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Sewage Contamination/Pathogens "Briefing Paper" & Proceedings

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Narragansett Bay Estuary Program

Current Report

The Narragansett Bay Project

SEWAGE CONTAMINATION - PATHOGENS "BRIEFING PAPER" AND PROCEEDINGS FROM NARRAGANSETT BAY PROJECT MANAGEMENT COMMITTEE

Ms. Caroline A. Karp,
Dr. Clayton A. Penniman,
Mr. Richard R. Zingarelli,
Ms. Ann M. Dixon,
and the staff of the
Narragansett Bay Project

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Recommendations included in this briefing paper represent preliminary decisions reached by the Management Committee and are subject to amendment prior to their incorporation into the Comprehensive Conservation and Management Plan (CCMP).

The Narragansett Bay Project is sponsored by the U.S. Environmental Protection Agency and the R.I. Department of Environmental Management.

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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 the Narragansett Bay Project (NBP) was established in 1985. Narragansett Bay was designated an "estuary of national significance" in 1988. 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 program of research and planning focussed on managing Narragansett Bay and its resources for future generations.

The NBP will develop a draft Comprehensive Conservation and Management Plan (CCMP) by December, 1991, 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/watershed 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 federal, state and local agencies, as well as with academic researchers, in order to apply research findings to the practical needs of managing the Bay and improving the environmental quality of its watershed.

The attached report includes a "briefing paper" prepared for consideration by the Management Committee of the Narragansett Bay Project (Section I) and Management Committee Proceedings (Section II). Section II includes a) minutes of the Management Committee meeting(s) where the issues identified in the "briefing paper" were discussed (Appendix A); b) preliminary recommendations endorsed by the Management Committee (Appendix B); and c) Management Committee attendance (Appendix C). The Narragansett Bay Project will subsequently estimate the cost of each preliminary recommendation made by the Management Committee and identify possible funding sources. This information will enable the Management Committee to develop the draft CCMP including priorities for implementation over a five year planning horizon. Upon completion, the draft CCMP will be available for public review and comment.

SECTION I:

SEWAGE CONTAMINATION
PATHOGENS
" BRIEFING PAPER "

Ms. Caroline A. Karp,
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" There is no guano comparable in fertility to the detritus of a capital. A great city is the most powerful of dung producers. To employ the city the plain would be a sure success. If our gold is manure, on the other hand, our manure is gold...The cleverness of man is such that he prefers to throw this hundred million into the gutter. It is the very substance of the people that is carried away, here drop by drop, there in floods, by our sewers' wretched vomiting into the rivers, and our rivers' into the ocean. Each hiccup of our cloaca costs us a thousand francs. From this two results: the land impoverished and the water contaminated. "

Victor Hugo, Les Miserables, 1862

SEWAGE CONTAMINATION (PATHOGENS) IN NARRAGANSETT BAY

SYNOPSIS

BACKGROUND

Concerns arising from sewage contamination of Narragansett Bay and its tributaries relate to the potential transmission of pathogenic microorganisms from infected humans, via their fecal waste, to other individuals who may come in contact with the contaminated water or consume contaminated shellfish. Historically, diseases such as cholera, typhoid fever and infectious hepatitis have been contracted from consumption of fecally contaminated molluscan shellfish (i.e., clams, oysters, and mussels). Today, however, the primary related health risk in the Northeast is viral gastroenteritis, probably caused by the Norwalk virus.

In order to prevent fecally contaminated shellfish from entering the marketplace, state and federal regulatory agencies routinely monitor shellfish growing areas (and shellfish in commerce) for indicators of microbial pathogens. The current standard used to indicate the presence (or absence) of pathogenic microbes in estuarine waters or shellfish is a group of bacteria generally associated with the gut of warm-blooded animals, including humans; i.e., fecal coliforms. While use of the fecal coliform indicator has provided apparent public health protection from widespread infectious disease, there appears to be no statistical relationship between pathogenic viruses and coliform concentrations in waters or shellfish. This briefing paper presents options for assessing and reducing the risk of exposure to sewage-derived pathogens.

Human fecal contaminants, and potential pathogens enter Narragansett Bay from both point and nonpoint sources. Point sources include publicly-owned wastewater treatment facilities (WWTFs), WWTF bypasses, combined sewer overflows (CSOs) and separated storm sewers. Nonpoint sources include individual septic disposal systems (ISDSs), stormwater runoff and boater discharges of sanitary wastes. The relative contributions, characteristics, control technologies and options for both point and nonpoint sources are discussed in this briefing paper.

INITIAL DECISIONS

This briefing paper addresses two categories of policy related issues: I. Assessment and management of the public health risk associated with sewage-related fecal contamination; and II. Options for controlling or reducing sources of fecal contamination. Although background information is presented for WWTF and CSO issues, discussion of both these issues was deferred to future briefing papers. Specific issues discussed are listed below. Please see Appendix B for the Summary of Decisions reached by the Management Committee of the Narragansett Bay Project with respect to these issues.

I. Risk Assessment-Risk Management

1) **Should the RIDEM and the RIDOH change their existing monitoring procedures to better assess the risk of human exposure to sewage-derived, water-borne disease from the consumption of molluscan shellfish harvested in Narragansett Bay?**

2) **Should the RIDEM and the RIDOH change their existing monitoring procedures to better assess the risk of human exposure to sewage-derived, water-borne disease from swimming in Narragansett Bay?**

3) **Should the RIDEM and the RIDOH include "indicators" of viral contamination in their monitoring programs to better assess the risk of human exposure to sewage-derived viral pathogens?**

4) **Should the State of Rhode Island endorse the use of commercial or non-commercial controlled purification ("depuration") facilities to better assure the sanitary quality of shellfish harvested from Narragansett Bay?**

5) **Should the State of Rhode Island increase its efforts to eliminate illegal commercial shellfishing in uncertified shellfish harvesting areas in Narragansett Bay?**

II. Source Control - Source Reduction

1) **Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from septic systems?**

2) Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from stormwater runoff?

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[Recommendations for source reduction of CSOs and Boater Waste are discussed in briefing papers specifically devoted to these topics. The issue of disinfection is discussed in the Toxics Briefing Paper.]

STATEMENT OF THE PROBLEM

I. INTRODUCTION

The Clean Water Act directs participants in EPA's National Estuary Program to develop a Comprehensive Conservation and Management Plan (CCMP) to "restore and monitor the ... integrity of the estuary, including restoration and maintenance of water quality, a balanced indigenous population of shellfish, fish, and wildlife, and recreational activities in the estuary, and assure that the designated uses of the estuary are protected."

This briefing paper begins the process of addressing the issue of sewage-derived pathogen contamination within Narragansett Bay and identifying alternative policy recommendations.

II. PUBLIC HEALTH RISK

Pathogenic or disease-causing microbes represent the major source of concern to public health with regard to sewage contamination of Narragansett Bay waters. Treated and untreated human fecal wastes are discharged to Narragansett Bay and its tributaries from a variety of sources, including municipal wastewater treatment plants and treatment plant bypasses, combined sewer overflows, on-site septic systems, boats, illegal cross-connections to storm sewers and storm runoff. Human fecal waste can contain "pathogenic" (disease-causing) enteric bacteria, viruses and protozoa that are excreted by human "hosts". To the extent that these microorganisms survive or avoid the sewage treatment process and also survive in seawater, they can potentially cause disease and infection in people who swim in Narragansett Bay or eat raw or improperly cooked molluscan shellfish (i.e., clams, oysters, and mussels) harvested from sewage–contaminated areas.

Historically, up to the first quarter of this century, cholera and typhoid fever were major water-borne diseases of concern. More recently, hepatitis A has been another health concern associated with consumption of contaminated, molluscan shellfish. Many of these diseases have been eliminated or controlled by improvements in sanitary conditions, medical advances, improvements in wastewater treatment, and the development of regulatory standards governing the certification of surface waters for recreational and commercial use. At the present time, the major public health risk in the Northeast associated with exposure to sewage-derived, water-borne pathogens is viral gastroenteritis.

Table 1 shows the confirmed incidence of disease outbreaks related to human consumption of contaminated molluscan shellfish in the Northeast. Note that the reported incidence of viral gastroenteritis has increased in recent years and may still be vastly under-reported because: 1) the symptoms are not severe enough to warrant

medical treatment (acute viral gastroenteritis is characterized by fever, nausea, diarrhea and vomiting), and 2) it is not a "reportable" disease. It has been estimated that only 10% or fewer cases of moderately serious (or worse) gastroenteritis come to the attention of a medical provider. An unknown proportion of these cases are attributable to contaminated shellfish. If mild cases are included, the reporting of shellfish-related gastroenteritis is likely to be far less than 10% of the actual cases (B. Matyas, pers. comm.).

Table 1 Disease outbreaks related to consumption of shellfish in the northeast (NH, NJ, NY, CT, RI, MA) Source: Rippey, 1988

Disease	Suspected Agent	Year	States	# of Cases	# Cases Possibly Linked to RI Shellfish
Typhoid	*Salmonella typhosa*	1954	NY	1 (last)	—
Cholera	*Vibrio cholerae*	1981	NH	1 (last)	1
Infectious Hepatitis	Hepatitis A virus	1961-88	Northeast	850	138*
Gastroenteritis	unknown	1930-88	Northeast	4,742	
	Norwalk virus	1980-88	Northeast	3,882	590

* Some cases may be due to contaminated shellfish illegally harvested from Massachusetts waters (J. Fester, RIDEM, pers. comm.).

III. PATHOGEN-RELATED LIMITATIONS ON THE USE OF NARRAGANSETT BAY

A. Shellfishing

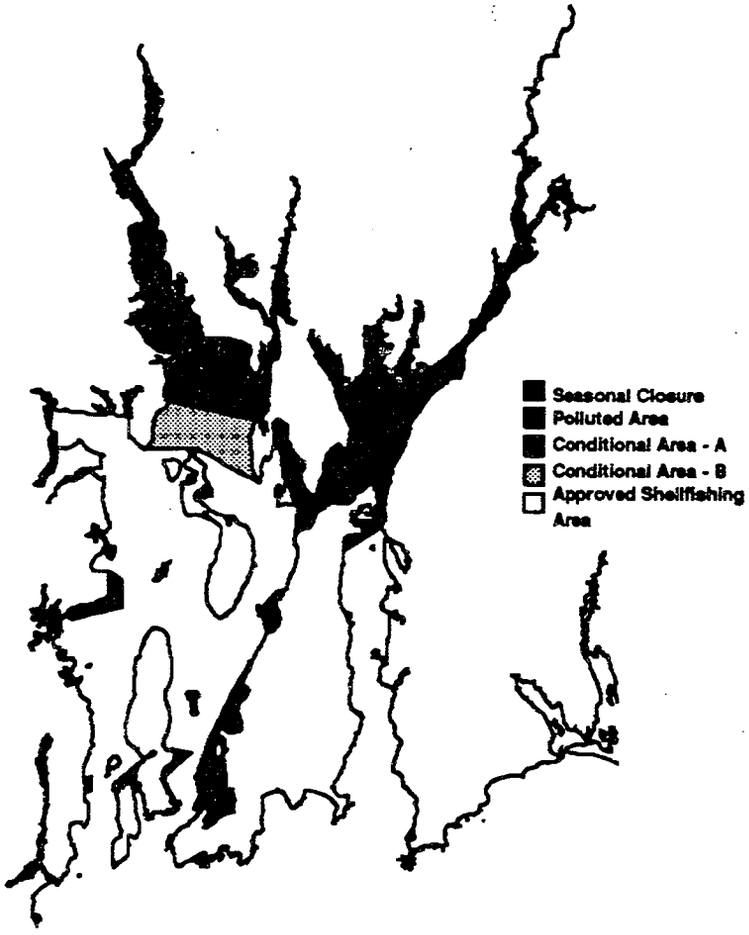
In order to protect the public from the risk of exposure to sewage-derived, water-borne diseases, the RI Department of Environmental Management (RIDEM) has adopted federal standards for the "certification" of marine waters for shellfishing. Based upon these standards, RIDEM approves and/or restricts shellfish harvesting in Rhode Island waters, subject to FDA National Shellfish Sanitation Program (NSSP) approval. Additional areas are periodically restricted based on routine bacteriological monitoring of shellfish growing waters. See Figure 1, "Shellfish Closures in Narragansett Bay (May 1990)." It should be noted that throughout this briefing paper, "shellfish" generally refers only to quahaugs.

As of May 1990, 40% of Narragansett Bay, including Mount Hope Bay, is restricted to shellfish harvesting for at least part of the year. This figure is even higher if corrected for the large portions of the bay that are approved for harvesting

but do not support harvestable populations of quahaugs (Pratt, 1988). Over 28% of Narragansett Bay is permanently closed to shellfishing. Mount Hope Bay and the Providence River have been permanently closed since the 1940s because of their proximity to municipal wastewater treatment plants and combined sewer overflows. An additional 11% of the bay (10,672 acres) is conditionally open depending upon the incidence of rain-triggered combined sewer overflows and treatment plant bypasses. In 1989, the conditionally approved areas were open for 28% of the year. An additional 769 acres (1%) are closed from May 28 to October 9 due to increased boating activity. The 1990 closures represent a 34% increase in seasonally restricted use from 1989 (RIDEM, 1990a). Table 2 summarizes trends in restrictions of marine waters to shellfishing between 1988 and 1990. Table 3 summarizes the number of days the conditionally-approved areas were closed due to combined sewer overflows and treatment plant bypasses.

Figure 1

Shellfish Area Closures (May 1990)



Source: NBP - RIGIS

Table 2 Trends in harvesting restrictions (by acres) in Narragansett Bay shellfish growing waters (total 93,875 acres) (1988-1990)

Year	Permanently Closed	Conditionally Closed	Seasonally Closed
1988	24,713	10,569	576
1989	25,743	10,696	576
1990	26,289	10,672	769

Table 3 Closure Rate of Conditionally Approved Shellfish Growing Areas in Upper Narragansett Bay 1986-1990

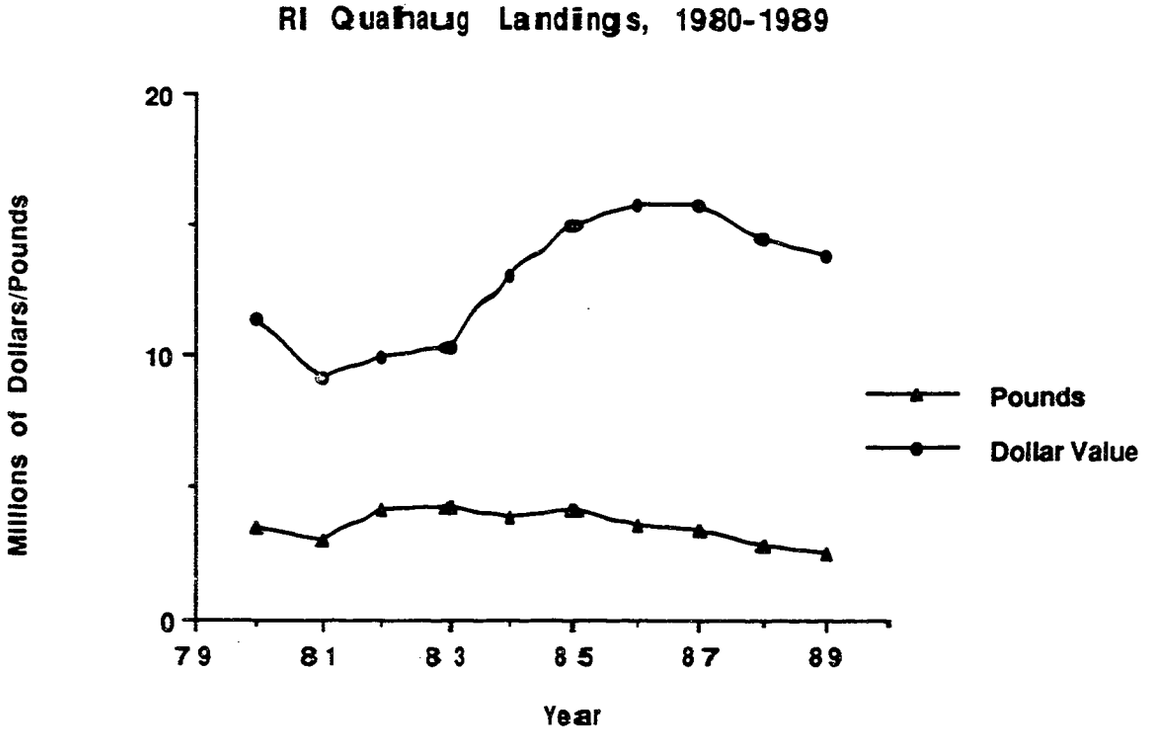
	1986	1987	1988	1989	1990*
Number of days closed year	217	201	186	263	137
% of year	59	55	51	72	92
% of closures not related to rainfall events	16	14	2	5	13

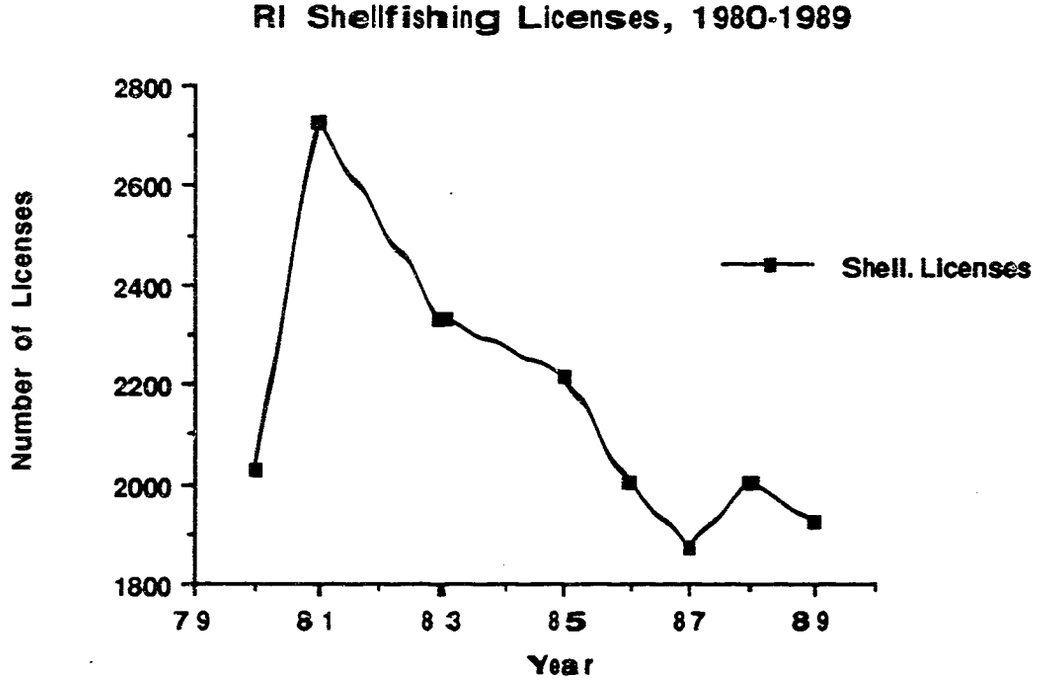
Source: RIDEM "State of the State's Waters", 1990.

* 1990 data is calculated to the end of May, and based on 149 days.

In 1988, 2,002 licensed shellfishermen working in Narragansett Bay reported quahaug landings of 2.8 million pounds worth $14.5 million (Figure 2). The estimated value of the potential quahaug harvest from the restricted areas of the Providence River, upper Narragansett Bay and Mount Hope Bay that was "lost" in 1988 due to harvesting restrictions was between $2.3 and $3 million. [Assumes that the value of the potential quahaug harvest in the permanently closed portions of the Providence River is $3,775,983 with a sustainable yield of well over $750,000 per year (Pratt, 1988). Estimates of the average sustainable yield in Mount Hope Bay, if it were re-opened to shellfishing, range from $142,000 to over $1 million per year (Pratt, 1988; Brubaker and Hamblett, 1989). Estimates for the conditionally-approved areas of upper Narragansett Bay, which were open only 49% of the year in 1988, are based on the proportionally calculated yield from the Providence River.]

