality segments. Nonpoint source pollution not included as originally planned.

**TITLE** Combined Sewer Overflow No. 9 Drainage District Dry Weather Discharge Report for the City of Providence, Rhode Island (1982)

**AUTHOR** Castelucci, Galli, Hayden, Harding & Burchanan, Joint Venture, Providence, RI

**AFFILIATION** Consultant

**AGENCIES INVOLVED** Narragansett Bay Commission, RIDEM

**IMPETUS FOR PLAN**

1. Consent Decree issued by USEPA and RIDEM in 1978.
2. Facilities Plan of 1979 by Anderson-Nichols and Waterman Engineers
3. Facilities Plan recommended design studies for CSO Areas 2 and 9 be carried out first

**TARGET AUDIENCE** Narragansett Bay Commission, RIDEM, USEPA, public

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--Water quality affected by CSOs

**DESCRIPTION OF DATA USED** Flow depth measurements and sewer pipe capacity

**MANAGEMENT PLAN FORMAT** Abatement alternatives for dry weather discharge at CSO No. 9

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Cost estimates on abatement alternatives

**SUMMARY OF INFORMATION COLLECTED** Field observations corroborated the existence of a dry weather discharge from CSO Area 9, Report presents alternative measures to treat the approximately 12 MGD flow.

**TITLE** Planning for Water Quality Improvements in Upper Narragansett Bay and its Tributaries (1982)

**AUTHOR** Ellen E. Deason

**AFFILIATION** Coastal Resources Center

**AGENCIES INVOLVED** Coastal Resources Management Council

**IMPETUS FOR PLAN**

1. Providence Harbor Special Area Management Plan
2. Funding from National Oceanic and Atmospheric Administration under provisions of Coastal Zone Management Act of 1972

**TARGET AUDIENCE** Harbor Estuary and Land Planning Advisory Committee of the Coastal Resources Management Council

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--Improvement of Water Quality in Upper Narragansett Bay

**DESCRIPTION OF DATA USED** Assessment of data from scientific literature

**MANAGEMENT PLAN FORMAT** Problem assessment

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Assessment of pollution problems in the Upper Bay.

The impacts of nutrients, toxics and conventional pollutant loadings from treatment plants, CSOs and rivers are assessed in light of their effect on water quality, living resources and sediments. The mitigation of SCO flows and improvements to the Field's Point plant are also considered.

**TITLE** Setting Industrial Discharge Limits for the Providence Sewage System (1983)

**AUTHOR** Donald D. Robadue, Jr. and Brooks K. Martin

**AFFILIATION** Coastal Resources Center

**AGENCIES INVOLVED**

**IMPETUS FOR PLAN**

1. setting up pretreatment program at Field's Point
2. US EPA Findings of Violation and Order for Compliance, Docket 82-1079

**TARGET AUDIENCE** Narragansett Bay Commission and Citizen's Advisory Group to CAC

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--Evaluation of pretreatment program

**DESCRIPTION OF DATA USED** pretreatment report for Field's Point

**MANAGEMENT PLAN FORMAT**

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Recommendations

**SUMMARY OF INFORMATION COLLECTED** Improvements need to be made in method of setting industrial discharge values

**TITLE** The State of Rhode Island Coastal Resources Program. As Amended (1983)

**AUTHOR** Stephen Olsen and George L. Seavey

**AFFILIATION** Coastal Resources Center

**AGENCIES INVOLVED** Coastal Resources Management Council

**IMPETUS FOR PLAN**

1. Coastal Zone Management Act of 1972 (16 USC 1455(c)(5)).
2. Replacement of management plan approved in 1977

**TARGET AUDIENCE** Coastal Resources Management Council, state agencies, general public

**SCOPE OF PLAN** Geographic area--Coastal areas of Rhode Island, Topic--coastal management

**DESCRIPTION OF DATA USED** Inventory data on coastal resources, water quality, erosion-prone areas and open space

**MANAGEMENT PLAN FORMAT** Agency regulations

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Maps delineating land and water use categories for coastal zones

**SUMMARY OF INFORMATION COLLECTED** Regulations defining practices and restrictions to be employed during development of the coastal region. Regulations defining where development can and cannot occur.

