waste management research Report

News from State University of New York at Buffalo and Stony Brook, and Cornell University

Vol. 4, No. 2 1992

The Implications of the Clean Water Act

Waste Management Research Report

Vol. 4, No. 2 1992

Research news coordinated through:

The New York State Center for Hazardous Waste Management
Dr. Ralph R. Rumer, Executive Director
Jane E. Warfield, Campus Correspondent
State University of New York at Buffalo
207 Jarvis Hall
Buffalo, NY 14260
(716) 645-3446

Dr. William P. Tully, ESF Coordinator
State University of New York
College of Environmental Science
and Forestry
1 Forestry Drive
Syracuse, NY 13210
(315) 470-6606

Waste Management Institute
Dr. R. Lawrence Swanson, Director
Anne West-Valle, Campus Correspondent
Marine Sciences Research Center
State University of New York
at Stony Brook
Discovery Hall
Stony Brook, NY 11794
(516) 632-8704

Cornell Waste Management Institute and the New York State Solid Waste Combustion Institute
Dr. Richard Schuler, Director
Carin A. Rundle, Campus Correspondent
Center for the Environment
Cornell University
468 Hollister Hall
Ithaca, NY 14853
(607) 255-7535

Editorial Office
123 Bray Hall
SUNY College of Environmental
Science and Forestry
1 Forestry Drive
Syracuse, NY 13210
(315) 470-6644
Editor, Louise W. Laughton

Articles in this journal are indexed in
Environmental Periodicals Bibliography

Printed on Recycled Paper

CONTENTS

Commentary

Features

Announcements

About This Newsletter

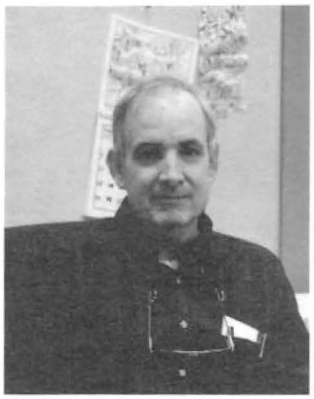
Waste Management Research Report appears three times a year to share research from the publication's contributing institutions. Each issue focuses on one major area of waste management and highlights the institution where researchers concentrate on the featured topic. The Waste Management Institute of the Marine Sciences Research Center at State University of New York at Stony Brook is responsible for this issue which focuses on the the implications of the Clean Water Act. An earlier version of the article by Robert W. Adler, which the author updated for this publication, and the piece on agricultural regulation by David J. Allee and Leonard B. Dworsky as printed here appeared in *Water Resources Update*, Issue 88, Spring 1992. We thank The Universities Council on Water Resources for allowing us to use the articles. The New York State Center for Hazardous Waste Management at State University of New York at Buffalo will be responsible for the next issue of the *Report* with the focus on research needs/priorities.

On the Covers

The Red Hook Sewage Treatment Plant in Brooklyn, across the East River from Manhattan. Photo courtesy of the New York City Department of Environmental Protection.

Director's Comment

Clean Water Act Needs Emphasis on Prevention



R. Lawrence Swanson

Twenty years ago, the Federal Water Pollution Control Act (PL 92-500), commonly called the Clean Water Act (CWA), was passed by the U.S. Congress and signed into law by President Richard Nixon. The 1972 Act replaced a previous Act, first passed in 1956, and all its amendments. At the time, PL 92-500 was perhaps the most far reaching environmental legislation ever enacted in the United States. Implementation has been extremely expensive — costing perhaps as much as $400 billion over the past 20 years. The goal of the Act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

It was to achieve this goal by controlling pollutant discharges into waterways for the "protection and propagation of fish, shellfish, and wildlife" while also providing for recreational opportunities. Amendments in 1977 and 1983 modified the original schedule for reaching various objectives. The 1987 Amendments to CWA broadened its objectives to include establishment of the National Estuary Program but at the same time limited some forms of funding, particularly those associated with capital projects.