Figure 2 Trends in Rhode Island quahaug landings and effort. Source: RIDEM, Division of Fish and Wildlife, 1990.





In summary, the sanitary quality of bay waters has a significant social and economic effect on the quahaug fishery in Narragansett Bay. Furthermore, public perception of seafood sanitary quality also plays a role in consumer demand.

B. Swimming

The RIDEM, RI Department of Health (RIDOH) and local (coastal) governments share responsibility for the "certification" of bathing beaches, subject to federal water quality criteria adopted by RIDEM. No Bay beaches were officially closed due to sanitary quality in 1989, including beaches in the Providence River region, i.e. class SC, non-swimmable waters (RIDEM, 1990a). Historically, although the beaches in class SC waters have not been officially posted as closed, there has not been significant use of these beaches. However, as the Providence Journal indicated in a story about the Riverside-area beaches in East Providence (9 July 1990), the public's interest in recreational use of the shoreline may increase, based upon perceptions of improving environmental quality. This relationship between recreational use and water quality is supported by a survey of shoreline users in upper Narragansett Bay conducted in 1987 (West, 1989). Approximately 27% of the respondents cited "unpleasant" conditions along the upper Narragansett Bay shoreline as limiting their use. Respondents also cited "unclear water" (11.1%), sewage (7.6%), contaminated marine life (8.2%) and litter (2.8%) as interfering with recreational uses (ibid.) Assuming that some of the aesthetic barriers to use are removed as a function of local waterfront reclamation efforts, active public use of these waters may emerge as a future public health problem because of their proximity to major urban sources of fecal contamination.

IV. FUTURE TRENDS

The description presented above is based upon existing sources of fecal contamination and empirical measurements of water quality. However, Rhode Island's population is projected to increase from 967,912 people in 1985 to 1,060,224 in the year 2010 (RI Department of Administration, 1989). This represents a net population increase of 9.5% statewide by the year 2010. The rural and developing coastal communities are projected to experience the most accelerated growth (18% compared to 2.6% in urban coastal areas). For example, North Kingstown, which is completely unsewered, is projected to grow by 31%; Narragansett by 33%; and Tiverton and Little Compton by 15 and 20%, respectively, in contrast to Providence which is projected to grow by only 2.8% by 2010. These projections may, in fact, underestimate the rate of growth; East Greenwich has already exceeded the Division of Planning's projected population for 2010 by 11% (ibid.).

Assuming a per capita water consumption rate of 70 gallons per day (Arthur D. Little, Inc., 1990), the net increase in wastewater discharge to the Bay may be in the vicinity of 6.5 million gallons per day (MGD) by 2010, of which 10-15%, or 0.6-1.0 MGD will be sanitary waste. These estimates do not include the waste generated by the seasonal influx of "travelers"; estimated at 38.9 million "traveler days" in 1988 (T. Tyrell, pers. comm.) Based upon the assumptions regarding water consumption and waste generation stated above, "travelers" in Rhode Island generate approximately 7.5 MGD of wastewater, of which 1.1 MGD is sanitary flow.

Approximately 75% of Narragansett Bay's shoreline communities are served by on-site septic disposal systems rather than municipal sewers (Roman, 1990). The significance of the population forecasts, therefore, is that most of the growth and tourist activity is expected to occur in near-coastal areas that are presently unsewered and already indicating signs of fecal contamination. In addition, the conversion from seasonal to year-round homes in the coastal zone, combined with a large seasonal influx of tourists, has aggravated the burden on existing septic systems and municipal wastewater treatment facilities.

ISSUES TO BE CONSIDERED

I. RISK ASSESSMENT - RISK MANAGEMENT

ISSUE A. Should the RIDEM and the RIDOH change their existing monitoring procedures to better assess the risk of human exposure to sewage-derived, water-borne disease from the consumption of molluscan shellfish harvested in Narragansett Bay?

PROBLEM DESCRIPTION

The RIDEM presently samples surface waters for microbial indicators of fecal waste within each of 17 molluscan shellfish growing areas in Rhode Island (RIDEM, 1990a). There are a total of 189 sampling stations for the twelve growing areas within Narragansett Bay. Approved shellfishing areas are sampled at least five times per year, while closed and conditionally approved areas are sampled more frequently (ibid.). All samples are collected from the surface waters and analyzed for total and fecal coliform bacteria in order to assess the potential risk of human exposure to pathogenic (disease-causing) microorganisms found in association with human waste. Current regulatory requirements and limitations in analytical techniques preclude routine, direct measurement of pathogens.

Fecal coliform bacteria, the indicator group presently used, are (generally) non-pathogenic bacteria found in the gut of all warm-blooded animals, including humans. A high concentration of fecal coliforms in fresh or marine waters may indicate the presence of human fecal waste; the higher the concentration of fecal coliform bacteria, the higher the risk of exposure to sewage-derived pathogens. Runoff from livestock operations, domestic animal waste, as well as large numbers of waterfowl, can also produce high fecal coliform counts, although these are considered to be unlikely sources of human pathogens (Hussong et al., 1979; Hill and Grimes, 1984). However, Salmonella has been demonstrated to be present in avian feces (Mitchell and Ridgwell, 1971; Berg and Anderson, 1972).

A possible problem in certifying shellfish growing areas is that, based upon National Shellfish Sanitation Program (NSSP) and Rhode Island regulatory requirements, RIDEM relies on samples of fecal coliform concentrations in the surface waters, not the quahaugs themselves. NBP investigators have been unable to document a predictable relationship between fecal coliform concentrations in surface waters with concentrations either in bottom waters or concentrations in quahaug tissue (Rippey and Watkins, 1988; Cabelli, 1990b; Roman, 1990). Consequently, the present

monitoring approach may under- or overestimate the risk of exposure to sewage-derived pathogens, particularly viruses, from eating molluscan shellfish harvested in Narragansett Bay.

ALTERNATIVES CONSIDERED

A.1. No change, at least until there is more evidence that direct sampling of shellfish tissue would provide greater protection of public health.

There is no evidence that a significant public health problem exists at the present time. There has not been a confirmed incident of shellfish-related disease, other than hepatitis A and viral gastroenteritis, associated with quahaugs harvested in Narragansett Bay since the 1970s. (However, as described elsewhere, acute gastroenteritis is believed to be greatly underreported.)

A.2. The State of Rhode Island should begin sampling quahaugs directly for indicators of water-borne pathogens as a supplement to surface water sampling in shellfish growing areas.

Fecal coliform bacterial concentrations in shellfish tissue are a more direct measure of the risk of exposure to sewage-derived pathogens. Depending upon shellfish handling procedures (i.e., sanitary conditions anywhere in the stream of commerce) and the temperature at which the product is stored, there is some evidence that fecal coliform bacteria (and associated pathogens) can multiply in clam tissue (W. Watkins, pers. comm.).

A.3. The State of Rhode Island should continue to collect samples in surface waters to regulate shellfish growing areas, at least until there is more evidence that direct sampling of shellfish is more protective, AND the State should randomly monitor shellfish tissue from product in the stream of commerce.

See A.1 and A.2, above.

PREFERRED ALTERNATIVE: Alternative A.3.

Based upon public health records, the RIDEM's approach to regulating shellfish growing areas appears to have been effective, and protective, in minimizing the human risk of exposure to sewage-derived pathogens. In addition, the level of effort necessary to sample a statistically significant number of quahaugs from each shellfish growing area may be prohibitive unless the samples can be composited without destroying the integrity of the bacteriological tests. [Note: the RIDEM presently collects approximately fourteen shellfish samples from the Bay twice per month for bacteriological analyses as part of the RI/NSSP agreement.]

There is, however, an unknown level of risk associated with eating raw shellfish depending on variables in shellfish handling, storage and transportation methods. In order to reduce the risk of contaminated shellfish entering the market, the following measures should be considered; the U.S. Food and Drug Administration (or other appropriate federal agency) and/or the RIDOH should institute a comprehensive inspection and sampling program to evaluate this risk at each stage of shellfish handling.

The RIDOH presently collects up to ten samples, two times per month, from various Rhode Island shellfish distributors for microbial analyses. However, the shellfish inspection program could be expanded, pursuant to R.I. General Laws 20-1-8 and a supporting Memorandum of Agreement between the RIDOH and the RIDEM. R.I.G.L. 20-1-8(e) authorizes RIDEM Conservation Officers to seize "all fish, shellfish, crustaceans...in possession or under control of any person or which have been shipped or are about to be shipped, at any time, in any manner, or for any purpose contrary to the laws of this state." [R.I.G.L. 20-8.1-7 authorizes RIDEM to confiscate shellfish which the Department has "reasonable cause" to believe have been harvested from polluted areas of Narragansett Bay, and R.I.G.L. 20-6-4 and 20-8.1-9 authorize RIDEM to inspect the premises of any shellfish buyer and any vehicles or vessels used in the transportation of shellfish.]

If RIDEM Conservation Officers were given additional training by RIDOH to collect and store shellfish samples for subsequent microbial analyses, RIDEM's existing authority could be used to increase the State's shellfish monitoring program, particularly where a sanitary handling, storage or transportation problem is suspected. Furthermore, water, as well as quahaug, sampling should be structured to allow detection of overall trends in Narragansett Bay, as well as sampling specific to potentially contaminated shellfish growing areas. [Note: The University of R.I. is presently designing a long term monitoring program for Narragansett Bay that will evaluate sampling requirements.]

ISSUE B. Should the RIDEM and the RIDOH change their existing monitoring procedures to better assess the risk of human exposure to sewage-derived, water-borne disease from swimming in Narragansett Bay?

PROBLEM DESCRIPTION

The RIDOH and local governments have the authority to close bathing beaches based upon recommendations made by the RIDEM, which is responsible for monitoring statewide (RIDEM, 1990a). RIDEM collects water samples at Rhode Island beaches prior to the beginning of the bathing season and subsequently only at "open" bathing beaches that are considered to have some evidence or risk of sewage contamination. Five saltwater beaches were sampled during the bathing season in 1989 (RIDEM, 1990a). No Rhode Island beaches are officially posted as closed due to fecal contamination, including beaches along the Providence River. [Note: the latter area is in class SC waters, i.e., classified by RIDEM as not suitable for swimming.]

There are two possible routes for bathers to be exposed to sewage-derived pathogens in seawater; ingestion and wound infection (Cabelli et al., 1983; Emerson and Cabelli, 1985). However, there have been few confirmed outbreaks of infectious disease attributable to bathing (ibid.). Note that the most common infectious enteric agent that bathers are likely to be exposed to (today) is the Norwalk virus which is one causative agent for viral gastroenteritis (see Table 1). However, the incidence of infection is believed to be greatly underestimated because: 1) there are other routes of transmission, 2) the symptoms of viral gastroenteritis (vomiting, diarrhea, etc.) may not be severe enough to justify medical attention, and 3) viral gastroenteritis is not a reportable disease (Cabelli et al., 1983). Consequently, Rhode Island bathers may not be adequately protected from the risk of exposure to sewage-derived infectious agents because Rhode Island's beaches are only sampled before the bathing season begins, unless the RIDEM or RIDOH is requested to collect samples or there is some reason for concern based on the area's water quality history.

ALTERNATIVES CONSIDERED

B.1. No change, at least until there is more evidence that more frequent sampling would be more protective.

There is no evidence that a significant public health problem exists at the present time, i.e., the present level of risk is acceptable. There has not been a confirmed, recorded incident of infectious disease associated with bathing in Narragansett Bay in recent years (RIDEM, 1990a). However, the actual incidence of viral gastroenteritis, "swimmer's ear" and "swimmer's itch" are believed to be greatly underreported.

B.2. The State of Rhode Island should continue to collect samples at bathing beaches prior to the bathing season AND should randomly monitor bathing beach water quality during the bathing season.

The magnitude of the public health risk associated with swimming at beaches in the vicinity of sources of fecal contamination (e.g., sewers, failed septic systems, boats) is uncertain, at least during periods of peak use, and should be evaluated. Congested beaches in the vicinity of point or suspected nonpoint sources of fecal contamination should particularly be monitored during peak use periods because peak use typically coincides with elevated air and sea surface temperatures which may promote survival and higher environmental concentrations of sewage-derived microbes. Coastal cities and towns should also be encouraged to develop local monitoring programs for town-owned or operated beaches.

B.3. The State of Rhode Island should institute a formal procedure for officially closing and posting closed beaches.

As beaches in the vicinity of municipal sewer outfalls (class SC waters), become aesthetically more attractive for recreational use, the RIDOH should issue a general health advisory about swimming in sewage-contaminated waters and post the beaches as closed for water quality reasons. [RIDEM and RIDOH are currently negotiating a Memorandum of Agreement covering sampling and closure policies for State bathing beaches.]

PREFERRED ALTERNATIVE: Alternatives B.2. and B.3.

Based on existing public health records, the State's approach to regulating saltwater bathing beaches appears to have been effective and protective in minimizing the risk of exposure to sewage-derived pathogens. However, there is an unknown level of risk associated with bathing because beaches are undersampled and the primary disease of concern at the present time, viral gastroenteritis, is not reportable.

The RIDEM and/or the RIDOH should monitor state beaches prior to and during the bathing season, focussing on beaches where there are known or suspected sources of fecal contamination. Cities and towns should be encouraged to institute similar monitoring programs at town beaches. In addition,

- the RIDEM and RIDOH should execute the draft Memorandum of Agreement covering bathing beach monitoring and beach closure policies for implementation by the summer of 1991;
- the RIDOH should issue a general health advisory about swimming in sewage-contaminated waters; and

- the RIDOH should post beaches in the Providence River region as unsafe for bathing based on their proximity to major urban sources of fecal contamination. Although these waters are currently classified as unsuitable for swimming (i.e., class SC waters), their attractiveness to swimmers may increase as enhancement of shore facilities occurs and public perception of water quality improves.

ISSUE C. **Should the RIDEM and the RIDOH include "indicators" of viral contamination in their monitoring programs to better assess the risk of human exposure to sewage-derived viral pathogens?**

PROBLEM DESCRIPTION

As indicated in Issue A above, the State uses fecal coliform bacteria as the bacteriological standard for regulating shellfish growing waters and bathing beaches. However, the primary public health risk today from eating sewage-contaminated molluscan shellfish or swimming in sewage-contaminated waters is the Norwalk virus, a causative agent of viral gastroenteritis (see Table 1).

First, there is evidence that fecal coliform bacteria are inappropriate or poor indicators of the risk of exposure to sewage-derived viral pathogens. Viruses are more resistant to chlorine disinfection (the disinfection practice presently used at all Rhode Island wastewater treatment facilities) than are bacterial indicators, including fecal coliforms (Goyal, 1984; Roman, 1990). Studies at the Narragansett Bay Commission indicate that greater than 98% of fecal coliform and enterococci bacteria are killed by chlorine disinfection in dry weather compared to less than 70% for the two viral simulants considered (Cabelli, 1990a). The Norwalk virus is also reported to be more resistant to chlorine disinfection than other pathogenic viruses, such as the poliovirus (Roman, 1990). Wet weather disinfection appears to be less effective for all fecal indicators considered, presumably because of the shorter exposure time to chlorine due to increased hydraulic loading at the treatment facilities (Watkins and Rippey, 1990). Consequently, the fecal coliform indicator may underestimate the risk of exposure to pathogens in sewage-contaminated shellfish or bathing areas, especially in the vicinity of chlorinated municipal effluents.

Second, fecal coliform bacteria do not survive indefinitely in seawater and cannot survive at colder temperatures. There is some evidence that viruses, based on the viral indicators used, do not die-off as quickly as fecal bacteria in seawater and survive better at colder temperatures (Roman, 1990). In addition, at least some viruses can persist in the environment for a long time (ibid.). Consequently, the use of coliform indicators may underestimate the risk of exposure to sewage-derived viral pathogens, especially in winter.

Third, the analytical method currently used by the State of Rhode Island for measuring fecal coliform concentrations (multiple tube fermentation) may take up to five days for complete results. Since environmental conditions may change over this period of time or contaminated shellfish may be consumed, the multiple tube fermentation fecal coliform test that is presently used cannot provide a timely measure of potential contamination. RIDOH is currently comparing the multiple tube

fermentation method to a membrane filter technique (mTEC). The mTEC (membrane E. coli) technique produces results within 48 h.

NBP-sponsored investigations have compared fecal coliform bacteria, with three alternative indicators, i.e., enterococcus, a group of enteric bacteria found in human fecal waste; *Clostridium perfringens*, a spore-producing bacterium that is more resistant to chlorination and persists longer in the environment than coliforms; and the male-specific bacteriophage (f-phage), a virus that infects host bacterial cells. The U.S. Environmental Protection Agency (EPA) has recommended enterococcus as the preferred sewage indicator in bathing waters, although this standard has not been adopted by Rhode Island. A comparative study of fecal indicators at Rhode Island bathing beaches in 1987 indicated that enterococci are extremely sensitive to chlorination and, therefore, should not be substituted for the fecal coliform standard, at least where treated sewage effluent is the suspected source of fecal contamination (Deacutis, 1988; Roman, 1990). Studies comparing the *C. perfringens* and f-phage indicators to the coliform and enterococci bacterial indicators found that the former indicators are 1) more resistant to chlorination, and 2) survive longer in bay waters than the latter (Goyal, 1984; Rippey and Watkins, 1988; Watkins and Rippey, 1990; Cabelli, 1990a and 1990b; Roman, 1990).

In summary, the bacterial indicators currently used may underestimate the risk of exposure to viral pathogens from sources of human fecal contamination (Goyal, 1984), especially in winter. Two alternative indicators (i.e. *Clostridium perfringens* spores and f-phage) have been tested and may be more appropriate for evaluating the risk of exposure to sewage-derived viral pathogens. In addition, the assays for the alternative indicators are more rapid (8 to 48 hours) than the method presently used for measuring fecal coliform bacteria (up to 5 days for confirmed results). Changes in methodology would, theoretically, enable regulators to move more swiftly to close shellfish growing areas or bathing beaches where a potential sanitary problem was identified.

ALTERNATIVES CONSIDERED

C.1. No change, at least until there is more evidence that inclusion of a viral indicator would be more protective.

There is no evidence that a significant public health problem exists at the present time since there has not been a confirmed incident of a shellfish-related or (saltwater) bathing beach-related disease outbreak in Rhode Island in recent years. The State should not unilaterally adopt new bacteriological standards until ongoing, comprehensive epidemiological studies are completed by the federal government and a widely-accepted alternative indicator is proposed.

C.2. The State of Rhode Island should adopt standards for the use of alternative indicators (e.g.,*Clostridium perfringens* spore), that should be sampled in addition to fecal coliforms, in order to more effectively protect the public from risk of exposure to sewage-derived viral pathogens.

Although there is no evidence that a significant public health problem exists at the present time, the currently used bacterial indicators are not necessarily effective indicators of the presence of enteric viruses. The State should continue to use a bacterial standard in order to 1) help detect the presence of untreated fecal waste, and 2) assess the risk of exposure to sewage-derived bacterial pathogens. The State should also adopt standards for a viral indicator (e.g., *Clostridium perfringens* spores) in order to better assess the risks of exposure to water-borne viral pathogens from treated sewage and all other existing and historic sources of fecal contamination.

C.3. The U.S. Food and Drug Administration (or other appropriate federal agency) should consider issuing a general health advisory about eating molluscan shellfish harvested from Narragansett Bay, and especially shellfish harvested from closed or conditionally approved areas.

The data collected to date suggest that there is some unknown risk of exposure to enteric viral pathogens (and possibly bacterial pathogens) that is not measured by the existing microbial indicators. This advisory should apply to all uncooked or improperly cooked molluscan shellfish, including oysters, since there is some evidence that harvestable numbers of oysters are re-appearing in Narragansett Bay, including the Providence River and other areas that are impacted by septic systems, storm drains, and boats.

PREFERRED ALTERNATIVE: Alternative C.1.