**TITLE** Combined Sewer Overflow Abatement: A Local Issue of National Importance (1983)

**AUTHOR** Brian W. Knowles

**AFFILIATION** Environmental Studies Department, Brown University

**AGENCIES INVOLVED**

**IMPETUS FOR PLAN** Senior Thesis Topic

**TARGET AUDIENCE** General Public

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--CSO Abatement

**DESCRIPTION OF DATA USED** Memos, reports

**MANAGEMENT PLAN FORMAT**

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Environmental benefit of CSO abatement

**SUMMARY OF INFORMATION COLLECTED** Evaluation of reasons at city (Providence) and federal (EPA) levels as to why there has been a lack of CSO abatement measures

**TITLE** Providence Harbor: A Special Area Management Plan (1983)

**AUTHOR** Donald D. Robadue, Jr.

**AFFILIATION** Coastal Resources Center

**AGENCIES INVOLVED** Coastal Resources Management Council

**IMPETUS FOR PLAN** Federal monies available under provisions of Coastal Zone Management Act (1972) for coastal zone planning

**TARGET AUDIENCE** Coastal Resources Management Council, state agencies and local governments

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--Improvement of the Providence Harbor Area for more efficient land uses and improved water quality

**DESCRIPTION OF DATA USED** Technical reports and state agency documents

**MANAGEMENT PLAN FORMAT** Recommendations for state agency and local government implementation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Maps of Providence Harbor land and water uses

**SUMMARY OF INFORMATION COLLECTED** Assessment of problems of Providence Harbor Area and recommendations to mitigate problems in order to revitalize the port area. Included is the outline of a water quality management plan for Upper Narragansett Bay

**TITLE** Setting Pollutant Discharge limits in an estuary: using mathematical models to predict pollutant distribution (1984)

**AUTHOR** Brooks Martin

**AFFILIATION** Coastal Resources Center

**AGENCIES INVOLVED** Narragansett Bay Commission (NBC)

**IMPETUS FOR PLAN** Setting up pretreatment program at NBC

**TARGET AUDIENCE** Citizen's Advisory Committee to the Narragansett Bay Commission

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--Use of one dimensional model of pollutant loadings of copper from Blackstone River and Field's Point

**DESCRIPTION OF DATA USED** NPDES standards

**MANAGEMENT PLAN FORMAT** Advice to Citizen's Advisory Committee

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Analysis of model results used to set copper influent standard at the Field's Point plant revealed that the analysis was flawed. In order to meet the 1980 USEPA Water Quality Criterion for total copper, the pretreatment standard should be lower.



**TITLE** State Guide Plan Overview. State Guide Plan Element 010 Report No. 48  
(1984)

**AUTHOR** RI Statewide Planning Program, June 1984

**AFFILIATION** State agency

**AGENCIES INVOLVED** Created by interagency agreement in May 1964 bet. RI Development Council & RI Public Works--1965--include RIPTA & RI Dept. Business Regulation

**IMPETUS FOR PLAN** Need for comprehensive planning recognized in 1964 Department of Community Affairs created in 1968 Statewide Planning Program designated as principal staff agency of the executive branch to coordinate plans for state's comprehensive development (G.L. 42-11-10)

**TARGET AUDIENCE** State agencies, federal funding sponsors, other official agencies & instrumentalities in planning area.

**SCOPE OF PLAN** Geographic area--state of RI, Topic--Guide for future development

**DESCRIPTION OF DATA USED** Goals and objectives

**MANAGEMENT PLAN FORMAT** Goals and objectives which state agency must be consistent with

**APPENDICES: TECHNICAL REPORTS. MAPS. COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Repository of goals and policies on various topics adopted by State Planning Council. Planning document to guide future development of State's human, economic and physical resources.