The primary means established to meet the requirements of the CWA were a granting program for constructing sewage treatment plants and a regulatory program for limiting municipal and industrial discharges. The 1987 amendments also established an industry pretreatment program.

The CWA would have to be considered successful as measured by completion or upgrading of the nation's Publicly Owned Treatment Works (POTWs) to secondary sewage treatment, by improvements in water quality measures in aquatic systems, or even, in some cases, by the overall productivity of specific water bodies. In the late 1980s, over 78 percent of the effluent from POTWs was secondary treatment or better. It is not quite so clear that there has been a significant improvement in upgrading many of our coastal waters to what can be considered "fishable or swimable." For example, in New York State there is little evidence that shellfish beds closed prior to implementation of the 1972 CWA are being reopened. Perhaps though, new closures are occurring less rapidly.

Now, it is appropriate to examine the benefits and costs of the CWA prior to consideration of its reauthorization:

Has the country maximized the benefits to be achieved through requiring particular treatment technologies and prescribing effluent concentrations?

Did the Act stifle innovations in sewage treatment by specifying a technology?

Is it appropriate to require the same level of treatment nationwide?

Do we know enough about the environmental effects of treated effluents — particularly downstream effects? The Long Island Sound Study may indicate that we did not.

Perhaps the new emphasis of the Clean Water Act should be on preventing contaminants from entering waste streams rather than on treating waste and then specifying permissible effluent concentrations. Control of mass loadings to water bodies may be appropriate. Consideration also might be given to the fact that the considerable variability in coastal processes among coastal environments must be better understood and used more advantageously to ameliorate pollution problems. Single technologies for all environments may be neither the most environmentally acceptable nor the most cost effective approach.

This volume of *Waste Management Research Report* examines the CWA. Representatives of the research and regulatory communities have written articles. We are indeed fortunate to have Thomas Jorling, Commissioner of the New York State Department of Environmental Conservation, provide his perspective of the CWA. He helped draft the 1972 bill and has had to implement its provisions at both Federal and State levels.

Dr. R. Lawrence Swanson is director of the Waste Management Instiutute of the Marine Sciences Research Center, State University of New York at Stony Brook.

The Clean Water Act
After 20 Years of Progress, Many Challenges Remain

By Kevin Bricke

Kevin Bricke

Kevin Bricke is deputy director of the Water Management Division, U.S. Environmental Protection Agency - Region II. At right, Robert Moses Causeway across Great South Bay, NY. Photo by Ian Stupakoff.

Background

As the 1970's arrived, there was growing dissatisfaction throughout the United States with the lack of progress in abating water pollution. As reported by the Council on Environmental Quality:

"... the overall national picture was bleak. Scant data available indicated that at best the nation had only 'held the line' on common organic pollution in recent decades. The effects of increased treatment had been virtually canceled by larger wasteloads. Other forms of water pollution, such as phosphate and nitrate nutrients, were on the rise. Fish kills, beach closings, algal growths, oily scums, and odors were still prevalent. Sporadic upgrading of municipal treatment plants were often more than offset by nearby industrial effluents. In other cases, cleanups of industry were offset by increasing municipal discharges. There was no real national strategy."[1] The picture in the coastal waters in the New York metropolitan region was as bleak as the national picture.

- The City of New York was discharging nearly half a billion of gallons per day of raw sewage.
- Fifty-eight of the one hundred and five sewage treatment plants in the Interstate Sanitation District were discharging primary effluent.
- A high percentage of combined sewer overflow regulators in the region were inoperable, allowing the bypass of raw sewage, even when it wasn't raining, or the conveyance of excessive wet weather flows to sewage treatment plants when it was raining.

The result was extremely poor water quality: low levels of dissolved oxygen and high levels of coliforms, toxic metals, and organics.