Unilateral action by the State of Rhode Island with respect to any of recommended bacterial or viral indicators is probably not appropriate at this time based on the absence of an apparent public health problem, and the effect that such a decision could have on the interstate transport of shellfish to and from Rhode Island. The Narragansett Bay Project and EPA Region I, however, have sent a joint letter to the Director, U.S. EPA Office of Marine and Environmental Protection, and the Food and Drug Administration (3 April 1990) urging both agencies to 1) continue investigating the need for alternative indicators; and 2) complete their jointly-sponsored epidemiological study of health effects associated with eating raw shellfish harvested from approved and conditionally approved coastal water. The RIDEM and the RIDOH should consider submitting letters to these federal agencies as well. In addition,

- in addition to the fecal coliform indicator, the RIDEM should use an alternative indicator (e.g., *Clostridium perfringens* spores) to verify future decisions about re-classifying closed and/or conditionally approved shellfish growing areas for shellfish harvesting.

As indicated above, *Clostridium perfringens* is conjectured to simulate viral behavior in the environment, is wide-spread and persistent in Narragansett Bay sediments and has been implicated as a potential pathogen. It may, therefore, be a more suitable indicator of the presence of treated (i.e., chlorinated) sewage and historic sources of fecal contamination than fecal coliform bacteria. *C. perfringens* spores and/or bacteriophage may be particularly useful in evaluating the adv bility of "certifying" previously closed and conditionally app ed areas for shellfish harvesting. In addition, the RIDEM and RID should continue to follow developments in gene probe technology with respect to a rapid assay for fecal indicators or direct detection of pathogens.

- the RIDEM should particularly use viral indicators to support decisions about certification of shellfish growing areas where septic systems are a source of fecal contamination.

There is evidence that viruses persist in groundwater and can migrate significant distances down-gradient from septic systems and sewage sludge landfills (up to 1,312 feet documented) (Roman,1990). Similar studies on bacterial transport suggest that bacteria are effectively removed within, 6 to 50 feet down-gradient from septic systems (Weiskel and Heufelder, 1989; Roman, 1990). As a result, fully functional septic systems in extremely permeable soils may be a source of viral pathogens where there is groundwater exchange with tidal waters. The conversion of seasonal homes to year-round residences will compound the problem, particularly in areas with a high incidence of failed septic systems and/or significant groundwater exchange.

- The RIDOH should establish reporting requirements for all infectious diseases that may be attributable to shellfish consumption or swimming in Narragansett Bay.

The establishment of a statewide database on water-borne infectious diseases (in addition to giardia) will help to better document the magnitude of the public health risk associated with eating shellfish harvested from Narragansett Bay and swimming at Bay beaches. These results will enable regulators and users of Narragansett Bay to make informed choices about "acceptable risks" of exposure.

ISSUE D. Should the State of Rhode Island endorse the use of commercial or non-commercial controlled purification ("depuration") facilities to better assure the sanitary quality of shellfish harvested from Narragansett Bay?

PROBLEM DESCRIPTION

Forty percent (40%) of Narragansett Bay, including Mount Hope Bay, is restricted for shellfish harvesting because of the proximity of shellfish beds to municipal wastewater treatment plants and bypasses, combined sewer overflows, high concentrations of boats, and coastal areas with a high incidence of failed or failing septic systems. It is, however, technologically possible to "purify" shellfish harvested from sewage-contaminated waters. The process of controlled purification, or depuration, entails placing the "contaminated" shellfish in clean, circulating seawater which is then irradiated with ultraviolet (UV) light to kill associated microbes that are excreted by the shellfish, including potential pathogens. This process could be used to further reduce the risk of human exposure to sewage-contaminated shellfish, subject to the caveats stated below. In principle, controlled purification could also allow more shellfish growing areas in Narragansett Bay to be certified for harvesting, at least where (moderate) fecal contamination was the only source of pollution, and could also be used to reduce pressure on the existing fishery to the extent that resource management concerns and market demands for shellfish allow shellfish beds to be "rotated" or managed to promote stock recruitment. ["Quahaug management" issues will be presented for discussion in spring 1991.]

The State of Rhode Island currently practices "natural" depuration via its shellfish relay program. Under the supervision of the RIDEM Division of Fish and Wildlife and subject to FDA approval, shellfish are relayed from conditionally approved harvesting areas to presumptively clean "grow-out" areas ,where harvest is restricted for six to eight months. The grow-out areas are then opened to commercial harvest. The program is funded by a $20,000 set-aside from shellfish license receipts. Rhode Island does not, however, have any land-based depuration facilities although the technology is accepted by the National Shellfish Sanitation Program (NSSP) and practiced in neighboring states, including Maine and Massachusetts (White and Campbell, eds., 1989).

Although UV depuration technology is accepted and practiced in other states, there may be limitations to its effectiveness in sanitizing shellfish tissue. In Europe, where controlled purification is extensively used as an intermediate step in shellfish marketing, several incidents of virally-transmitted disease from human consumption of "purified" oysters have been reported (Shellfish Industry Round Table, 1990). NSSP guidelines stipulate that shellfish harvesting areas must be only moderately to non-

polluted to qualify for controlled purification (less than 88 fecal coliform bacteria per 100 ml) and that a minimum of two days are required for depuration of bacteria (White and Campbell, eds., 1989). Clearance of viruses, including potential viral pathogens, however, can take over four weeks (Shellfish Industry Round Table, 1990). In addition, the UV purification process is ineffective at removing heavy metals and toxic organic chemicals from shellfish tissue.

ALTERNATIVES CONSIDERED

D.1. Rhode Island should approve the licensing of commercial and/or non-commercial controlled purification facilities.

Controlled purification could improve public confidence in the sanitary quality of shellfish harvested from Narragansett Bay by further reducing the risk of exposure to sewage-derived pathogens from the consumption of locally harvested shellfish. In addition, the establishment of a state-regulated controlled purification facility could potentially allow an additional 11,000 acres of Narragansett Bay to be opened to shellfish harvesting. Furthermore, greater control for sanitary testing of shellfish can be exercised through the controlled purification facility.

D.2. Rhode Island should not approve the licensing of commercial and/or non-commercial controlled purification facilities, at this time.

There is no evidence of a significant or unacceptable public health problem related to the consumption of shellfish harvested from Narragansett Bay at this time that justifies the need for such a facility. In addition, there are uncertainties about the effectiveness of depuration in removing viruses, including potential viral pathogens. Conversely, there is experimental evidence that viruses, toxic metals and organic chemicals are not effectively depurated within the 48 hour minimum period mandated under NSSP guidelines. In addition, the use of approved controlled (shellfish) purification plants in Rhode Island could operate to relax state initiatives to reverse existing pollution trends in Narragansett Bay contrary to the federal Clean Water Act.

PREFERRED ALTERNATIVE: Alternative D.2.

Rhode Island's current shellfish relay program and subsequent "natural" depuration in shellfish growing areas is approved by RIDEM and the FDA and supported by the shellfishermen. This program should continue in the absence of any evidence of a significant, unacceptable public health risk resulting from this practice.

Given uncertainties about the effectiveness of available shellfish purification technologies in removing viruses, toxic metals and organic chemicals, there is no basis at the present time for the State of Rhode Island to invest in or subsidize the development of land-based, controlled purification facilities. However, RIDEM should continue to follow developments in depuration technology and should not foreclose the option of licensing commercial ventures in the event that 1) a public health problem should materialize with shellfish harvested from presently certified waters, or 2) additional areas of Narragansett Bay are restricted to shellfish harvesting due to new or newly discovered sources of fecal contamination.

ISSUE E. **Should the State of Rhode Island increase its efforts to eliminate illegal commercial shellfishing in uncertified shellfish harvesting areas in Narragansett Bay?**

PROBLEM DESCRIPTION

As discussed previously, 40% of Narragansett Bay is presently closed to shellfishing for at least some part of the year based on the proximity of the beds to known or suspected sources of fecal contamination. The closures are intended to protect shellfish consumers from the risk of exposure to sewage-derived, water-borne pathogens concentrated in shellfish tissue. Illegal harvesting and marketing of shellfish from closed areas, therefore, exposes consumers to an increased risk of exposure to shellfish-associated disease, as well as to elevated concentrations of toxic metals and organic contaminants.

RIDEM records indicate that over 37 million pounds of quahaugs (shell weight included) worth over $30 million were harvested from Narragansett Bay between 1987 and 1988 (see Figure 2). A survey of 413 Rhode Island shellfishermen conducted in July 1988 indicated that as much as 870,000 pounds of quahaugs were harvested from uncertified waters in the year preceding the survey, i.e., July 1987 to June 1988 (Bean and Sutinen, 1990). If true, the illegal harvest of quahaugs from uncertified (closed) waters represented 4% of the total quahaug landings in 1987.

Thirteen percent (13%) of the active shellfishermen could be characterized as "frequent violators" according to the survey, spending an average of 44 days per year fishing in closed areas (ibid.). The incentive for illegal harvesting is strictly economic; the value of the illegal catch was estimated at $300 per trip per fisherman, for a total illegal harvest of over $1 million between July 1987 and June 1988. The survey also indicated that the probability that frequent violators would be detected and convicted once during the year was only 1 in 4, although the probability that a shellfisherman would be inspected and subsequently prosecuted by RIDEM varied by geographic region of the bay (ibid.). [Note: The probability that Rhode Island shellfishermen who are violating the State's shellfishing laws will be detected and prosecuted is reportedly 100 times greater than the probability that a violator of Massachusetts' lobster laws will be detected and prosecuted (Bean and Sutinen, 1990).]

Fifty-nine percent (59%) of the respondents to the 1988 survey said that Rhode Island's enforcement efforts were not adequate (ibid.) However, participants at a Shellfish Industry Round Table sponsored by the Bay Project in July 1990 generally praised RIDEM's enforcement efforts and asserted that there has been better industry compliance with State regulations regarding closed shellfishing areas since the survey was performed. The shellfishermen at the Round Table discussions generally attributed the improvement in

compliance to: 1) RIDEM's use of regulatory sanctions, including impoundment and forfeiture of boats and equipment pursuant to R.I.G.L. 20-6-13 and 20-1-8.1, and shellfish license suspension/revocation pursuant to R.I.G.L. 20-3-6; 2) RIDEM's willingness to prosecute cases and seek jail time and/or penalties; and 3) self-policing by the shellfishermen.

In spite of these asserted improvements, the shellfishermen acknowledged that illegal harvesting still occurs (Shellfish Industry Round Table, 1990). Participants stated that fishing in closed areas was most likely to occur 1) immediately following shellfish transplant/relay to the shellfish management area (summer); 2) during the periods when RIDEM Conservation Officers were diverted to oversee hunting activities (fall); 3) during foggy, overcast days with reduced visibility; and 4) at night, or before 9:00 AM, when RIDEM Conservation Officers begin patrolling the bay.

Rhode Island and Massachusetts officials have cooperated in several night sweeps in Mount Hope Bay in order to catch shellfishermen violating the prohibition on night fishing and the prohibition against fishing in closed waters. Participants at the Shellfish Industry Round Table suggested that illegal harvesting in closed areas could be further reduced or eliminated by 1) increasing patrols; 2) using RIDEM Boating Safety personnel to enforce the State's fisheries' laws when RIDEM Conservation Officers are diverted to other duties; 3) establishing a full-time, year-round marine patrol unit within the RIDEM Division of Enforcement with the administrative authority to inspect (and seek regulatory action against) shellfishermen and shellfish dealers; and 4) focussing enforcement efforts on shellfish dealers who knowingly take illegally harvested shellfish (ibid.).

In summary, an unknown amount of illegal harvesting and marketing of shellfish from uncertified waters in Narragansett Bay probably still occurs. This activity exposes shellfish consumers to an increased risk of exposure to sewage-derived bacterial, viral and protozoan pathogens, as well as to elevated concentrations of metals and organic contaminants.

ALTERNATIVES CONSIDERED

E.1. No change. RIDEM's present level of enforcement is adequate.

Based on the 1988 survey, the estimated rate of violation is small (4% of total 1987 landings) and there is no evidence that a significant public health problem has resulted to date. In addition, the shellfishermen assert that the incidence of shellfishing violations has decreased since the 1988 survey because of RIDEM's aggressive use of its authority to seek boat and equipment forfeitures, license suspension/revocation, jail time and monetary sanctions for repeat offenders.

E.2. The RIDEM should increase its present level of enforcement to reduce or eliminate the illegal commercial harvesting of shellfish from uncertified (closed) areas of Narragansett Bay.

An unknown amount of illegal harvesting and marketing of shellfish from uncertified waters in Narragansett Bay probably still occurs. This activity exposes shellfish consumers to an increased risk of exposure to sewage-derived bacterial, viral and protozoan pathogens (see Table 1), as well as to elevated concentrations of toxic metals and organic contaminants. Illegal harvesting also exposes the shellfishing industry (and secondary businesses) to economic disaster in the event that a disease outbreak is traced back to Narragansett Bay shellfish. Since the primary incentive for violating the closure restrictions is economic, the incidence of shellfishing violations may increase during weaker economic periods. The RIDEM should:

1) stagger its patrols of bay waters to increase the probability of detecting illegal harvesting between dusk and dawn;
2) deploy Boating Safety Officers to enforce the State's fisheries' laws when RIDEM Conservation Officers are occupied elsewhere;
3) upgrade the Division of Enforcement's equipment (e.g., acquire night vision glasses) and adjust its patrols to focus on established patterns of violation, e.g., immediately following a relay/ transplant to shellfish management areas;
4) establish a full-time, year-round marine patrol unit within RIDEM Division of Enforcement, fully deputized to enforce the provisions of Title 20 of Rhode Island's General Laws;
5) increase inspections and regulatory oversight of shellfish dealers and distributors suspected of knowingly marketing illegally harvested shellfish;
6) continue cooperating with Massachusetts' Fish and Wildlife officials to patrol Mount Hope Bay, and consider entering an interstate Memorandum of Agreement with Massachusetts to provide for
   a) reciprocity with respect to license suspensions/revocations;
   b) periodically exchanging enforcement officers; and
   c) pooling and/or sharing field equipment;
7) systematically follow up on information provided by shellfishermen and others regarding illegal harvesting and/or marketing of shellfish; and
8) attempt to equalize the probability that violators are detected and consistently prosecuted for shellfish violations in all regions of the bay.

PREFERRED ALTERNATIVE: Alternative E.2.

See #2, above.

II. SOURCE CONTROL

INTRODUCTION

Untreated and incompletely treated human fecal wastes are discharged to Narragansett Bay and its fresh water tributaries via municipal wastewater treatment facilities and treatment bypasses, combined sewer overflows, on-site septic systems, boats, illegal cross connections to storm sewers and storm runoff. These discharges continue to occur in spite of the fact that 1) (some of) the public health risks associated with these practices have been clearly understood since the 1880s and these risks cannot be eliminated with present medical technology; 2) these discharges jeopardize other socially and economically important uses of Rhode Island waters; and 3) accepted technologies and management practices exist that could reduce or eliminate many sources of human fecal contamination to Rhode Island waters.

The goal of this section is to identify key recommendations that will enable Rhode Island to make every reasonable effort to eliminate the discharge of untreated fecal waste to Narragansett Bay and its tributaries by the year 2000 in order to protect public health and safety, protect the status of presently approved shellfish waters (and bathing beaches) and re-open presently closed or conditionally approved shellfish waters (and bathing beaches). Alternative approaches to reducing or eliminating discharges of untreated or incompletely treated human fecal waste to the Bay and its tributary waters are presented by "source". Additional recommendations regarding implementation of source reduction and source control policies will be detailed in the "Nutrients", "Toxics", "Land Use", "Critical Areas", "WWTF", and "CSO" briefing papers.

1. Wastewater treatment facilities

[Note: The following discussion on wastewater treatment facilities is presented as background on pathogen-related issues from this source. No issues or alternatives requiring decisions are presented here; they will be included in the "WWTF" briefing paper.]

The Federal Water Pollution Control Act of 1972 (the "Clean Water Act") mandated that all publicly-owned treatment works discharging to surface waters should achieve full secondary treatment limits by 1977 (extended to 1983 and then to 1988 pursuant to the 1985 amendments to the Act). Although treatment plant design was not prescribed under the Clean Water Act, fully operational secondary treatment systems are intended to remove a minimum of 85% of the total influent organic matter, including fecal wastes, via mechanical, physical and biological mechanisms. Approximately 35% of the influent sewage solids, including fecal matter, is removed via grit screens and passive settling (primary treatment). Up to 50% of the remaining solids (and associated organic matter) is removed via aerobic

bacterial digestion (secondary treatment). The resulting effluent is "disinfected" (typically with chlorine) to kill bacteria and potential pathogens entrained in the wastestream, prior to discharge to the receiving waters.

There are 33 municipal or publicly-owned wastewater treatment facilities (WWTFs) in the Narragansett Bay watershed; 16 in Rhode Island and 17 in Massachusetts. Based upon dry weather, average flow conditions, these facilities discharge an average of 81 million gallons per day (MGD) of treated primary effluent and 165 MGD of secondary effluent to the Bay and its tributaries. Only 27 of the 33 WWTF discharges to Narragansett Bay have achieved full secondary treatment; 12 in Rhode Island and 15 in Massachusetts. There are eleven WWTFs that discharge directly to Narragansett Bay, ten in Rhode Island (99 MGD) and one in Massachusetts, the City of Fall River's WWTF, that discharges 31 MGD to Mount Hope Bay. The Narragansett Bay Water Quality District Commission (NBC) is the largest direct discharger to Narragansett Bay, discharging 54 MGD of secondary effluent to the Providence River (average dry weather flow). Table 4 summarizes the average WWTF flows to Narragansett Bay and its tributaries.

Untreated sanitary wastewater typically has fecal coliform concentrations of 300,000 to 50,000,000 cells/100 ml. Even after secondary treatment, and prior to disinfection, effluent may still have fecal coliform concentrations of between 10,000 and 1,600,000 cells/100 ml. Conventional treatment and discharge of domestic wastewater without disinfection, therefore, is insufficient to remove pathogens. All National Pollutant Discharge Elimination System (NPDES) permits issued to WWTFs in Rhode Island contain monthly average and daily maximum fecal coliform limits, which effectively mandate the use of disinfection at these WWTFs in order to "kill" enteric bacteria and potential pathogens entrained in the final effluent.

Historically, chlorine disinfection has proven to be a relatively inexpensive and effective disinfection method. Chlorination is the sole method of disinfection used by Narragansett Bay basin WWTFs. In addition, Burrillville uses chlorination/dechlorination.

There are, however, many negative aspects to chlorination that have led to the development of alternative methods of disinfection. Gaseous chlorine is extremely hazardous. In addition, chlorine is acutely toxic at low concentrations to marine fish and aquatic invertebrates, especially planktonic larval stages (Petrocelli et al., 1990). Chlorine reacts with suspended organic matter in water to produce extremely toxic compounds such as chloramines and chlorbromines. [Chlorine toxicity will be discussed in greater detail in the "WWTF" element of the CCMP.] Most importantly for the purpose of this discussion, however, is the fact that while chlorine has proven very effective at reducing bacterial concentrations in sewage effluents, it is relatively ineffective at controlling viruses (Goyal, 1984; Roman, 1990).