**TITLE** Final Report, Chapters 1-5 for combined Sewer Overflow No. 9 (1984)

**AUTHOR** Hayden-Castelucci, Joint Venture

**AFFILIATION** Consultant

**AGENCIES INVOLVED** Narragansett Bay Commission

**IMPETUS FOR PLAN**

1. Facilities Plan (1979) by Anderson-Nichols and Waterman
2. Consent decree issued by USEPA and RIDEM in 1978

**TARGET AUDIENCE** Narragansett Bay Commission, USEPA, RIDEM

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--CSO Abatement Alternatives

**DESCRIPTION OF DATA USED**

1. Field surveys: collection system inspection, rainfall monitoring, flow rate monitoring
2. Analysis of data collected on field surveys cost/benefit analysis of abatement alternatives and site acquisition

**MANAGEMENT PLAN FORMAT** Recommendations

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Cost estimates on abatement alternatives, maps of sewer line structures

**SUMMARY OF INFORMATION COLLECTED** Review and detailed analysis of applicable treatment alternatives for the control and abatement of storm and dry weather related pollutant discharges originating from CSO 9 district

**TITLE** Combined Sewer Overflow Mitigation Study--CSO Area B. Moshassuck River  
Interceptor Drainage Basin (1985)

**AUTHOR** O'Brien & Gere, Engineers, Inc.

**AFFILIATION** Consultant

**AGENCIES INVOLVED** Narragansett Bay Commission

**IMPETUS FOR PLAN**

1. Consent Decree issued by USEPA and RIDEM in 1978
2. Facilities Plan of 1979 by Anderson-Nichols and Waterman Engineers

**TARGET AUDIENCE** Narragansett Bay Commission, RIDEM, USEPA

**SCOPE OF PLAN** Geographic area--Upper Narragansett Bay, Topic--CSO abatement

**DESCRIPTION OF DATA USED** Flow monitoring during dry wet weather. Dry and wet weather water  
quality response to CSOs. Tidal monitoring of sewers. Modeling simulations

**MANAGEMENT PLAN FORMAT** Recommendations for agency implementation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Cost estimates on CSO  
abatement measures

**SUMMARY OF INFORMATION COLLECTED** Recommendations for improvements to sewer system  
and for construction of facilities for abatement and treatment of CSO flows.

**TITLE** Rhode Island Department of Environmental Management (RIDEM) Water  
Resources Control Program Plan (FY'85, FY'87, FY'88, FY'89)

**AUTHOR** Division of Groundwater and Freshwater Wetlands, Division of Water Resources

**AFFILIATION** state agency

**AGENCIES INVOLVED** RIDEM

**IMPETUS FOR PLAN** Annual program planning

**TARGET AUDIENCE** RIDEM

**SCOPE OF PLAN** Updates in annual planning process

**DESCRIPTION OF DATA USED** Statistics on RIDEM activities

**MANAGEMENT PLAN FORMAT** Goals and objectives of RIDEM for upcoming fiscal year in the  
continuing process of meeting federal regulations

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Accomplishments by the Water Pollution Control  
program in the form of narrative and statistics and objectives for upcoming year.

**TITLE** The State of the State's Water-Rhode Island. A Report to Congress (PL. 92-500, 305b) (1986, 1988)

**AUTHOR** Division of Water Resources, RI Department of Environmental Management

**AFFILIATION** State agency

**AGENCIES INVOLVED** Division of Groundwater and Freshwater Wetlands and Office of Environmental Coordination, RIDEM

**IMPETUS FOR PLAN** Federal Regulation requiring biannual review of the status of water quality

**TARGET AUDIENCE** USEPA, US Congress

**SCOPE OF PLAN** Geographic area--State of Rhode Island, Topic--Status of water quality and agency implementation of regulations

**DESCRIPTION OF DATA USED** Agency reports and statistics, scientific data

**MANAGEMENT PLAN FORMAT** Overview of programs and recommendations for improvement of pollution control

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Maps on water quality segment status

**SUMMARY OF INFORMATION COLLECTED** Biannual review of pollution abatement programs, monitoring programs, status of water quality segments and concerns of state to maintain effective management

**TITLE** Pawtuxet River Basin Non-point Water Quality Standards Review and Management Plan (1987)

**AUTHOR** Office of Environmental Coordination, RI Department of Environmental Management

**AFFILIATION** State agency

**AGENCIES INVOLVED** Pawtuxet River Advisory Group, RIDEM, Division of Water Resources, RI Division of Planning

**IMPETUS FOR PLAN**

1. Section 205(j) of the Clean Water Act of 1972
2. Federal funding under Section 205(j)
3. Review water quality standards

**TARGET AUDIENCE** Local officials

**SCOPE OF PLAN** Geographic area--Pawtuxet River Basin, Topic--Mitigation of Nonpoint pollution

**DESCRIPTION OF DATA USED** Estimates of runoff loadings and impervious area; federal, state, and consultant reports on water quality and land use