The Clean Water Act

It was against this backdrop that the Administration and the Congress of the United States debated clean water legislation. After nearly three years of deliberations, the Congress passed the Federal Water Pollution Control Act Amendments, over the President Richard Nixon's veto, in October of 1972. At the heart of this statute was a conscious movement away from a water quality-based approach to regulation that had been found wanting, and toward a technology-based approach that held promise for dramatic action. Congress, after extensive deliberation, decided that it was too

[1]Environmental Quality, The Fourth Annual Report of the Council on Environmental Quality, September 1973, pg. 168.

scientifically and administratively difficult to issue and enforce permits based on case-by-case analyses of the impact of discharges on ambient water quality. Rather, permits would be issued and enforced consistent with national effluent guidelines based on technological and economic feasibility. Although these technology-based limits could be supplemented, as necessary, with more stringent water-quality-based limits, EPA and the states put their energies primarily into developing and enforcing technology-based permits, and into providing grants to municipal governments to assist them in complying with those limits.

The Clean Water Act has been amended twice since its passage in **1976**. In 1977 it was amended to incorporate more rigorous technology-based controls on toxic chemicals. And, in 1987, it was amended again, with the pendulum beginning to swing back this time from technology-based to water quality-based controls. But, we're getting ahead of ourselves. Let's first examine what we've accomplished primarily through the implementation of a technology-based program based on national effluent guidelines.

Twenty Years of Progress

Twenty years after the passage of the Clean Water Act, we can take pride in what we, as a nation, have accomplished:

- ❒ The discharge of pollutants from municipal and industrial facilities is now controlled through the issuance and enforcement of NPDES permits.
  - Industrial permits include stringent technology-based effluent limits focused, in particular, on the control of toxics.
  - Municipal permits require a minimum of secondary treatment.
  - Some industrial and municipal permits include more stringent water quality-based effluent limits.
  - Indirect industrial discharges are effectively regulated by the pretreatment program.
- ❒ On a nation-wide basis, there is widespread compliance with the terms of these permits.
  - The compliance rate for major industrial facilities is 92 percent.
  - The compliance rate for major, municipal facilities is 90 percent.
- ❒ We've made a major investment in our wastewater treatment infrastructure.
  - Since 1972, the federal government has obligated almost nine billion dollars for grants and loans for municipal wastewater infrastructure in New York and New Jersey alone.
- ❒ The results of investment in the wastewater treatment infrastructure in the New York metropolitan region have been dramatic.
  - Discharges of raw sewage during periods of dry weather have been virtually eliminated.
  - Almost all of the municipal sewage treatment plants in the Interstate Sanitation District have been upgraded to secondary treatment; the handful of plants that have not been fully upgraded to secondary treatment (West New York and Hoboken in New Jersey, Newtown Creek, Coney Island, and Owls Head in New York) are on judicially enforceable schedules to upgrade.
- ❒ The implementation of the Marine Protection Research and Sanctuaries Act (MPRSA) and the Ocean Dumping Ban Act (ODBA) have drastically reduced the amount of ocean dumping going on in the New York metropolitan region.
  - We've eliminated the dumping of acid wastes in the New York Bight.
  - We've eliminated the dumping of industrial wastes in the waters adjacent to the New York Bight.
  - We've eliminated woodburning in the New York Bight.
  - We've eliminated the disposal of cellar dirt in the Bight.
  - We're in the process of phasing out the ocean dumping of sewage sludge.

Waves break on the South Shore of Long Island Sound. Photo by R. George Rowland.

- In 1991, eight of the nine remaining dumpers stopped dumping.
- In 1991, the last remaining dumper, New York City, reduced its dumping by 20 percent and, on June 30, 1992, it too will cease dumping.

Beginning July 1, 1992, therefore, the only remaining ocean dumping activity in the New York metropolitan region will be dredged material disposal.

❒ Implementation of the Clean Water Act, MPRSA, ODBA, and a host of other environmental statutes, including the Clean Air Act and the Toxic Substances Control Act, has resulted in substantial reductions in pollutant loadings to coastal waters in the New York metropolitan region and in associated improvements in ambient water quality.