Table 4 **Wastewater Treatment Facility Discharges in the Narragansett Bay Watershed** (1989 average flows from Discharge Monitoring Reports)

	MGD	design level of treatment	achieved level
Direct Discharges to Narragansett Bay (1 MA, 10 RI) (total: 130.12 MGD)			
(MA) Fall River	31.01	2	1*
(RI) Bristol	2.55	2 as of 8/89	2 after 8/89
Blackstone Valley District Commission	22.56	2; but construction: 1	
East Greenwich	0.81	2	2
East Providence	5.53	2	2
Fort Adams	0.05	2	2
Jamestown	0.53	2	2
Narragansett Bay Commission	54.38	2	2
Newport	9.28	1	1
Quonset	0.94	1	1
Warren	2.48	2	2
Blackstone River Basin (8 MA, 2 RI) (total: 53.77 MGD)			
(MA) Douglas	0.15	2	2
Grafton	1.03	2	2
Hopedale	0.50	2	2
Millbury	0.95	2	2
Northbridge	1.28	2	2
Upper Blackstone	39.57	2	2
Uxbridge	0.68	2	2
West Upton	0.15	2	2
(RI) Burrillville	0.53	2	2
Woonsocket	8.93	2	1*
Moshassuck River Basin			
(all within RI) no WWTF discharge			
Pawtuxet River Basin (3 RI) (total: 21.73 MGD)			
(all within RI)			
Cranston	12.17	2	2
Warwick	3.59	2	2
West Warwick	5.97	1; upgrading	1
Taunton River Basin (6 MA) (total: 30.35 MGD)			
(all within MA)			
Bridgewater	0.70	2	2
Brockton	16.75	2	2
Mansfield	2.10	2	2
Middleborough	1.29	2	2
Somerset	2.80	2	1*
Taunton	6.71	2	2
Ten Mile River Basin (2 MA) (total: 9.3 MGD)			
(all within MA)			
Attleboro	5.35	2	2
North Attleboro	3.95	2	2
Woonasquatucket River Basin (1 RI) (total: 1.62 MGD)			
(all within RI)			
Smithfield	1.62	2	2

* does not meet "secondary treatment" when defined (40 CFR, Part 133) as 85% reduction in BOD and TSS.

The relative merits of various alternative disinfection schemes are presented in Table 5. Seasonal chlorination or the elimination of disinfection is not expected to merit serious consideration in most areas due to the need to protect the State's seafood industry from contamination and human health concerns related to direct contact with receiving waters. Additionally, reduced disinfection practices would require the modification of water quality standards, an action which would be prohibited by the antidegradation provisions of the Rhode Island Water Quality Regulations and the anti-backsliding provisions of the Clean Water Act.

Ozone is an excellent bactericide and viricide which, due to its instability in water, dissipates to non-toxic levels before adverse environmental effects can occur. A significant secondary benefit of ozone disinfection, or ozonation, is that the process contributes dissolved oxygen to the effluent. However, ozonation tends to be about twice as expensive as chlorination, and more complex to operate and maintain. Ozonation is most effective where the final effluent is low in chemical oxygen demand and nitrite concentration.

Table 5 Applicability of Alternative Disinfection Techniques

Consideration	Chlorination	Chlor/Dechlor	Ozone	Ultraviolet
Plant Size	all	all	medium to large	small to medium
Bactericidal	good	good	good	good
Viricidal	poor	poor	good	good
Toxicity	toxic	non-toxic (1)	none expected	non-toxic
Contributes DO	no	no	yes	no
Complexity	simple to moderate	moderate	complex	simple
Safety Concerns	yes	yes	no (2)	no
Key Effluent Requirements	low TSS required	low TSS required	low COD and nitrite required	low solids and turbidity required
Relative Cost (Chlorination 1)	1	1.3-1.5	2	1-1.5

(1) Chloramines produced in chlorination are not removed by dechlorination.

(2) Potential safety concerns from ozone-oxygen; none from ozone-air.

Adapted from: EPA Design Manual, Municipal Wastewater Disinfection, October 1986.

Ultraviolet (UV) radiation is also an effective bactericide and viricide and is non-toxic, due to its being a physical rather than chemical process. UV is also simpler to operate and maintain than either chlorination or ozonation. The cost of UV disinfection can be competitive with that for chlorination. The presence of solids, soluble organics, or turbidity, however, can attenuate the UV rays, reducing their effectiveness. In addition, deposits can form on the material separating the UV lamp from the wastewater. To date, UV disinfection has only been used in small to medium sized treatment plants.

In summary, disinfection efficiency at WWTFs is directly related to the disinfection practice used and level of solids removal. Alternative disinfection practices exist which are far more effective than chlorine both as bactericidal and viricidal agents. However, some alternative methods, such as UV and (experimental) laser technologies, depend upon solids removal efficiencies that are not achieved by conventional secondary WWTFs, although they are otherwise economically competitive with, and environmentally safer than, the use of chlorine. Since the NBP will be examining the need for advanced secondary or tertiary treatment at RI WWTFs for nitrification-denitrification and/or nutrients removal, and these processes would result in 90 to 95% organic solids removal, further discussion of alternative disinfection practices will be deferred until the "Nutrients" and "WWTF" briefing papers are presented.

2. Combined Sewer Overflows

[Note: The following discussion on pathogen issues related to combined sewer overflows is presented as background. No issues or alternatives requiring decisions are presented; they will be included in the "CSO" briefing paper.]

Combined sewer overflows (CSOs) and wastewater bypasses have been identified as important sources of fecal contaminant input to the Narragansett Bay. Combined sewers carry residential and industrial waste flows during dry weather. These flows, however, when combined with storm runoff during periods of precipitation and snow melt, often exceed the carrying capacity of the drainage system, resulting in overflows of untreated wastewater. CSOs are, in fact, designed to divert flows from a combined sewer directly to a receiving water in order to prevent hydraulic overload of the WWTF. CSOs are distinguished from bypasses which are defined as "intentional diversions of waste streams from any portion of a treatment facility" [40 CFR 122.41(m)]. Although CSO flows are typically not metered, the estimated CSO flow to Narragansett Bay is approximately 2 to 4 billion gallons per year (BGY) compared to approximately 73 BGY from treated WWTF discharges.

Over 100 CSOs and WWTF bypasses discharge directly to the Narragansett Bay or to its tributaries. The Narragansett Bay Commission (NBC) owns 61 CSOs in Providence, as well as a secondary bypass (bypass prior to secondary treatment) at Fields Point. The Blackstone Valley Water Pollution Abatement District (BVDC) is responsible for 29 CSOs in Pawtucket and Central Falls, and also has a primary bypass (bypass prior to primary treatment) at its Bucklin Point WWTF (RIDEM, 1990b). The City of Newport also has three CSOs that discharge directly to the Bay. In Massachusetts, CSOs discharge to the Blackstone River in Worcester, where a CSO treatment facility is expected to go on-line in 1990, and to Mount Hope Bay (19 CSOs in Fall River, including the Quequechan River).

The Narragansett Bay Project has sponsored several research efforts to quantify the relative loadings of pathogen indicators to Narragansett Bay. In the Providence River area, a study was conducted in 1988-1989 in order to determine indicator inputs from various sources during several storm or "wet weather" events. Preliminary data indicate that nearly 80% of the fecal coliform loading to the Providence River may result from CSOs and the NBC and BVDC bypasses. Fecal coliform loading from Providence River CSOs and the two bypasses in a "typical" wet weather event were estimated at 2×10^{15} cells (Wright et al., 1990). Sanitary surveys in Mount Hope Bay showed that CSOs were responsible for 96% of the fecal coliforms entering the bay in wet weather periods (Rippey and Watkins, 1988). SWMM modeling for Fall

River CSOs estimated an annual fecal coliform loading of 1.43×10^{16} cells (Maguire Group, 1990).

Over 26,000 acres (28%) of Narragansett Bay are permanently closed to shellfishing because of their proximity to WWTFs and CSOs. An additional 10,672 acres (11%) of the Bay are conditionally closed depending on the occurrence of rain-triggered CSOs and bypasses. Conditional Area A (6,744 acres) is closed when one-half inch of rainfall or a 0.5 million gallon bypass occurs within a 24-hour period; Area B (3,928 acres) is closed with one inch of rainfall. In 1989, the conditional areas were closed for 263 days (72% of year). Since CSOs and bypasses appear to be the largest source of pathogen input to the closed and conditionally approved areas, the potential for reopening portions of closed shellfish area as a result of CSO abatement will be investigated further in the "CSO" briefing paper.

Several structural and non-structural measures can be used to eliminate or abate CSO discharges. Structural CSO abatement measures fall into three categories. The first involves the separation of combined sewer flows into independent sanitary and storm flows. The sanitary flows then receive full (usually secondary) treatment. An important remaining consideration, however, is the level of treatment that should be provided to storm sewer discharges, since storm runoff, and particularly urban and highway runoff, are important sources of heavy metals such as lead, zinc and cadmium, and organic chemicals such as petroleum hydrocarbons and polyaromatic hydrocarbons (PAHs). The second category of structural measures involves the storage of wet weather combined sewer flows, and subsequent discharge to WWTFs when treatment capacity is available. Storage can be achieved prior to runoff entering the collection system via detention systems, located at or near individual overflow points ("localized" storage), or at a central location tributary to the WWTF. Treatment technologies comprise the third category of structural measures. As with storage measures, treatment can be conducted either in a localized or centralized manner. Treatment measures commonly used include screening, sedimentation, coagulation-flocculation, and swirl concentration-vortex separation. Disinfection (typically chlorination or chlorination/ dechlorination) can also be provided to CSO discharges.

Non-structural mitigation measures, or Best Management Practices (BMPs), can be used as a stand-alone CSO abatement strategy or in conjunction with structural measures to reduce the scale of structural improvements. BMPs such as street sweeping and controlling erosion from construction sites reduce the base pollutant load since these materials would be captured and treated under normal dry weather operating conditions. Inflow reduction methods such as elimination of groundwater infiltration and inflow and the use of porous paving materials can decrease the total combined flow during a wet weather event, thereby reducing the volume of

CSO discharge. Interceptor capacity can be enhanced by sewer flushing to remove trapped solids and by adjustment of regulators to ensure that the full capacity of the system is utilized, and existing network storage can be increased by planned surcharging or the use of inflatable dams.

A number of projects and studies are underway to abate CSO impacts to Narragansett Bay. Fall River has a two phase CSO abatement plan involving elimination of dry weather discharges (complete) and abatement of wet weather discharges (facilities plan due November 1990). A CSO facility was recently constructed in Worcester and another is soon due for completion in Newport (March 1991). Both NBC and BVDC are conducting comprehensive CSO studies for their service areas.

In summary, CSOs are a significant source of untreated fecal waste to Narragansett Bay and its tributaries, resulting directly in the closing of significant portions of the Bay to shellfishing and public bathing, and contributing indirectly to the closing of other areas. A detailed discussion of CSO-related issues and potential solutions will be provided in a subsequent briefing paper due late in 1990.

3. On-site Individual Septic Disposal Systems

ISSUE: Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from septic systems?

PROBLEM DESCRIPTION

On-site septic disposal systems have been implicated as a potential cause of degraded water quality in Rhode Island's salt ponds, Wickford Harbor, Mount Hope Bay and the Sakonnet and Narrow Rivers, as well as in many other tributaries to Narragansett Bay (RIDEM, 1990a). These closures may be attributable, in part, to eutrophication-related impacts and illegal direct discharges, a ell as to direct pathogen input from ISDSs. Approximately 70(es of shellfish growing waters have been closed to shellfishing, in part, ecause of on-site septic disposal systems (RIDEM, 1990a). Storm drains, which may include sub-surface drains from septic systems and discharges from illegal sewer cross-connections, have been implicated in the closure of an additional 17,000 acres of potential shellfishing beds (ibid.).

Based on 1980 population census figures, only 37% of Rhode Island's population is served by on-site septic disposal systems (*Land Use 2010,* R.I. Dept. Admin., 1989). However, as of 1985, five of Rhode Island's 20 coastal communities were completely unsewered, and another six provided sewer service to less than 50% of their populations (ibid.). Since over 75% (280 miles) of Rhode Island's coastline is unsewered and served by on-site septic systems (Roman, 1990), the potential for fecal co mination of near coastal waters from failed systems and sep system le te in rural and developing communities is locally significant.

On-site, or individual, septic disposal syste.ns (ISDSs) are designed to take advantage of soil microorganisms to decompose conventional domestic, household wastes, including fecal wastes. Consequently, pathogenic microorganisms discharged from on-site septic disposal systems can potentially enter Bay waters through two different routes. First, improperly designed or maintained septic systems can fail and discharge raw waste to the soil surface where it can then be transported to surface waters via overland runoff. Second, properly designed and fully functional septic systems can leach fecal contaminants directly to groundwater supplies which are tributary to surface fresh and coastal waters.

Septic system failures are most likely to occur in areas that were developed before the RIDEM adopted septic system design and siting criteria in 1969 and before the Coastal Resources Management Council began to exercise control over coastal development in 1978. However, the potential for failed ISDSs exists wherever the cumulative density of development exceeds

the soil's assimilative capacity. This may be a particularly serious problem in coastal areas where seasonal homes have been converted to year-round use.

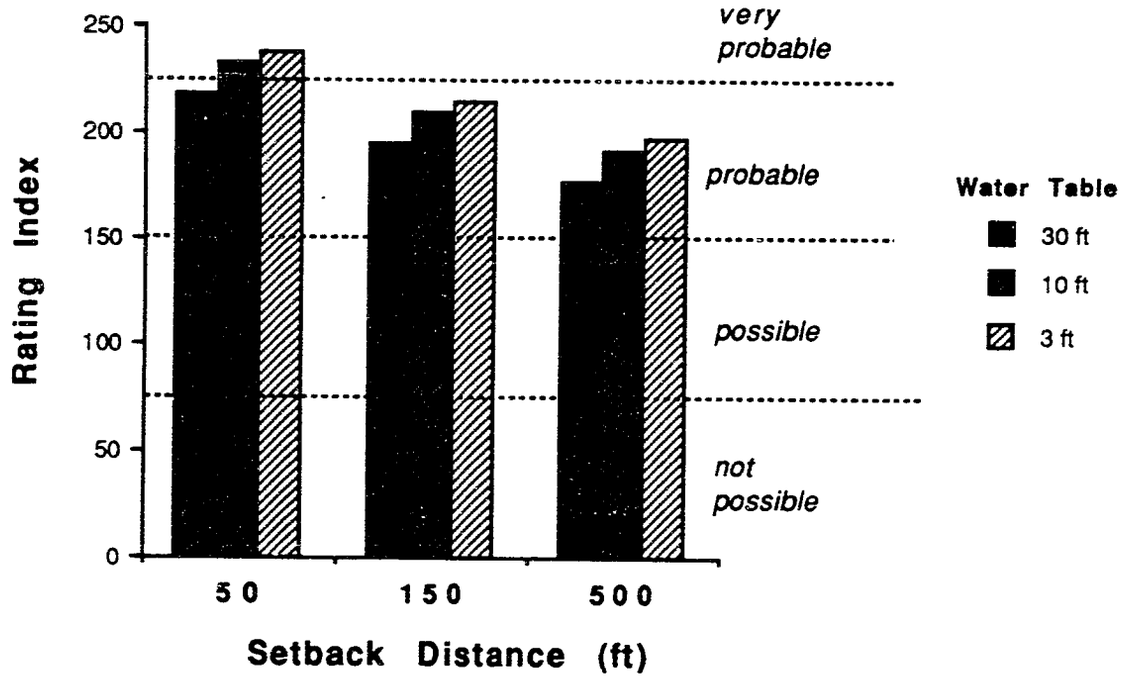
It is difficult to quantify the magnitude of fecal contamination that is directly attributable to failed systems unless there are no other significant point or nonpoint sources of contamination, e.g., along Rhode Island's salt ponds and the Narrow River. However, the R.I. Division of Planning estimates that the overall septic system failure rate is between 3 and 5% based upon the number of violations reported to RIDOH which are subsequently acted upon by RIDEM because the property owner failed to correct the problem. In fiscal year 1988-89, RIDEM issued 2,462 Letters of Warning and 103 Notices of Violation, statewide, for failures to correct failed septic systems; to date, it has spent more than $2 million of the $5 million Sewer and Water Supply Failure Fund on financing the replacement or repair of failed ISDSs. In 1989 the R.I. Aqua Fund Council received applications for grant funding from seven communities representing over 2,000 households with failed or failing septic systems. The scope of the problem may be underestimated, however, since property owners are likely to have failed or failing systems pumped out for aesthetic and sanitary reasons before the State officially intervenes.

Fecal contamination of surface waters via leaching of septic system effluents to groundwater is also potentially significant. There is evidence that viruses remain viable in groundwater and can migrate significant distances down-gradient from septic systems and sludge landfills (Roman, 1990). A study of a Long Island Sound ISDS leach field, with geological and soil characteristics similar to Rhode Island's coastal areas, found viable human enteroviruses approximately 200 feet down-gradient from the septic system (Roman, 1990). Viruses have also been detected over 1,300 feet down-gradient from sewage sludge landfills (ibid.). Similar studies on bacterial transport, however, suggest that bacteria are effectively removed within 6 to 50 feet down-gradient from septic systems (Roman, 1990; Weiskel and Heufelder, 1989).

RIDEM's ISDS regulations presently require new systems to be installed at least 3 feet above the seasonal high water table (or 5 feet above impervious formations) and set back a minimum of 50 feet from surface waters. The Coastal Resources Management Council (CRMC) requires up to 180 foot set-backs between septic systems and surface waters in erosion-prone areas. However, the ISDS Task Force convened by RIDEM in 1985 to review the State's ISDS regulations concluded that a minimum separation distance of 4 feet from the bottom of the ISDS to the seasonal high water table should be required, at least in critical resource areas and areas with excessively permeable soils. The ISDS Task Force also recommended greater "horizontal" buffer distances between septic systems and critical surface and groundwater resources to allow for some additional incidental treatment in

the event of a septic system failure (ISDS Task Force, January 1987). [Note that when EPA's septic system siting model was applied using typical Rhode Island soil types, a high probability of ground and surface water contamination from septic systems is predicted even under the most restrictive siting restrictions, i.e., 30 feet to water table and a 500 foot horizontal buffer (Roman, 1990) (see Figure 3). Based on these model results, fecal contamination of ground and surface waters is likely around the perimeter of Narragansett Bay as well as along rivers, streams and wetlands since the depth to water table in these areas is typically 3 to 8 feet, and 50 to 100 foot buffers are typically required (ibid.).]

Figure 3 Results of a US EPA model to evaluate the probability of pathogen contamination from septic systems (from Roman, 1990).



In summary, on-site septic systems have been implicated as a source of degraded water quality in many regions of Narragansett Bay and the Bay watershed. Rhode Island's buffer requirements may be minimally adequate to protect drinking water supplies, shellfish growing areas and bathing beaches from bacterial pathogens entering groundwater, based on information collected to date. However, the separation distances between septic systems and surface waters are probably not adequate to protect the public from exposure to bacterial or viral pathogens (or other dissolved contaminants) in the event of ISDS failure or ISDS contamination of

groundwater. [ISDS policy issues will be examined in more detail in the "Land Use" element of the CCMP.]

ALTERNATIVES CONSIDERED

3.1. No change. Increased buffer distances and set-backs between ISDSs and surface and groundwaters will unfairly or unconstitutionally limit development of some otherwise buildable lots.

More restrictive ISDS siting and set-back standards may render some presently buildable sites unbuildable (in the absence of lot-merger provisions); create a preference for large-lot developments, which may be antithetical to the development of "affordable housing"; interfere with "grandfathered" rights; and may increase building and ISDS installation costs.

3.2. Areas of high density, unsewered development should be connected to publicly owned sewers, wherever possible.

On-site septic systems have been implicated as a source of degraded water quality in many regions of the bay and the bay watershed. Rhode Island's buffer requirements may be minimally adequate to protect drinking water supplies, shellfish growing areas and bathing beaches from bacterial pathogens entering groundwater. However, based upon the best available evidence, the required separation distances between septic systems and surface waters are not adequate to protect the public from exposure to bacterial or viral pathogens (or other dissolved contaminants) in the event of ISDS failure or ISDS contamination of groundwater. The potential for fecal contamination of coastal waters is exacerbated because of the trend toward increased development in the coastal zone, and complicated by the conversion of seasonal homes to year-round residences.

Therefore, areas with chronically failing on-site septic disposal systems, and areas of high density development (e.g., greater than 3 or 5 units per acre) that presently depend upon on-site septic disposal systems should be connected to existing WWTFs, wherever possible. Priority for sewering should be based upon 1) areas where multiple ISDS failures have been documented; 2) areas where ISDS failures are likely to occur based on the existing pattern and density of development and the presence of highly permeable soils; and 3) areas with known or suspected ISDS problems within 1,000 feet of RIDEM Class A or SA waters, CRMC Type 1 and 2 waters or identified critical resource areas. Sewering is recommended only in those regions that 1) are already "built-out"; or 2) are evidencing water quality problems related to septic systems. Local comprehensive land use plans and facilities plans should account for the predicted increase in wastewater treatment capacity that could result from additional sewering.