**MANAGEMENT PLAN FORMAT** Recommendations for implementation upon willingness of local officials

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Technical reports on estimated runoff loadings and impervious area inventory of water quality conditions

**SUMMARY OF INFORMATION COLLECTED** Identification of nonpoint sources of pollution in the Pawtuxet River Basin and the determination of the suitability of designated uses and priorities for nonpoint control

**TITLE** Assessment of Nonpoint Pollution in Rhode Island (1988)

**AUTHOR** Office of Environmental Coordination, RI Department of Environmental Management

**AFFILIATION** State agency

**AGENCIES INVOLVED** Divisions of RI Department of Environmental Management

**IMPETUS FOR PLAN**

1. Federal regulations under Federal Water Pollution Control Act 1972
2. Federal monies available to set up Nonpoint Source Program

**TARGET AUDIENCE** USEPA and state agencies

**SCOPE OF PLAN** Geographic area--State of Rhode Island, Topic--Nonpoint source pollution control

**DESCRIPTION OF DATA USED** Technical and agency reports

**MANAGEMENT PLAN FORMAT** Assessment of nonpoint pollution

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Assessment of waters threatened or impacted by nonpoint sources of pollution and discussion of best management practices to mitigate effects of nonpoint pollution

**TITLE** Governance of Non-point Source Inputs to Narragansett Bay: A Plan for Coordinated Action (1988)

**AUTHOR** Jennie C. Myers

**AFFILIATION** Consultant

**AGENCIES INVOLVED** Narragansett Bay Project (RI Department of Environmental Management and U.S. Environmental Protection Agency)

**IMPETUS FOR PLAN** Narragansett Bay Project goal to study land use impacts on water quality

**TARGET AUDIENCE** Narragansett Bay Project Committees; state agencies, general public

**SCOPE OF PLAN** Geographic area--Narragansett Bay Basin watershed, Topic--Control and prevention of nonpoint sources of pollution

**DESCRIPTION OF DATA USED** Interviews, scientific literature, institutional review

**MANAGEMENT PLAN FORMAT** Recommendations for federal and state agency implementation

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Detailed recommendations to federal and state agencies in Rhode Island for reorganization and expanded duties in order to make control of nonpoint more effective

**TITLE** Rhode Island's Non-point Source Management Plan (1988)

**AUTHOR** Office of Environmental Coordination, Rhode Island Department of Environmental Management

**AFFILIATION** State agency

**AGENCIES INVOLVED** RI Department of Environmental Management

**IMPETUS FOR PLAN** 1987 Amendments to the Clean Water Act (Section 319) required states to set up program and allocated federal money

**TARGET AUDIENCE** Federal, state and local regulatory agencies in Rhode Island

**SCOPE OF PLAN** Geographic area--Rhode Island, Topic--Nonpoint Pollution

**DESCRIPTION OF DATA USED** Recommendations from management plans and task forces

**MANAGEMENT PLAN FORMAT** Agency regulation, adopt as element of State Guide Plan

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES** Timeline for implementation

**SUMMARY OF INFORMATION COLLECTED** Recommendations to mitigate nonpoint pollution problems in Rhode Island covering twelve broad areas. Timeline for specific federal, state and local agencies to implement recommendations.

**TITLE** Land Use 2010 (1989)

**AUTHOR** Division of Planning, Department of Administration

**AFFILIATION** State agency

**AGENCIES INVOLVED** Division of Planning, RIDEM, CRMC

**IMPETUS FOR PLAN**

1. Comprehensive Planning and Land Use Regulation Act (88-H9734)
2. Update 1975 Land Use Element of State Guide Plan

**TARGET AUDIENCE** State regulatory agencies, local governments and planning boards

**SCOPE OF PLAN** Geographic area--State of Rhode Island, Topic--Land Use

**DESCRIPTION OF DATA USED** 1975 Land Use Element, agency management plans

**MANAGEMENT PLAN FORMAT** Agency regulation; goals, objectives and recommendations to guide land use planning

**APPENDICES: TECHNICAL REPORTS, MAPS, COST ESTIMATES**

**SUMMARY OF INFORMATION COLLECTED** Goals and objectives of land use planning in Rhode Island to guide the development of local Comprehensive Plans in an environmentally sound manner.