When sewering is impractical or prohibitively expensive, RIDEM and CRMC should also explore the use of alternative wastewater treatment methods such as the Wisconsin mound system (ISDS Task Force, 1987), package treatment plants subject to utility regulation, and/or passive solar aquatic "greenhouses".

3.3. Increase set-back distances between on-site septic disposal systems and critical resource areas, including Narragansett Bay, its tributaries and adjacent tidal wetlands.

Based on the best available information regarding the overland and groundwater transport of fecal contaminants from on-site septic systems, RIDEM and CRMC should consider increasing minimum "setback" distances from Class A and SA waters, CRMC Type 1 and 2 waters and other critical reource areas. Increased set-back distances should also be considered for all proposed developments within 1,000 feet from said critical resource areas based upon 1) various siting factors, including soil permeability, depth to water table, and groundwater recharge rate, and 2) the expected cumulative impact of the proposed development (see Maryland's Critical Area Program for examples).

Additionally, setback distances should reflect the following two types of technical guidance. First, the various regulatory agencies should consider using the technical guidance document, *Septic tank siting to minimize the contamination of groundwater by microorganisms,* in siting on-site septic systems in critical resource areas and critical protection areas (EPA, 1987). Second, the Rhode Island Division of Planning (DSP) should prepare statewide maps -- for planning purposes only -- that identify areas that are unsuitable for ISDSs based on the criteria presented in the EPA guidance document, and identify areas that are high priorities for sewering based on the intensity of existing development, physiographic features and proximity to critical resource areas or critical protection areas. [The "Nutrients", "Land Use" and "Critical Area" briefing papers will discuss ISDS policy recommendations further.]

3.4. Provide local and state leadership, funding, and programs to support adequate septic system maintenance and septage disposal.

The CRMC cites the build-up of sewage solids and scum in septic system tanks and leach pipes, poor soil drainage, damage caused by tree and shrub roots, and wasteful water use practices as causes of failed septic systems. (See brochure, *Your septic tank and the the reasons to pump it out* , published by CRMC and South County Planners, attached.) The failure to properly maintain on-site septic systems is one major factor in septic system failures which can be costly to repair or replace -- repair of a septic system serving a

family of four can cost be ween $2,000 and $5,000 (ibid.), replacement can cost much more (A. Gold, pers. comm.).

The following steps should be undertaken to support proper septic system maintenance practices and to provide for septage disposal:

Public Education:

- RIDEM, CRMC, DSP and all local permitting authorities should increase their efforts to educate the public about the need and procedures for maintaining on-site septic systems.

Maintenance and Inspection:

- Local governments should be encouraged to establish wastewater management districts,pursuant to the 1987 enabling legislation, that provide for the routine maintenance of on-site septic systems, including septage treatment and disposal. Should continued delays occur in the establishment of wastewater management districts, the State of Rhode Island should explore additional options, such as the establishment of incentives that would encourage existing water or sewer utilities to assume responsibility for the maintenance of on-site septic disposal systems within their service areas, perhaps under the regulation of the Public Utilities Commission.

- RIDEM and RIDOH should negotiate an inter-agency Memorandum of Agreement transferring responsibility for ISDS inspections to RIDEM.

- RIDEM and CRMC should investigate delegating (some) inspection and enforcement authority to local building inspectors in order to better evaluate and reduce the statewide rate of septic system failures.

Septage Treatment and Disposal:

- The proposed DEM/OSP policy conditioning receipt of funds for WWTFs on septage acceptance should be supported. This policy would require any WWTF receiving state funds for upgrades or repairs to accept septage from unsewered cities and towns. This policy should be incorporated into the State Guide Plan.

- The State of Rhode Island should explore the permitted use of alternative wastewater and septage treatment technologies, such as

passive solar aquatic "greenhouses" which have been successfully used in Sugarbush, Vermont; Harwich, Massachusetts; and Dearborn, Illinois to treat residential and industrial wastewater and septage.

Funding:

- The State of Rhode Island should re-authorize the "Sewer and Water Supply Failure Fund" in order to provide financial assistance to individuals and communities with documented septic system failure problems (the original $5 million appropriation was committed as of July 1990).

PREFERRED ALTERNATIVE: Alternatives A.2, A.3, A.4.

Since failed and even fully functional on-site septic systems represent a locally significant source of fecal contamination to Narragansett Bay, remedial and more protective measures are necessary to protect the public from the risk of exposure to sewage-derived bacterial and viral pathogens in drinking water supplies, shellfish harvesting areas and swimming beaches. The effects of the proposed recommendations on developers and property owners can be mitigated to some extent by the use of transferrable development rights; local policies that encourage cluster development; and land acquisition.

[The "Nutrients", "Land Use" and "Critical Areas" briefing papers will develop these recommendations further.]

4. Stormwater Runoff

ISSUE: Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from stormwater runoff?

PROBLEM DESCRIPTION

"Stormwater runoff" is the overland flow of storm-generated rainwater and snow melt. As stormwater washes across the landscape, it transports solids and dissolved and particulate matter in its path, which can include sediment, metals, organic chemicals, nutrients and fecal wastes depending upon existing land uses. This storm flow, with its entrained contaminant load, then drains to surface receiving waters such as Narragansett Bay and its tributaries where it can potentially degrade water quality. Alternatively, the surface flow can be recharged to the groundwater, depending upon the soil surface (pervious versus impervious) and water table.

Stormwater enters Narragansett Bay from both "point" and "nonpoint" (diffuse) sources. Along highways and in urban and developed areas, some fraction of the storm-generated runoff may be captured and "channeled" into storm drains for direct discharge to a receiving water. In this case, stormwater is discharged from a "point source", i.e., a storm drain. (If the storm drains are also designed to carry sanitary waste, they are known as "combined sewers"; see Issue #2, above.) In the absence of storm sewers, stormwater can also cut its own channel across the land or travel as "sheet flow" depending on the soil surface, depth to water table and storm intensity and duration. The volume and water quality of stormwater discharges from both storm drains and uncontained overland flow are directly related to land use, soil and groundwater characteristics and land cover within the drainage area. Impervious surfaces such as highways, driveways, paved parking areas, and roofs promote surface runoff since the stormwater cannot filter into the soil. Based on an average annual rainfall of 44 inches in the Bay basin, (Ries, 1990) estimates the mean total annual runoff to Narragansett Bay to be 758 billion gallons per year (BGY). 177 BGY of this flow represents urban or suburban runoff since 23% of the watershed can be characterized as urban or suburban based on 1979 land use data (USGS, 1989). In summary, storm runoff can represent a significant water quality problem for Narragansett Bay, particularly in urban and developing areas of the watershed.

Stormwater discharges to Narragansett Bay constitute a potentially serious public health problem to the extent that fecal contaminants, including potential human pathogens, are discharged to near coastal waters that are used for shellfish harvesting or bathing. Fecal discharges from storm drains

have been implicated in the closure of approximately 17,000 acres of potential shellfish harvesting waters in Narragansett Bay (RIDEM, 1990a). Based on two recent shoreline surveys, RIDEM identified 19 storm drains (or pipes) in Greenwich Bay and 17 discharges along the lower West Passage of Narragansett Bay as confirmed sources of fecal contamination based on fecal coliform bacteria concentrations. In addition, the City of Providence estimates that between 20 and 35% of the City is served by separated storm sewers that were constructed since the late 1940s (City of Providence application to the R.I. Aqua Fund).

There are, however, many stormwater and non-stormwater sources of fecal contaminants to these storm sewers. First, some of the "storm drains" identified by RIDEM shoreline surveys may, in fact, be illegal sub-surface drains from residential, commercial and industrial on-site septic systems. Although sub-surface drains from on-site septic systems are prohibited in the State of Rhode Island, they may be still be common (although illegal) in areas developed prior to 1968 when the ISDS regulations were adopted. In addition, some sub-surface drains may have been illegally installed by property owners in areas where septic systems chronically fail because of soil drainage problems. As described earlier, RIDOH is charged with inspecting failed and failing on-site septic systems although RIDEM is charged with enforcement in the event that the property owner fails to comply with an order to repair or replace the system.

Other non-stormwater (dry weather) sources of human fecal waste to storm drains include the (illegal) connection of residential, commercial and industrial sanitary waste lines to storm sewers; runoff from failed septic systems and (illegal) direct disposal of septage. The frequency and magnitude of dry-weather discharges to storm sewers that are tributary to Narragansett Bay are difficult to determine, however, unless shoreline surveys are performed in dry weather. In summary, although storm drains are not designed to carry sanitary waste, they can behave like combined sewers (CSOs) depending upon upstream, illegal connections and land use in the drainage area. [Note: The 1987 amendments to the federal Clean Water Act mandate the issuance of NPDES discharge permits for all separate stormwater discharges that serve populations of greater than 100,000. The Clean Water Act also effectively prohibits the discharge of dry weather flows to storm sewers. Draft EPA regulations issued in response to the 1987 amendments (1988) would require municipalities with populations of greater than 100,000 people to 1) inventory all municipal storm drains; 2) estimate the contaminant loads discharged by municipal storm drains; 3) prepare a stormwater management plan for abatement of stormwater flows; and 4) eliminate illegal dry weather flows. The draft regulations promote the use of non-structural "best management practices" to reduce or eliminate pollutant inputs rather than treatment of the stormwater discharge.]

Uncontained, "nonpoint" source flows of stormwater also discharge fecal wastes to Narragansett Bay. Sources of fecal waste can include runoff from failed septic systems, agricultural lands, livestock operations and sewage sludge landfills. In addition, storm runoff carries wild and domestic animal fecal wastes. Animal wastes deposited in Narragansett Bay would be reflected as high fecal coliform counts in the Bay since fecal coliform bacteria, the accepted bacteriological indicator of fecal contamination, inhabit the gut of all warm-blooded animals. Waterfowl, for example, have been associated with high fecal coliform counts in some areas of Buzzards Bay (Heufelder, 1988). RIDEM identified runoff from a dairy operation near the Blackstone River as a suspected source of high bacterial levels (RIDEM, 1989). In general, however, enteric pathogens cannot be transmitted from animals to humans (Roman, 1990). There is an unknown human health risk related to birds that scavenge at municipal WWTFs or sludge landfills to the extent that they defecate near water supplies and thereby act as passive vectors of human enteric pathogens. In addition, waterfowl may be natural hosts to certain sepcies of Salmonella (Berg and Anderson, 1972).

In summary, storm drains and overland stormwater runoff represent a significant source of human fecal waste (and potential pathogens) to Narragansett Bay, although the relative importance of these sources is difficult to quantify. The 1987 amendments to the federal Clean Water Act require municipal storm sewers that serve over 100,000 people to be treated as point source discharges for the purposes of the NPDES permit program, although EPA has not issued final regulations as of August 1990. EPA (1990) has, however, issued draft guidance to assist state and local officials in detecting non-stormwater inputs to storm drains. Providence is the only Rhode Island municipality that qualifies for federally-mandated stormwater controls pursuant to the Clean Water Act. Under a grant from the R.I. Aqua Fund, Providence will prepare an inventory of municipally-owned storm sewers and will collaborate with EPA to test EPA's draft guidance for detecting upstream, non-stormwater inputs.

As indicated by the results of the RIDEM shoreline surveys, stormwater runoff also represents a direct source of fecal contamination to non-urban portions of Narragansett Bay. Except for Providence, none of Rhode Island's coastal communities are covered by the Clean Water Act with respect to permitting of storm drains. Rhode Island's "Nonpoint Source Management Plan" (1989), however, recommends using the "Recommendations of the Stormwater Management and Erosion Control Committee Regarding the Development and Implementation of Technical Guidelines for Stormwater Management (1988)" as technical guidance for the abatement and elimination of stormwater discharges. [Stormwater management issues will be discussed in greater detail in the "Nutrients", "Toxics", "Land Use" and "Critical Areas" elements of the CCMP.]

ALTERNATIVES CONSIDERED

4.1. No change in current stormwater management or regulatory programs.

There is no evidence of a significant public health risk at this time that can be directly associated with stormwater runoff.

4.2. While recognizing that all stormwater discharges within the Narragansett Bay basin potentially contribute to water quality degradation and should be reduced and mitigated, the State of Rhode Island should establish priorities for abating and/or eliminating significant stormwater discharges. These priorities should recognize the need to: 1) regulate new discharges; 2) abate existing discharges; 3) prevent shifting pollutants to the groundwater; and 4) should be linked to the level of impact on the receiving water.

- Storm drains that discharge directly to Narragansett Bay and its tributaries should be systematically surveyed in order to detect and eliminate illegal, dry weather human fecal inputs. RIDEM, in collaboration with EPA, RIDOH and/or local governments, should expand its existing shoreline surveys to attempt to identify and eliminate dry weather sources of untreated fecal contamination to Narragansett Bay.

- The EPA and other Federal agencies should formulate technical guidance regarding the abatement of existing sources of runoff in urban and non-urban areas. The States of Rhode Island and Massachusetts should promulgate regulations to abate existing sources of storm runoff, especially those not covered by existing regulations (e.g., storm drains serving populations of less than 100,000). Both the Federal and State governments should provide guidance to municipalities regarding "best management practices" for prevention of new sources of stormwater runoff.

- Rhode Island cities and towns should be required to draft local and/or regional stormwater management plans in conformance with the Rhode Island "Nonpoint Source Management Plan" and related guidance. Technical assistance should be provided by the RIDEM Nonpoint Source Management Program, the University of Rhode Island Cooperative Extension Service, the R.I.Division of Planning and the U.S. Department of Agriculture Soil Conservation Service. [This issue will be discussed in subsequent briefing papers since stormwater is also a vector for the discharge of sediments, organic oxygen-demanding matter, nutrients and toxics to Narragansett Bay.]

- Rhode Island's "Nonpoint Source Management Plan" and the "Recommendations of the Stormwater Management and Erosion Control Committee Regarding the Development and Implementation of Technical

Guidelines for Stormwater Management (1988)" should be incorporated by reference into the CCMP in order to provide consistent statewide policies with respect to the use of "best management practices" for controlling stormwater runoff.

- The States of Rhode Island and Massachusetts should provide technical assistance to cities and towns regarding the implementation of "best management practices" for controlling and/or eliminating stormwater discharges.

PREFERRED ALTERNATIVE: Alternative 4.2.

Fecal contaminants, including pathogens, are discharged to the Bay via storm drains and overland storm runoff. These flows pose a potential public health risk to shellfish consumers and recreational users of Narragansett Bay. In addition, stormwater discharges from storm drains have been implicated in the closure of over 17,000 acres of shellfish growing waters in Narragansett Bay, which imposes an economic burden on Bay shellfishermen. The federal government has provided a regulatory mechanism for the eventual abatement of storm flows in major urban areas. However, stormwater runoff represents a significant source of fecal contaminants to rural and developing embayments within Narragansett Bay. These flows should be abated or eliminated in order to protect existing and future uses of Narragansett Bay.

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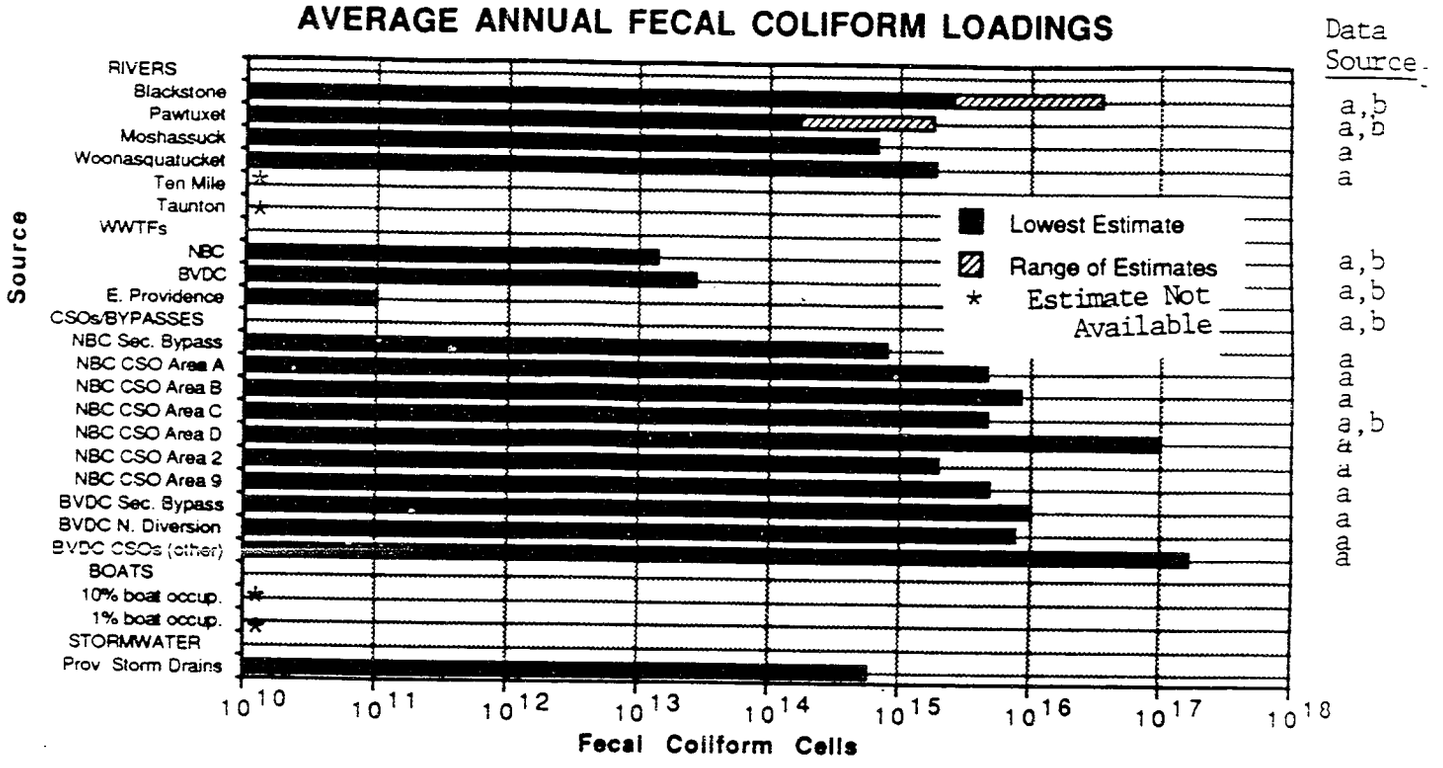
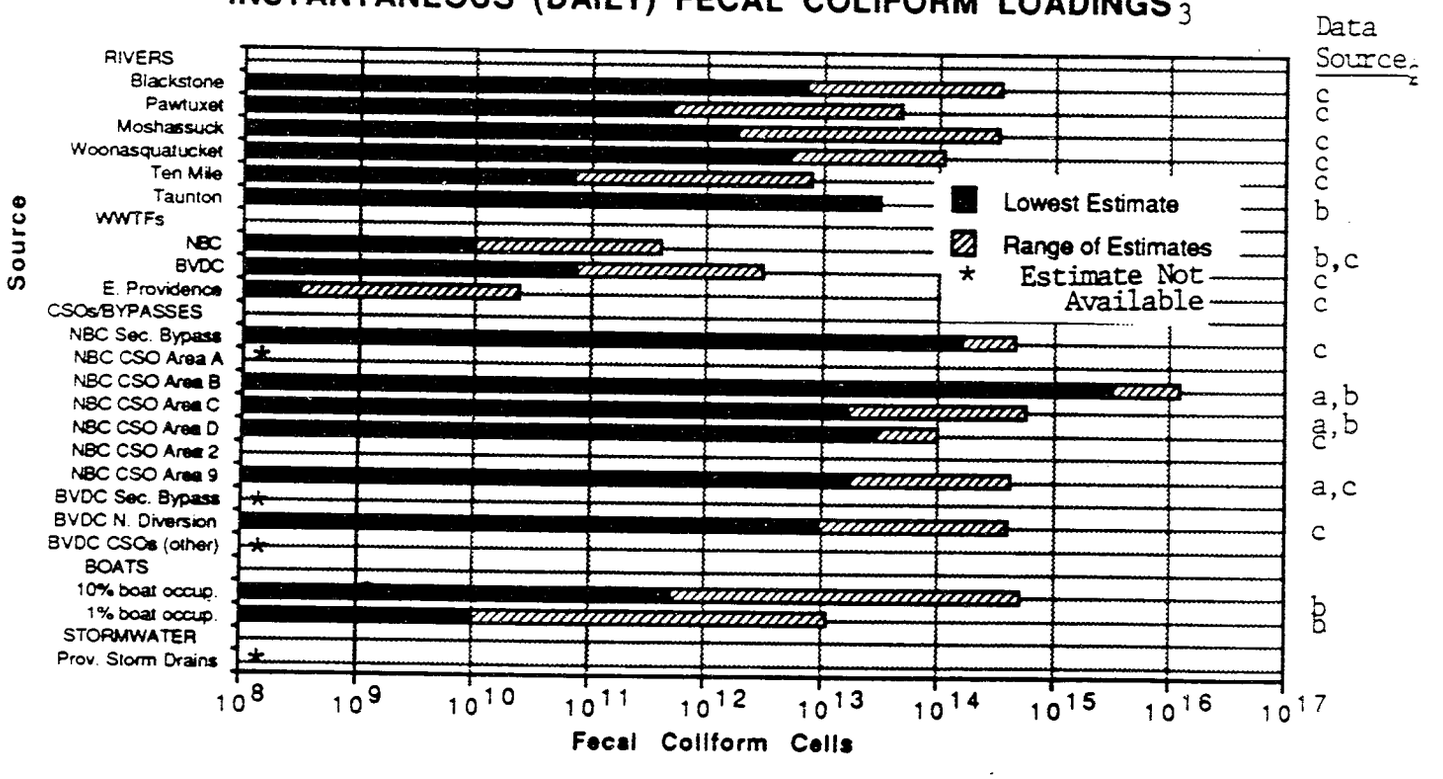
APPENDIX 1

Figure 1: Relative contribution of fecal contaminants to Narragansett Bay, by source, as measured by estimated average annual and instantaneous (daily) input of fecal coliform bacteria.[1]





FOOTNOTES TO FIGURE 1:

1. The graphs are intended only to show the relative magnitude of various sources of fecal coliform bacteria loadings, as an indirect measure of potential pathogen loadings. Differences of one order of magnitude or less should not be considered to be significant.

2. Graphs represent data compiled from a number of sources. The primary data sources used were:

   a) Metcalf & Eddy, Inc. 1990. Narragansett Bay Combined Sewer Overflows. Draft report to the Narragansett Bay Project.

   b) Roman, C. T. 1990. Pathogens in Narragansett Bay - Issues, Inputs, and Improvement Options. Narragansett Bay Project, Providence, RI. NBP-90-47.

   c) Watkins, W. D. and S. R. Rippey. 1990. Narragansett Bay Project Wet Weather Study - Microbiology. Draft report to the Narragansett Bay Project.

   No attempt has been made to verify or reconcile the estimates from various data sources. Since each source used different raw data sets and methodology in developing estimates for annual and daily loadings, estimates from different sources may not be directly comparable (e.g., an average annual loading estimate from one data source may not be equal to 365 times an average daily loading estimate from a different data source).

3. The graph of instantaneous daily loadings contains data for three categories of sources: continuously discharging sources (rivers, WWTFs), intermittent wet weather discharges (CSOs/bypasses, stormwater), and intermittent dry weather discharges (boats).

   a) For continuously discharging sources, the loadings represent a range from average daily discharge (lowest estimate) to "typical" wet weather discharge [events of longer than 24 hours were converted to "daily" by dividing event load by (period of discharge)/24].

   b) For intermittent wet weather discharges, the loadings represent a range of "typical" wet weather discharges [events of longer than 24 hours were converted to "daily" by dividing event load by (period of discharge)/24].

   c) For boats, the loadings represent estimates under specified boat occupancy and discharge assumptions, as follows:

      - Approximately 34,000 boats using Rhode Island waters are equipped with a head/toilet.
      - Scenarios of 10% or 1% of these boats discharging to the Narragansett Bay were assumed.
      - Each boat discharges 8 gallons per day, at a fecal coliform density of 1×10^5 to 1×10^8 fc/100 ml.

SECTION II:

PROCEEDINGS FROM NARRAGANSETT BAY PROJECT MANAGEMENT COMMITTEE

AUGUST 22, 1990
SEPTEMBER 19, 1990
OCTOBER 24, 1990

APPENDIX A:

MANAGEMENT COMMITTEE MEETING MINUTES

AUGUST 22, 1990
SEPTEMBER 19, 1990
OCTOBER 24, 1990

TRANSCRIPT HAS BEEN RESTRICTED TO PATHOGENS DISCUSSION
FOR THE PURPOSES OF THIS DOCUMENT

Minutes August 22, 1990 Management Committee Meeting

SEWAGE CONTAMINATION - PATHOGENS

I. RISK ASSESSMENT- RISK MANAGEMENT

Issue A. Should RIDEM and RIDOH change their existing monitoring procedures to better assess the risk of human exposure to sewage-derived, water-borne disease from the consumption of molluscan shellfish harvested in Narragansett Bay?

Mr. Spalding said the recommendation should be extended to Massachusetts as well as the Rhode Island agencies.

Mr. Grant said the committee appeared to have reached a consensus in support of this recommendation.

Issue B. Should RIDEM and RIDOH change their existing monitoring procedures to better assess the risk of human exposure to sewage-derived, water-borne disease from swimming in Narragansett Bay?

Mr. Cooperman asked whether there were now EPA water quality standards for bathing waters.

Dr. Walter Coombs (RIDOH) stated that closing beaches as unsafe is not practical. There are extensive problems with installing and maintaining signs. There is a need to explore other ways to achieve the objective, such as public education.

Mr. Greene suggested the use of swimming maps similar to the shellfish closure maps currently issued.

Mr. Spalding said that the posting of signs for beach closing is done elsewhere, New Jersey for example, and asked why not in Rhode Island?

Dr. Coombs indicated that resources need to be allocated to do this. The better solution is to explore the use of maps and other public education tools.

Mr. Allan Beck (Prudence Island National Estuarine Research Reserve) asked why there was inconsistency between the state's monitoring of shellfisheries and the monitoring of bathing beaches.

Dr. Deacutis said the difference arises because of the state responsibilities under the National Shellfish Sanitation Program.

Mr. Ernest Julian (DOH) stated the authority to post signs on private or town property is an open question.

Mr. Beck says that since the State owns the waters, State programs would be more efficient.

Mr. Mulhearn suggested that "no swimming" signs be added to the public access signs.

Mr. Dillingham asked why additional monitoring is needed if there is no indication of gross pollution?

Ms. Karp indicated that there is some unknown additional risk.

Dr. Deacutis said several years ago Dr. Victor Cabelli recommended the location of beaches where a long-term monitoring program should be instituted.

Ms. Holly DesRosiers (R.I. Marine Trade Assoc.) asked how many times the beaches were closed last year?

Ms. Karp indicated they were closed after the *World Prodigy* spill. In general, all beaches are tested prior to the swimming season. There is no testing in SC waters.

Ms. DesRosiers expressed concern about having signs all over the State saying that the beaches are polluted.

Mr. Grant indicated that we should explore posting and all alternative means of public education.

Mr. Spalding said that, at a minimum, there should be posting for those beaches near CSO's.

Mr. Anderson indicated that RIDEM will require posting of CSOs under RIPDES facility permits, as the permits are due for renewal.

Mr. Beck stated that monitoring is still needed, posting is a management tool.

Ms. DesRosiers inquired whether lifeguards could do the testing and whether mandatory testing can be instituted.

Mr. Julian said RIDEM samples all saltwater beaches as well as most freshwater beaches. Licensing is based on the beach history, and the sample collected prior to the bathing season.

Mr. Grant said that he heard a consensus from the Committee on these recommendations, and directed the staff to include the refinements concerning disclosure of bathing beach proximity to CSOs, through the posting of signs or through the production of an informational map.

ISSUE C. Should RIDEM and RIDOH include "indicators" of viral contamination in their monitoring programs to better assess the risk of human exposure to sewage-derived viral pathogens?

Regarding the recommendation that RIDEM use viral indicators to verify decisions about certification of shellfish growing areas where septic systems are a source of fecal contamination, Ms. Scott asked why the proposal is to use viral indicators only in areas with ISDS problems.

Dr. Deacutis suggested changing the wording to "support" rather than "verify". This cannot be verified since there are no numerical standards for viral indicators. Try to develop a data base relating viral indicators and coliform measurement. From his perspective as a regulator, there is no national standard. The only standard relates to interstate trade.

Mr. Grant stated his support of changing "verify" to "support".

Mr. Mulhearn expressed concern that the statement that seasonal housing is changing to full-time housing is not true. The opposite is occurring.

Mr. Beck disagreed and said that the change from seasonal to full-time is occurring.

Mr. Grant concluded that there was a consensus of the Committee on the recommended option with the change of wording from "verify" to "support".

ISSUE D. Should the state of Rhode Island endorse the use of commercial or non-commercial controlled purification ("depuration") facilities to better assure the sanitary quality of shellfish harvested from Narragansett Bay?

Dr. Jan Prager (EPA/ERL-N) said that the state should not endorse depuration but should concentrate on water quality improvements so that shellfish can meet criteria. Relay is inconsistent with water quality goals.

Mr. Dick Sisson (DEM F&W) indicated that the shellfish for relay program come from polluted areas.

Mr. James Boyd (RIDEM) said that shellfish for relay are not from grossly polluted areas and urged that relay is essential to the shellfish management area (Greenwich Bay) for the winter harvest there.

Mr. Dave Borden (DEM F&W) said that shellfish are tested for both bacteria and metals at the time of transfer, and on the opening of the beds.

Mr. Grant concluded that there was consensus in agreement with the recommendations presented in the briefing paper, with the addition of the concerns about consistency with water quality goals.

ISSUE E. Should the State of Rhode Island increase its efforts to eliminate illegal commercial shellfishing in uncertified shellfish harvesting areas in Narragansett Bay?

Mr. Borden urged caution in using the numbers that represent the estimate of the amount of illegal harvesting. Sutinen's data has large confidence intervals. Care should be also be taken in the presentation of numbers because of their impact on the shellfishery. The numbers are high in terms of the total number of days of shellfishing. He also expressed concern about the use of specific numbers because of possible misunderstanding by the public.

Mr. Eddie Agin (R.I. Shellfishermen's Assoc.) said the numbers for illegal harvesting are too high, and the quahoggers are meeting with Dr. Sutinen to go over the questionnaire. He said the ill -al harvesting numbers are higher than the amount of quahogs that go into the ma gement area. He also said that these are 1986 and 1987 data and that enforcement changes have resulted in better enforcement today.

Ms. DesRosiers indicated that re-deployment of boating safety officers could jeopardize the state's Wallop-Breaux funding.

Mr. Agin said that most of these recommendations were ironed out at Shellfish Round Table and that most fishermen are in agreement.

Mr. Grant concluded that there was a consensus on the recommendations with changes consistent with the discussion.

NBP MANAGEMENT COMMITTEE MEETING
September 19, 1990
12:00 p.m. - 4:00 p.m.

Meeting Minutes

SEWAGE CONTAMINATION - PATHOGENS (cont'd from 8/22/90)

II. SOURCE CONTROL

Mr. Grant began the sewage contamination discussion by noting that although the first two subjects –1) wastewater treatment facilities and 2) combined sewer overflows (pp. 24-32)– did not require any decisions to be made at this time, the NBP staff is interested in committee members' comments. Comments should be submitted in writing to the NBP, attention: Mr. Richard Zingarelli.

ISSUE II.3: Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from septic systems?

Mr. Grant summarized the alternatives presented and suggested that the committee first review the briefing paper alternatives requiring a change in present practices, before weighing all of the various alternatives, including the "no change" alternative (3.1) supported by the Rhode Island Association of Realtors, Inc., in a memo distributed to those present.

Alternative 3.2: Areas of high density, unsewered development should be connected to publicly owned sewers, wherever possible.

Dr. Ward asked why sewering was being recommended before other wastewater treatment options.

Mr. Fester said that package treatment plants should not be considered as an option because these plants lead to overdevelopment in areas which would not otherwise support development. Once used in one type of area, people will want to use them elsewhere. And if they fail, he asked, who will be responsible?

Ms. Karp pointed out that these options are only for already "built-out" areas.

Mr. Grover Fugate (CRMC) said that using package treatment plants as a last option in already built-out areas may make sense, but he cautioned that the plants would need to be highly regulated and that a corresponding change would be needed in ISDS regulations. He also noted that several jurisdictions, including South Carolina, have had "bad" experiences with such plants.

Mr. Fester suggested that more restrictive density controls should be considered for protection of "critical areas" before resorting to alternative treatment technologies.

Mr. Tom Mulhearn (RI Association of Realtors) noted that lowering the density reduces open space and increases sprawl, without really addressing the issue of "critical areas." He stated that the CCMP should emphasize the need for wise development and recognize that increasing densities makes sense in certain areas.

Ms. Anna Prager (RI Governor's Office) noted that ISDS limitations have worked to preserve critical areas and cautioned about the potential for sewage extension to lead to overdevelopment. She recommended that the language "experiencing intensive development pressure" (p. 35 Alternative 3.2 par 2 (2)) be deleted in order to emphasize that sewering was only appropriate in <u>developed</u> areas.

Dr. Deacutis said that introducing sewers to an area can change the "legal" definition of "built-out", resulting in a change in the amount of development allowed.

Ms. Karp said that NBP staff uses two definitions of "built-out": 1) to refer to maximum building density under current zoning; and 2) as the building density which meets or exceeds the soil saturation threshold. For example, zoning may allow building beyond the saturation limits for various pollutants, including pathogens. The term will be clearly defined when used in the future.

Ms. Ruta asked who would be responsible for implementation, what "wherever possible" would mean, and where the wastewater treatment facility (WWTF) capacity would be found. She also asked if it would be necessary to consider the capacity of nearby WWTFs.

Mr. Greene commented that perhaps sewage failure problems should be separated out from other nonpoint source problems.

Mr. Grant stated that there appears to be a line being drawn between "built-out" areas and areas where development pressure still exists. There seems to be a reluctance to encourage the use of package treatment plants in areas where development pressures exist, and that package treatment plants should only be recommended in dire circumstances as a corrective measure under very strict regulation. In addition, he noted that the term "built-out" needs to be carefully and rigorously defined.

Ms. Prager said that allowing continued ISDS malfunctioning in certain areas should also be considered as an alternative in order to prevent overdevelopment, and that package treatment plants should not be endorsed in undeveloped, otherwise constrained, areas.

Mr. Grant asked if it would be worthwhile in those cases to conduct an environmental cost/benefit analysis of package treatment vs. allowing continued malfunctioning.

Mr. Joe Migliore (DEM) cautioned that package treatment plants may degrade water quality and violate DEM rules against new direct discharges to protected waters (Class SA and A).

Mr. Mariscal said that package treatment plants can not discharge into Class SA waters and do not resolve the problem of failed systems. Active development of water conservation programs should be promoted, he said, because most systems fail as a result of hydraulic overloading. Presently, there is a mandatory 1.6 gallon flush toilet regulation in Rhode Island. A toilet recently developed by Mr. Luther Blount functions on one pint of water. Mr. Mariscal added that the NBP should consider recommending replacing individual failed systems, before considering package treatment plants. Because these plants do not remove nutrients, they will not be effective except regarding biological oxygen demand (BOD), total suspended solids (TSS), and fecal microbial contaminants.

Dr. Prager commented that package treatment plants should not be allowed unless the plant could recycle treated waste water back into the water supply.

Mr. Bob Richardson (RIDEM) stated that package treatment plants should only be used if all else fails. On small lots, he suggested, repairs should be investigated.

Dr. Ward observed that in marginal areas water-use frequently functions as a device to control development. If that control is removed, he asked, how will the land remain undeveloped?

Dr. Ward asked about the potential for solar aquatic wastewater treatment.

Mr. Al Cooperman (MA DEP) said that Massachusetts was considering rescinding solar aquatics approval for septic/sewage treatment. He asked whether holding tanks were used in Rhode Island?

Mr. Fester responded that holding tanks are used only as remedies. He also suggested that perhaps the language in Section 3.2 is too inclusive and needs to be more restrictive. In addition, the problem of failed septic systems and septage management should be dealt with by the community, so that there is community management. Localized problems need localized solutions.

Mr. Scott Millar (DSP) noted that the city of Warwick conducted a facilities maintenance plan a decade ago to examine the possibility of rehabilitating facilities. They found it more cost-effective to replace individual systems.

Mr. Mariscal said that Warwick had a unique problem because many residences used cesspools instead of tanks. The life of tanks varies, he said, but can be greatly extended by proper maintenance and active water conservation measures.

Ms. Prager and Mr. Bob Richardson (DEM) agreed on the importance of stressing septic system maintenance and water conservation.

Mr. Grant summarized the discussion on this alternative as follows. The NBP should recommend the extension of public sewerage only to those sensitive areas that are both built-out **and** facing ongoing development pressures, and only after all reasonable alternatives, (including water conservation, system upgrade, rehabilitation, and replacement) have been explored. Package treatment plants should be considered only as an absolute last resort and the RIDEM ISDS regulations should contain explicit restrictions on their use.

Mr. Curt Spalding (Save the Bay) said that this summation was consistent with Save the Bay's position.

Alternative 3.3. Consider increasing set-back distances between on-site septic disposal systems and critical resource areas, including Narragansett Bay, its tributaries, and adjacent tidal wetlands.

Ms. Karp clarified that the staff was not recommending specific setbacks at this time. The 1,000 feet distance used in Maryland is a critical zone (not a setback), within which different density criteria and performance standards apply.

Dr. Ward suggested broadening the recommendation beyond setbacks to focus on water conservation measures, given that hydraulic loading is the major problem in failed systems.

Mr. Fester suggested using the state building code to help institute these measures.

Ms. Susan Morrison (Office of Statewide Planning) proposed that state grant programs for facilities upgrades be made conditional upon water conservation efforts.

Mr. Beck said that elliptical charts should be used, when available, to help delineate water flow patterns.

Mr. Fugate observed that the CRMC has a mandatory 180 foot setback, and a 200 foot setback in Special Area Management (SAM) Plan areas. He also noted that the 200 foot SAM area setback is not great enough to filter out nitrates and other nutrients, even where it is adequate for filtering out bacterial pathogens.

Mr. Mulhearn suggested that the Management Committee examine the Barnstable County proposed ordinance on setbacks.

Ms. Karp responded that the committee will revisit this issue and that the the Barnstable County approach will be presented as an alternative at that time.

Ms. Ruta asked to whom the Management Committee recommendations will be made.

Ms. Karp said that the recommendations will be made to a variety of implementing authorities in Rhode Island, including RIDEM, CRMC, and local governments, and also to various authorities in Massachusetts.

Ms. Prager observed that local communities will find it easier to take the recommended steps if an explicit policy is included. She added that planners and other officials around the state are looking for guidelines of this sort.

Ms. Ruta asked if the committee would in fact be providing guidelines.

Ms. Karp said yes, but not at the present time.

Mr. Fester commented that CCMP recommendations would be going into the Rhode Island State Guide Plan.

Mr. Mulhearn expressed concern about the quality of the study underlying the setback recommendation and said that the committee should examine how modern systems will function in new construction, instead of concentrating on old, failed systems.

Ms. Karp defended the reliability of the data, noting that they were based on a number of published studies.

Dr. Clayton Penniman (NBP) observed that we need to concentrate on the system's potential for viral contamination, not just on its age or history of bacterial contamination.

Ms. Kristine Stuart (Soil Conservation Service) suggested that the briefing papers should address Massachusetts' regulations and agencies as well.

Mr. Beck suggested that the staff also consider the ramifications of sea level rise and bank erosion within the Bay.

Ms. Karp responded that the staff does not have a lot of information on sea level rise and bank erosion, but that the staff would utilize all the information on these subjects that it had.

Mr. Grant brought this discussion to a close by suggesting that the staff put the "critical area" setback recommendation within the context of a package of related recommendations, watershed-wide--for both Massachusetts and Rhode Island--including: denitrification systems, water conservation, repair and rehabilitation of systems, soils criteria, etc.

Alternative 3.4: Provide local and state leadership, funding, and programs to support adequate septic system maintenance and septage disposal.

Mr. Grant proposed that the committee consider one at a time the seven specific steps listed under this alternative. He summarized the recommendation calling for increased public education about ISDS maintenance and concluded that there was a consensus on this step.

Mr. Millar summarized the wastewater management district enabling legislation, explaining that towns have been reluctant to take advantage of the legislation because of the difficulty in locating a facility willing to accept the collected septage.

Mr. Fester suggested that state education aid to local governments be tied to the formation of wastewater management districts.

Ms. Karp asked if incentives could be designed to entice existing local utilities, (i.e., water supply districts, electricity distributors, etc.) to establish and oversee these districts.

Mr. Mathew Haggerty (Newport Water Department) suggested the plumbing inspector or building supervisor as two possibilities for overseeing the district.

Mr. Millar recommended that the NBP staff examine related laws from the 1960's when towns had responsibility for septage disposal.

Mr. Spalding stated that the towns would still need a facility to accept the collected septage.

Mr. Fester pointed out that towns would need to raise new fees to collect the septage. He also noted that the problem being addressed was failed systems which generally occur sporadically.

Mr. Spalding urged the committee to consider the potential for linking wastewater management districts to stormwater utilities.

Mr. Millar mentioned the DSP document Waste Water Management Districts...A Starting Point, and said the major obstacle to establishing these districts is the

reluctance of town councils' to establish what appears to be a new user fee. He emphasized the need to conduct a major public education effort before establishing new districts and raising new fees.

Ms. Karp and Mr. Spalding agreed, adding that incentives and enforcement efforts should accompany education efforts.

Mr. Hubbard suggested looking at the Buzzards Bay Program's flyer on this subject.

Mr. Migliore suggested that banks and realtors could be encouraged to establish some sort of septage system certification that would be recorded on the deed, similar to that currently used for private wells. Showing the certificate to buyers would be a precondition for transfering landownership.

Mr. Fester suggested that wastewater management districts could be responsible for recording septic system maintenance and replacement.

Dr. Prager suggested that penalties be established for failure to disclose.

Mr. Mulhearn asked what the penalty would be for the seller.

Mr. Grant suggested that instead of attempting to enforce penalties, the committee simply recommend that all owners of individual septic disposal systems be required to keep a "certification" maintenance record, and that the record be shown to potential buyers as a "buyer beware" document before land could be transferred.

Mr. Grant and Ms. Prager said that wastewater management districts should be required wherever communities propose to extend water supplies. Ms. Prager added that soil suitability, saturation thresholds, etc., should be considered before water line extensions are allowed.

Mr. Bob Richardson (DEM) said that organic loading should not be allowed to extend beyond present zoning restrictions.

Mr. Grant concluded that the recommendation to encourage the formation of wastewater management districts be modified to incorporate the above suggestions.

Mr. Fester said that the recommendation concerning RIDEM, CRMC, and RIDOH cooperation on ISDS inspections misconstrued those agencies' current responsibilities. He explained the nature of the agreement that DEM and DOH expect to reach as of Oct. 1 regarding these inspections. DEM will have enforcement responsibilities except where DOH retains licensing and permitting authority and where DEM has delegated this responsibility to local authorities. He also noted, with Mr. Fugate's concurrence, that CRMC forwards septic system enforcement actions to RIDEM.

Ms. Karp said that this recommendation was meant to support the process as described by Mr. Fester.

Mr. Fugate asked, regarding the recommendation that RIDEM and CRMC delegate (some) inspection and enforcement authority to local governments, why building inspectors do not currently forward enforcement cases to DEM.

Mr. Fester noted that local building inspectors can cite people for system failures, but that the inspectors have no incentive to assume enforcement responsibilities. He also noted that DEM has delegated enforcement responsibility to some communities, such as Block Island and Prudence Island.

Dr. Prager cautioned that DEM should retain oversight and veto powers when delegating inspection and enforcement authority.

Mr. Hagerty suggested using RIDEM oversight of pretreatment as a model for expanding oversight of ISDS inspections.

Ms. Morrison and Ms. Prager said that delegation of enforcement to local authorities was impractical and that its goals could be accomplished more readily through the establishment of wastewater management districts.

Ms. Karp asked whether staff should focus on incentives for establishing wastewater management districts, rather than modifying state role in enforcement.

Mr. Grant (and the Committee) agreed and Mr. Grant asked if the wastewater management district enabling legislation should be made mandatory.

Mr. Grant and Ms. Ruta suggested that state eligibility should be conditioned upon the establishment of such a district.

Mr. Ken Kubic (RI Marine Trades Association) questioned how the Management Committee planned to deal with interstate issues and how it planned to "sell" the CCMP and its costs to the public. Thus far, he said, the CCMP appears as if it will limit public access to the waterfront, as well as private property rights.

Ms. Prager commented that the public is already paying the price for pollution that originates on private property, and that private property owners should be responsible for preventing and remediating pollution on their property.

Mr. Kubic agreed, but emphasized the need to market the plan to the people of RI and MA. To sell the plan effectively, he said, the committee must recognize the need for creating a vision and a rationale that makes sense to the public and offers

people something worthwhile for their investment. We especially need to offer something to enable people on fixed incomes to retain their access to and their (existing) dwellings near the shore.

Mr. Beck and Mr. Spalding said that development in sensitive areas should not be encouraged, regardless of individual income levels.

Dr. Prager, Ms. Prager and Mr. Spalding stated that property owners should bear the cost of ISDS repairs.

Ms. Marie O'Neill (NBC) said that the NBC was working on a response to the proposed DEM/OSP policy to support linking funds for WWTFs to septage acceptance.

Ms. Karp stated that the draft policy would include acceptance of sewage from boats.

Mr. Alan Cooperman (MA DEP) noted that Massachusetts has experienced poor performance at the Harwich solar aquatics facility, regarding the recommendation to explore permitted use of alternative wastewater and septage treatment facilities. He offered to send the committee an 8-month case history for the facility.

Ms. Karp welcomed the offer, but noted that other such facilities around the country have been very successful.

Mr. Spalding said that the state should focus on land-based disposal, rather than exploring other techniques. He cautioned that permitting solar aquatics in selective cases would lead to a situation where all developers would want to use this technology to overcome sensitive land areas' current limitations.

Dr. Prager suggested replacing the word "facilities" with the word "technologies." He also suggested predicating permits for alternative technologies upon their successful treatment of wastes. If they fail, owners should be required to install a system that works. He stressed the need for incentives, likening the ISDS to energy conservation.

Mr. Spalding cautioned that permits for alternative technologies should only be applicable to nonresidential facilities because of the political and practical obstacles to preventing residents from using water once a system has failed. He also stressed that such permits should be issued only where specific siting criteria and performance standards are available.

Mr. Grant commented that the concerns expressed over package treatment plants apply to this recommendation as well. He cautioned that the recommended

permitting change might stimulate development in critical areas. He added that limitations on sewage and septic systems have in the past effectively served to protect sensitive areas.

Ms. Karp noted that the recommendation only urges the state to consider alternative technologies. She added that sewer and ISDS limitations do not necessarily provide an effective tool for directing growth.

Mr. Mulhearn observed that development is not a "public enemy." The CCMP needs to promote well-planned and sensible development. He suggested that some presently "marginal" lands could be developed if sewering were extended, and that availability of alternative technologies would produce an incentive for and promote compliance among the development community.

Mr. Mulhearn and Mr. Kubic said that widespread business community and public support for the plan will require a change in attitudes regarding development. Mr. Kubic suggested an incentive in which a portion of a lot could be held undeveloped as a "bond," while new technologies were tested on another part of the parcel.

Mr. Fugate commented that the ultimate goal of these recommendations should be to prevent practices which exceed the carrying capacity of the land. Present regulatory tools lack the sophistication necessary to allow the best use of alternative technologies.

Ms. Ruta commented that, in developing an integrated approach to water pollution control, the Management Committee should endeavor to use "trade-offs" in different areas as an incentive (i.e., between waste water treatment and water conservation).

Mr. Grant concluded that this recommendation should be modified to stress exploration of alternative "technologies" (replacing "facilities") and to include a sensitivity towards the impact of such technologies on land development and the carrying capacity of that land.

Mr. Grant summarized the recommendation supporting re-authorization of the "Sewer and Water Supply Failure Fund," which offers grants to municipalities and loans to individuals.

Ms. Ruta suggested tying these grants to the creation of waste water management districts. She said using the funds as a "carrot" would be more effective than mandating the establishment of districts.

Mr. Grant concluded that there was consensus on endorsing re-authorization of the fund.

Mr. Spalding suggested that the NBP staff investigate how other states regulate the use of alternative technologies in "marginal areas."

Mr. Grant said the committee would consider the "no change" alternative at the start of the next meeting.

The next meeting will take place on October 24, from 1:00 p.m. to 5:00 p.m. The following two meetings will take place on November 19 and November 26, from 1:00 p.m. to 5:00 p.m.

NARRAGANSETT BAY PROJECT
MANAGEMENT COMMITTEE MEETING
October 24, 1990
1:00 p.m. - 5:00 p.m.

Meeting Minutes

Review and Approval of Summary of Decisions from September 19 meeting.

Mr. Grant presented the Summary of Decisions from the September 19 meeting for review and approval.

Dr. Harold Ward (Brown University) commented that the section pertaining to the connection of unsewered, "built-out" areas to public sewers (Sewage Contamination-Pathogens "Briefing Paper," II. Source Control, Issue 3, Alternative 3.2 (p.35)). did not seem to reflect accurately the discussion at the last Management Committee meeting. He said that the Committee had agreed to emphasize the recommendation to place a high priority on considering water conservation and alternative technologies *before* considering sewering or package treatment for unsewered, "built-out" areas.

Ms. Karp agreed and said the summary was meant to reflect that decision.

Mr. Grant directed staff to reword this summary and promised to revisit this section at the next meeting. The summary of decisions was accepted pending this revision.

SEWAGE CONTAMINATION - PATHOGENS (continued from 9/19/90)

ISSUE II.3: (Continued) Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from septic systems?

Mr Grant began the sewage contamination discussion by returning to the "no change" alternative (3.1).

Mr. Tom Mulhearn (Rhode Island Association of Realtors, Inc.) said that the "no change" alternative has to be considered. He said that, before recommending any changes, the staff and the Management Committee should recognize the potential constitutional problems created by "takings," and be responsive to the impacts of increased buffer zones and other measures on individual property owners.

Dr. Ward asked if the NBP intended to conduct a legal analysis of the "taking" issue.

Ms. Karp said the NBP planned to conduct such an analysis in the future.

Ms. Elizabeth Scott (RIDEM Nonpoint Source Pollution Management Program) suggested that the Rhode Island Geographic Information System (RIGIS) could be used to identify the properties and calculate the acreage and number of lots which would be impacted by increasing setbacks. Ms. Scott said that it would be necessary to use Plat scale maps and to look at a wide range of minimum lot sizes.

Mr. Grant summarized the discussion of this alternative by urging the staff to consider the impacts of a broad range of possible measures, including measures that do not involve "takings." He also noted that the mere fact that a piece of land does not meet the regulatory requirements for further development of that land does not mean that a "taking" has occurred.

Ms. Anna Prager (RI Governor's Office) agreed that "taking" has a limited definition, noting that buffers and setbacks are already in place.

Mr. Tim Dillingham (RI CRMC) expressed concern that the briefing paper did not address the issue of sitings on sub-standard lots, which is presently governed only by local zoning requirements. He also suggested that the NBP recommend a State program to "buy out" properties where new regulations constitute a taking.

ISSUE II.4: Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from stormwater runoff?

Mr. Grant summarized this issue and suggested that the committee consider the specific recommendations under alternative 4.2 before considering the "no change" alternative (4.1).

Alternative 4.2. Stormwater discharges that presently cause or contribute to water quality degredation or shellfish area closures within the Narragansett Bay basin should be abated, or eliminated, to the maximum extent possible.

Mr. Dillingham asked if this alternative would apply automatically to all stormwater discharges. He also asked if NBP research indicates that stormwater is a problem "everywhere" or only in urban areas.

Ms. Karp responded that the Management Committee should decide if this alternative automatically applies to all stormwater discharges, but that the NBP's research indicates that the problem occurs throughout the watershed.

Ms. Scott said that the definition of "non-urban" needs to be clarified.

Ms. Karp said that the staff defines "non-urban" as municipalities with less than 100,000 residents (i.e., EPAs definition). In addition, stormwater runoff in "non-urban" areas has a significant impact on Narragansett Bay.

Mr. Grant asked Mr. Dillingham if he was suggesting that the Committee remove the word "that" from the first line of alternative 4.2.

Mr. Dillingham responded that he was asking the staff if NBP research supported such a rewording.

Ms. Scott said that all stormwater discharge creates a problem, but given the need to set priorities, she suggested addressing presently impaired water first.

Mr. Robert Klumpe (Soil Conservation Service) clarified that the issue under discussion was the pollutants in stormwater, not the stormwater itself; efforts should deal with the pollutants.

Dr. Christopher Deacutis (RIDEM) expressed concern about the potential for surface water remediation efforts to contaminate ground water. He suggested adding a caveat to the recommendation, stating that all remediation efforts be undertaken with consideration of the potential to shift contamination to ground water.

Mr. Grant proposed that the "goal" for this alternative be rewritten to clarify that while all stormwater discharges are of potential concern, we need to set priorities among those concerns on the basis of the receiving waters' present conditions.

Ms. Scott said that the overall goal should also recognize that we continue to permit new discharges which impair water quality. She urged that the recommendation include an "up-front" commitment to prevent direct discharges to all waters, impaired or not.

Mr. Grant then summarized the first specific recommendation, which calls for a systematic survey of all storm drains that discharge directly into Narragansett Bay and its tributaries.

Dr. Deacutis supported this step but cautioned that more funds and manpower would be needed to conduct the surveys.

Ms. Virginia Lee (URI Coastal Resources Center) asked if municipalities could perform these surveys.

Ms. Judy Pederson (MA CZM) asked if RI conducted sanitary surveys for shellfish.

Ms. Karp said yes.

Mr. Dillingham said that these surveys were only conducted in shellfishing areas.

Mr. Roy Anderson (Newport) said that while municipalities could readily identify stormwater discharge locations, they lack the resources for comprehensive testing of the discharge. He asked if a local/state cost-sharing scheme could be devised.

Mr. Grant concluded that there was consensus that municipalities should take the lead on the surveys, but that the high costs need to be recognized and addressed in the CCMP. Mr. Grant summarized the second recommendation, which calls on EPA and SCS to promulgate regulations and offer technical assistance to abate existing, and prevent new, sources of runoff in non-urban areas.

Mr. Dillingham said that EPAs proper role was to offer technical assistance, and not to formulate new regulations (beyond their current NPDES efforts). He also noted that "prevention" of new storm runoff could only be accomplished by preventing any alteration of the land. "Mitigation and reduction of stormwater runoff" is a more appropriate goal, he said, and should be accomplished through non-structural remedies where possible.

Ms. Scott agreed with Mr. Dillingham that EPA, aside from NPDES regulations, should focus on technical assistance. She emphasized the importance of distinguishing between the State's approach to existing and to new discharges. Ms. Scott also suggested focusing state efforts on the drains that slip through NPDES "cracks."

Mr. Klumpe pointed out that the real focus of this recommendation is the pollutants in the stormwater, not the stormwater itself.

Mr. Grant concluded that there was a consensus that Federal government should focus on technical assistance and that the states should focus on promulgating regulations, especially to cover areas not covered by existing regulations.

Ms. Lee said that the recommendations should be future-oriented and focus on both urban and non-urban areas, rather than on defining the differences between them. She cautioned that the CCMP should avoid the mistakes of other programs, such as the Soil Erosion and Sediment Control Plan, which allowed each municipality to devise its own course of action. The NBP should recommend a comprehensive approach, and set mandatory minimum standards.

Ms. Scott commented that the Nonpoint Source Management Program is reviewing the Stormwater Control Management Committee's recommendations to help design performance standards and regulations that will be uniformly implemented by the various RIDEM divisions and CRMC. She said that ultimately the Nonpoint Source Program hopes to apply these standards to all municipalities and state agencies, including the Department of Transportation (DOT), through incorporation

in the State Guide Plan. She added that these recommendations could also become binding if they enter the State Guide Plan through the CCMP. Ms. Scott also said that (under the proposed plan) CRMC and RIDEM regulations would cover all storm drains except those municipal or DOT drains connecting to existing systems that discharge directly into receiving waters. She suggested that the CCMP address these indirect charges and consider delegating enforcement authority to local government.

Ms. Prager said that any legislation recommended in the CCMP should go beyond enabling to include a mandatory component. She suggested including an additional recommendation encouraging the Land Use Commission to place strong stormwater controls within the Subdivision Enabling Act and explicitly referring to the mandatory nature of stormwater management..

Mr. Grant and Mr. Dillingham said that the State should be involved in designing controls. Mr. Dillingham said that regulatory agencies need a clear directive from the senior officials on stormwater control. He added that the CRMC uses pre-approval meetings with towns and Memorandums of Understanding to help ensure stormwater compliance.

Ms. Scott stated that the CCMP needs to incorporate a regional approach to stormwater management, noting that a site-by-site approach is not only more expensive, but also can create potential flooding problems at other sites. She suggested using "build-out" models to project potential loadings and floods. State technical assistance would be needed to perform these studies, she said.

Mr. Klumpe agreed, but suggested that stormwater planning should be done on a hydrologic, watershed basis, not on the basis of political or other boundaries.

Mr. Eric Jankel (Narragansett Bay Commission) observed that other agencies and existing laws already address certain of the problems under discussion. He suggested that the CCMP should focus on the areas not being addressed.

Mr. Dillingham questioned the capacity of the State Guide Plan to bind agencies like the DOT, and reiterated his concern that this stormwater policy should be established at higher levels of State government..

Ms. Lee, Ms. Scott and Mr. Jankel said that maintenance concerns should be clearly addressed in each recommendation.

Ms. Scott said that the Nonpoint Source Management Plan needs the support of the NBP to pass new regulations.

Mr. Klumpe said that all recommendations should reflect the time and funding constraints faced by local municipalities, as well as municipalities need for technical assistance and guidance from the state.

Mr. Grant then summarized the recommendation requiring RI cities and towns to draft local and/or regional stormwater management plans in conformance with the Nonpoint Source Management Plan.

Ms. Scott supported this recommendation, including the wording which calls upon towns to implement the plans, but cautioned that towns do not have the expertise to do the underlying technical work.

Mr. Klumpe suggested that the state should develop a standardized process for towns to utilize in drafting consistent stormwater management plans.

Mr. Grant concluded that there was consensus that towns should have administrative responsibility for the plans, but that state and Federal agencies should provide technical guidance and support.

Mr. Grant summarized the recommendation calling for incorporation, by reference, into the CCMP of the Nonpoint Source Management Plan and the "Recommendations of the Stormwater and Erosion Control Committee." Mr. Grant concluded that there was a consensus to support this step.

Mr. Grant also summarized and concluded that there was consensus about the recommendation to provide cities and towns with technical assistance in implementing "best management practices."

Ms. Karp asked if these recommendations should apply to Massachusetts where relevant.

Dr. Pederson said yes, and added that the recommendations should call for cooperation between the MA Nonpoint Source Program and its RI counterpart.

Ms. Karp noted that the NBP staff expects to produce a separate CCMP chapter devoted to stormwater and its role as a vehicle for all classes of contaminants.

APPENDIX B:

SUMMARY OF MANAGEMENT COMMITTEE DECISIONS

AUGUST 22, 1990
SEPTEMBER 19, 1990
OCTOBER 24, 1990

TRANSCRIPT HAS BEEN RESTRICTED TO PATHOGENS DISCUSSION
FOR THE PURPOSES OF THIS DOCUMENT

SUMMARY OF MANAGEMENT COMMITTEE DECISIONS

SEWAGE CONTAMINATION — PATHOGENS

I. RISK ASSESSMENT—RISK MANAGEMENT

ISSUE A: **Should the RIDEM and the RIDOH change their existing monitoring procedures to better assess the risk of human exposure to sewage-derived, water-borne disease from the consumption of molluscan shellfish harvested in Narragansett Bay?**

DECISIONS: The State of Rhode Island should continue to collect bacteriological samples in surface waters to regulate shellfish growing areas, at least until there is more evidence that direct sampling of shellfish is more protective of public health.

Both Rhode Island and Massachusetts should monitor fecal contaminant levels in shellfish tissue from the time that shellfish are harvested through retail sale, particularly where a sanitary handling, storage or transportation problem is suspected. [Rhode Island and Massachusetts regulations may differ and should be conformed to the maximum extent possible to ensure that consistent standards are applied.] Specific recommendations regarding monitoring frequency should be developed by the University of Rhode Island.

ISSUE B: **Should the RIDEM and the RIDOH change their existing monitoring procedures to better assess the risk of human exposure to sewage-derived, water-borne disease from swimming in Narragansett Bay?**

DECISIONS: The State of Rhode Island should continue to collect samples at bathing beaches prior to the bathing season, and should randomly monitor bathing beach water quality during the bathing season. In addition:

- RIDOH should continue to test alternative analytical procedures that will provide a more rapid turn-around time for results of bacteriological tests for fecal coliform levels in sea water.

- Coastal cities and towns should be encouraged to develop local bacteriological monitoring programs for town-owned or operated beaches.

The State of Rhode Island should institute a formal procedure for officially closing and posting closed beaches:

- RIDOH should issue a general health advisory about swimming in sewage-contaminated waters.

- RIDOH should post beaches in the Providence River region as unsafe for swimming based on their proximity to major urban sources of fecal contamination and/or publish a map indicating the location of beaches closed to swimming for water quality reasons.

- RIDOH should post beaches as unsafe for swimming if there is actual evidence of fecal contamination and/or publish a map indicating the location of beaches closed to swimming for water quality reasons.

- The relevant state and/or local authorities should be required to clearly identify each combined sewer overflow and post the area as unsafe for swimming (and shellfishing) as a condition of the authority's R.I. Pollutant Discharge Elimination System (RIPDES) permit.

- RIDEM and RIDOH should execute the draft Memorandum of Agreement covering bathing beach monitoring and beach closure policies for implementation by the summer of 1991.

ISSUE C: **Should the RIDEM and the RIDOH include "indicators" of viral contamination in their monitoring programs to better assess the risk of human exposure to sewage-derived viral pathogens?**

DECISIONS: The State of Rhode Island should sample alternative fecal indicators (e.g., Clostridium perfringens spores) in addition to fecal coliform bacteria levels, in order to support future decisions about re-classifying closed and/or conditionally approved shellfish growing areas for shellfish harvesting.

- RIDEM and RIDOH should consider submitting letters to the Director, U.S. EPA Office of Marine and Environmental Protection, and the Food and Drug Administration urging both agencies to 1) continue investigating the need for alternative indicators; and 2) complete their jointly-sponsored epidemiological study of human health effects associated with eating raw shellfish harvested from approved and conditionally approved coastal waters.

- RIDEM and/or RIDOH should continue to follow developments in gene probe technology with respect to a rapid assay for fecal indicators or direct detection of pathogens.

• RIDEM should particularly use viral indicators to support decisions about certification of shellfish growing areas where septic systems are a suspected source of fecal contamination.

• RIDOH should establish reporting requirements for all infectious diseases that may be attributable to shellfish consumption or swimming in Narragansett Bay.

ISSUE D: **Should the State of Rhode Island endorse the use of commercial or non-commercial controlled purification ("depuration") facilities to better assure the sanitary quality of shellfish harvested from Narragansett Bay?**

DECISIONS: The State of Rhode Island should not actively promote shellfish depuration of any kind, including the shellfish relay program, in any way that might relax state initiatives to reverse existing pollution trends in Narragansett Bay contrary to the federal Clean Water Act.

The State of Rhode Island should not approve the licensing of commercial and/or non-commercial shellfish purification facilities at this time. However:

• The current shellfish relay program should continue in the absence of any evidence of a significant, unacceptable public health risk resulting from this practice to the extent that the program also serves acceptable shellfish management objectives.

• RIDEM should continue to follow developments in depuration technology and should not foreclose the option of licensing commercial ventures in the event that a public health problem should materialize with shellfish harvested from presently certified waters.

ISSUE E: **Should the State of Rhode Island increase its efforts to eliminate illegal commercial shellfishing in uncertified shellfish harvesting areas in Narragansett Bay?**

DECISIONS: RIDEM should increase its present level of enforcement to reduce or eliminate the illegal commercial harvesting of shellfish from uncertified (closed) areas of Narragansett Bay. Specifically, RIDEM should:

• continue to stagger its patrols of Bay waters to increase the probability of detecting illegal harvesting between dusk and dawn;

• deploy Boating Safety Officers to enforce the State's fisheries' laws when RIDEM Conservation Officers are occupied elsewhere, and/or establish a full-

time, year-round marine patrol unit within RIDEM Division of Enforcement, fully deputized to enforce the provisions of Title 20 of Rhode Island's General Laws;

• upgrade the Division of Enforcement's equipment (e.g., acquire night vision glasses) and adjust its patrols to focus on established patterns of violation, e.g., immediately following a relay/ transplant to shellfish management areas;

• increase inspections and regulatory oversight of shellfish dealers and distributors suspected of knowingly marketing illegally harvested shellfish;

• continue cooperating with Massachusetts' Fish and Wildlife officials to patrol Mount Hope Bay, and consider entering an interstate Memorandum of Agreement with Massachusetts to provide for:

a) reciprocity with respect to license suspensions/ revocations;
b) periodically exchanging enforcement officers; and
c) pooling and/or sharing field equipment;

• systematically follow up on information provided by shellfishermen and others regarding illegal harvesting and/or marketing of shellfish; and

• attempt to equalize the probability that violators are detected and consistently prosecuted for shellfish violations in all regions of the Bay.

II. SOURCE CONTROL

II.1 / II.2. Wastewater Treatment Facilities/ Combined Sewer Outflows

There was a preliminary discussion of WWTF/CSO-related issues. However, no decisions were required at this point and none were made. Committee members were invited to submit comments on this subject in writing to NBP staff.

II.3. ON-SITE SEPTIC DISPOSAL SYSTEMS

ISSUE: **Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from septic systems?**

DECISIONS: The States of Rhode Island and Massachusetts should encourage the use of water conservation and alternative technologies before extending public sewers. The States should recommend sewering in sensitive areas of the Narragansett Bay watershed if they are "built-out" in terms of pollutant loading or existing zoning, and after all reasonable alternatives are explored, including, but not limited to: mandatory water conservation, and the use of alternative on-site wastewater treatment technologies, such as engineered wetlands or solar aquatic facilities.

The States of Rhode Island and Massachusetts should consider increasing the set-back distance between on-site disposal systems (ISDS) and critical areas, including Narragansett Bay, its tributaries, and adjacent wetlands. In addition, the staff should investigate utilization of site-specific environmental parameters for ISDS siting criteria (e.g. Barnstable County).

The staff should also consider a package of related recommendations, including: improved treatment (e.g. denitrification); mandatory water conservation; maintenance, repair and rehabilitation of septic systems, etc., as alternatives to increased set-backs.

- RIDEM, CRMC, DSP, their Massachusetts counterparts, and all local permitting authorities should increase their efforts to educate the public about the need and procedures for maintaining on-site septic systems.

- RIDEM and RIDOH should negotiate an inter-agency Memorandum of Agreement trasnsferring responsibility for ISDS inspections to RIDEM.

- RIDEM and CRMR should investigate delegating (some) inspection and enforcement authority to local building inspectors. RIDEM should retain oversight and veto powers when delegating this authority.

- The States of Rhode Island and Massachusetts should adopt incentives to encourage local communities to establish wastewater management

districts. These incentives should include making all water-related state grants dependent on the establishment of such districts. The staff should explore the feasibility of using existing utilities to establish wastewater management districts.

- The States of Rhode Island and Massachusetts should require owners of residences and other facilities with on-site septic disposal systems to keep a "certification" record of system maintenance. This record should be made available to prospective buyers, realtors, and banks, before ownership of this land can be transferred.

- The States of Rhode Island and Massachusetts should explore the permitted use of alternative wastewater and septage treatment technologies, such as passive solar aquatic "greenhouses." The staff should consider carefully whether proposed alternative technologies have been proven effective and if use of these technologies will promote increased development in critical or sensitive areas that exceed the carrying capacity of the land.

- The State of Rhode Island should re-authorize the "Sewer and Water Supply Failure Fund" as a revolving loan fund to allow continued repair and replacement of failed septic systems. Loans should be conditioned on the existence of local wastewater management districts.

II.4. STORMWATER RUNOFF

ISSUE: **Should the State of Rhode Island and affected municipalities undertake initiatives to mitigate and, in the future, prevent contamination of Bay and tributary waters from stormwater runoff?**

DECISIONS: While recognizing that all stormwater discharges within the Narragansett Bay basin potentially contribute to water quality degradation and should be reduced and mitigated, the State of Rhode Island should establish priorities for abating and/or eliminating significant stormwater discharges. These priorities should recognize the need to: 1) regulate new discharges; 2) abate existing discharges; 3) prevent shifting pollutants to the groundwater; and 4) should be linked to the level of impact on the receiving water.

- Rhode Island cities and towns should survey systematically all storm drains in their jurisdictions in order to detect illegal, dry weather flows to Narragansett Bay and its tributaries. RIDEM, RIDOH, EPA, and local governments should collaborate to eliminate these inputs.

- The EPA and other Federal agencies should formulate technical guidance regarding the abatement of existing sources of runoff in urban and non-urban areas. The States of Rhode Island and Massachusetts should promulgate regulations to abate existing sources of storm runoff, especially those sources not covered by existing regulations (e.g., storm drains serving populations of less than 100,000). Both the Federal and state governments should provide guidance to municipalities regarding "best management practices" for prevention of new sources of stormwater runoff. The staff should should address long-term maintenance issues for all stormwater control recommendations.

- Rhode Island cities and towns should draft and assume administrative responsibility for local and/or regional stormwater management plans in conformance with the Rhode Island "Nonpoint Source Management Plan." Federal and state agencies should provide technical guidance and support for the municipalities in this regard.

- The State of Rhode Island should endorse the Rhode Island "Nonpoint Source Management Plan" and the "Recommendations of the Stormwater Management and Erosion Control Committee Regarding the Development and Implementation of Technical Guidelines for Stormwater Management (1988)" for reducing stormwater pollutants.

- The States of Rhode Island and Massachusetts should provide technical assistance to cities and towns regarding the implementation of "best management practices" for controlling and/or eliminating stormwater discharges.

II.5. BOATER WASTE DISPOSAL

The Management Committee directed NBP staff to meet with Rhode Island Marine Trades Association (RIMTA) and other interested parties to discuss and rewrite the problem description for boater waste disposal.

APPENDIX C:

MANAGEMENT COMMITTEE ATTENDANCE

AUGUST 22, 1990
SEPTEMBER 19, 1990
OCTOBER 24, 1990

Management Committee Attendance at August 22, 1990 Committee Meeting

Attended:

Mr. Eddie Agin
Board Member
RI Shellfishermen's Association

Mr. Roy B. Anderson
Director of Utilities
Newport Water Department

Mr. Allan D. Beck
Reserve Manager
Narragansett Bay - National Estuarine Research Reserve

Mr. Alan N. Cooperman
Environmental Engineer
Technical Services Branch
MA Department of Water Pollution Control

Ms. Holly A. DesRosiers
Executive Director
RI Marine Trade Association

Mr. Malcolm J. Grant (Chair)
Assistant Director for Administration
RI Department of Environmental Management

Ms. Caroline A. Karp
Project Manager
Narragansett Bay Project

Ms. Katrina V. Kipp
Project Officer
Region I
US Environmental Protection Agency

Ms. Susan P. Morrison
Chief, Office of Systems Planning
Division of Planning
RI Department of Administration

Mr. Thomas E. Mulhearn
Executive Vice President
RI Association of Realtors

Ms. Anna Prager
Senior Policy Analyst
RI Governor's Office

Mr. H. Curtis Spalding
Acting Director
Save The Bay

Dr. Harold R. Ward
Director
Center for Environmental Studies
Brown University

Mr. Eric Weiner
Assistant Executive Director
Manufacturing Jewelers and Silversmiths of America, Inc.

Sent Alternate:

Mr. David Abedon
Cooperative Extension Specialist
University of Rhode Island

Mr. James W. Fester
Assistant Director for Regulations
RI Department of Environmental Management

Mr. David A. Fierra
Director, Water Management Division
Region I
US Environmental Protection Agency

Mr. Grover J. Fugate
Executive Director
RI Coastal Resources Management Council

Dr. Norbert A. Jaworski
Director
Environmental Research Laboratory - Narragansett
US Environmental Protection Agency

Mr. Robert Klumpe
State Conservationist
US Department of Agriculture - Soil Conservation Service

Mr. Dennis B. Ledbetter
Vice President
Armbrust Chain Company

Ms. Virginia Lee
Coordinator of Domestic and Environmental Programs
Coastal Resources Center
University of Rhode Island

Mr. John A. Stolgitis
Chief, Division of Fish & Wildlife
RI Department of Environmental Management

Did Not Attend:

Mr. Robert L. Bendick, Jr.
Deputy Commissioner
NY Department of Environmental Conservation

Mr. Matthew Benedict
RI Builders' Association

Mr. Thomas E. Bigford
Division Chief
National Marine Fisheries Service
National Oceanic and Atmospheric Administration

Senator David Carlin
RI Senate Majority Leader
RI State Senate

Ms. Priscilla Chapman
Executive Director
New England Chapter
Sierra Club

Mr. David C. DePetrillo
Director of Tourism
RI Department of Economic Development

Mr. Thomas Hall, III
President
Ocean State Fishermen's Association

Mr. Eric R Jankel
Executive Director
Narragansett Bay Commission

Rep. Donald J. Lally, Jr.
RI State Assembly

The Hon. Robert McKenna
Representative
RI League of Cities and Towns

Dr. Scott W. Nixon
Director
RI Sea Grant

Mr. Lawrence R. Oliver
Environmental Resources Specialist
Environmental Resources Branch
US Army Corps of Engineers, New England Division

Dr. Judith Pederson
Principal Policy Analyst
MA Costal Zone Management Program

Mr. R. Daniel Prentiss, Esq.
Attorney-at-Law

Mr. Gary S. Sasse
Executive Director
RI Public Expenditure Council

Management Committee Attendance at September 19, 1990 Meeting

Attended:
Mr. David Abedon
Cooperative Extension Specialist
University of Rhode Island

Mr. Eddie Agin
Board Member
RI Shellfishermen's Association

Mr. Allan D. Beck
Reserve Manager
Narragansett Bay - National Estuarine Research Reserve

Mr. Alan N. Cooperman
Environmental Engineer
Technical Services Branch
MA Department of Water Pollution Control

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Mr. David C. DePetrillo
Director of Tourism
RI Department of Economic Development

Mr. Thomas Hall, III
President
Ocean State Fishermen's Association

Mr. Dennis B. Ledbetter
Vice President
Armbrust Chain Company

Ms. Virginia Lee
Coordinator of Domestic and Environmental Programs
Coastal Resources Center
University of Rhode Island

The Hon. Robert J. McKenna
Representative
RI League of Cities and Towns

Dr. Judith Pederson
Principal Policy Analyst
MA Coastal Zone Management Program

Mr. R. Daniel Prentiss, Esq.
Attorney-at-Law

Mr. Gary S. Sasse
Executive Director
RI Public Expenditure Council

Mr. John A. Stolgitis
Chief, Division of Fish and Wildlife
RI Department of Environmental Management

Mr. Eric Weiner
Assistant Executive Director
Manufacturing Jewelers and Silversmiths of America, Inc.

Management Committee Attendance at October 24, 1990 Meeting

Attended:

Mr. David Abedon
Cooperative Extension Specialist
University of Rhode Island

Mr. Roy B. Anderson
Director of Utilities
Newport Water Department

Mr. Allan D. Beck
Reserve Manager
Narragansett Bay - National Estuarine Research Reserve

Mr. Malcolm J. Grant (Chair)
Assistant Director for Administration
RI Department of Environmental Management

Mr. Eric R Jankel
Executive Director
Narragansett Bay Commission

Ms. Caroline A. Karp
Project Manager
Narragansett Bay Project

Ms. Katrina A. Kipp
Project Officer
Region I
US Environmental Protection Agency

Mr. Robert Klumpe
State Conservationist
US Department of Agriculture - Soil Conservation Service

Rep. Donald J. Lally, Jr.
RI State Assembly

Ms. Virginia Lee
Coordinator of Domestic and Environmental Programs
Coastal Resources Center
University of Rhode Island

Ms. Susan P. Morrison
Chief, Office of Systems Planning
Division of Planning
RI Department of Administration

Mr. Thomas E. Mulhearn
Executive Vice President
RI Association of Realtors

Dr. Scott W. Nixon
Director
RI Sea Grant

Mr. Lawrence R. Oliver
Environmental Resources Specialist
Environmental Resources Branch
US Army Corps of Engineers, New England Division

Dr. Judith Pederson
Principal Policy Analyst
MA Coastal Zone Management Program

Ms. Anna Prager
Senior Policy Analyst
RI Governor's Office

Dr. Harold R. Ward
Director
Center for Environmental Studies
Brown University

Sent Alternate:

Mr. Alan N. Cooperman
Environmental Engineer
Technical Services Branch
MA Department of Water Pollution Control

Ms. Holly A. Desrosiers
Executive Director
RI Marine Trade Association

Mr. James W. Fester
Assistant Director for Regulations
RI Department of Environmental Management

Mr. David A. Fierra
Director, Water Management Division
Region I
US Environmental Protection Agency

Mr. Grover J. Fugate
Executive Director
RI Coastal Resources Management Council

Mr. John A. Stolgitis
Chief, Division of Fish & Wildlife
RI Department of Environmental Management

Did Not Attend:

Mr. Eddie Agin
Board Member
RI Shellfishermen's Association

Mr. Robert L. Bendick, Jr.
Deputy Commissioner
NY Department of Environmental Conservation

Mr. Matthew Benedict
RI Builders' Association

Mr. Thomas E. Bigford
Division Chief
National Marine Fisheries Service
National Oceanic and Atmospheric Administration

Senator David Carlin
RI Senate Majority Leader
Rhode Island State Senate

Ms. Priscilla Chapman
Executive Director
New England Chapter
Sierra Club

Mr. David C. DePetrillo
Director of Tourism
RI Department of Economic Development

Mr. Thomas Hall, III
President
Ocean State Fishermen's Association

Dr. Norbert A. Jaworski
Director
Environmental Research Laboratory - Narragansett
US Environmental Protection Agency

Mr. Dennis B. Ledbetter
Vice President
Armbrust Chain Company

The Hon. Robert J. McKenna
Representative
RI League of Cities and Towns

Mr. R. Daniel Prentiss, Esq.
Attorney-at-Law

Mr. Gary S. Sasse
Executive Director
RI Public Expenditure Council

Mr. H. Curtis Spalding
Executive Director
Save the Bay

Mr. Eric Weiner
Assistant Executive Director
Manufacturing Jewelers and Silversmiths of America, Inc.