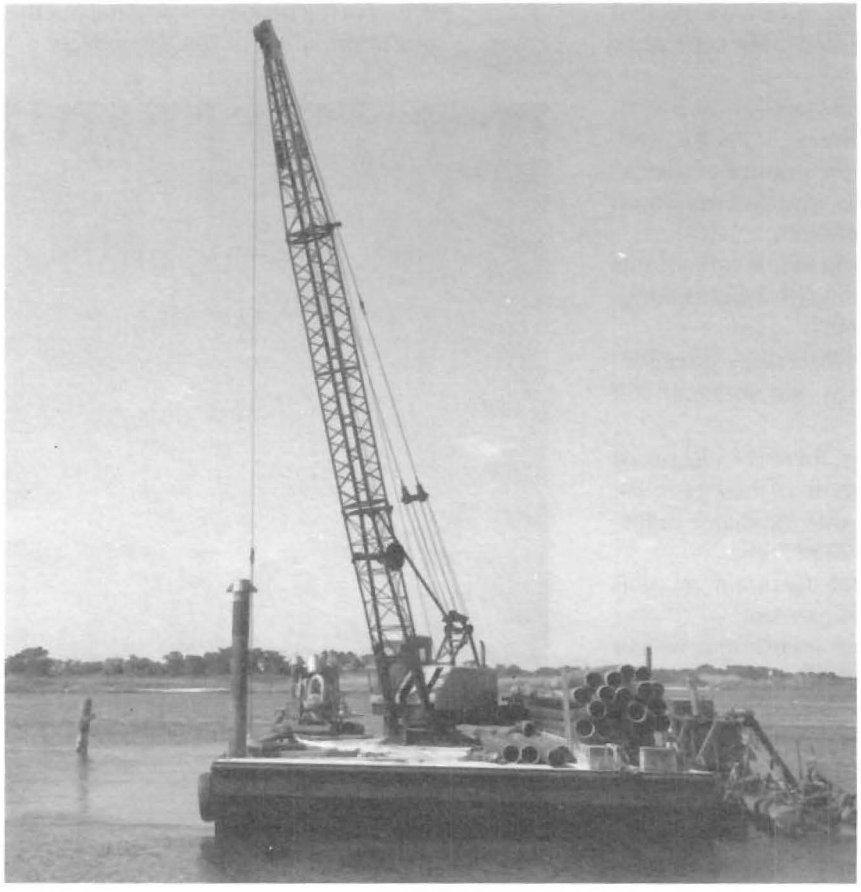
- The load of toxic metals and organics has been substantially reduced by the pretreatment and treatment of industrial wastes and other environmental controls such as the ban on lead in gasoline and the ban on PCBs. This is reflected in decreasing levels of these toxics in the ambient environment, and the ambient water column data show reductions in the levels of such toxic metals as copper and lead.
- The tissue data for striped bass show reductions in the levels of PCBs.
- The load of organic carbon has been substantially reduced, primarily because of improved treatment of domestic sewage. This is reflected in improved levels of dissolved oxygen, particularly in the Hudson and East Rivers.
- The load of coliform bacteria has been substantially reduced, due primarily to the chlorination of domestic sewage. This is reflected in substantial reductions in the levels of total and fecal coliforms, particularly in the Hudson and East Rivers.

In summary, much has been accomplished in the last twenty years. Unfortunately, however, much remains to be done.

The Unfinished Agenda

Twenty years after the passage of the Clean Water Act, we've come full circle in our efforts to improve the quality of our nation's waters. In 1972, the Congress, in its wisdom, recognized that it wasn't practical to base our cleanup efforts on case-by-case analyses of the impact of discharges on ambient water quality.

And so, we embarked on a successful program of issuing and enforcing permits for municipal and industrial discharges based primarily on national effluent guidelines. In 1992, we must recognize that the technology-based program for point source discharges has taken us about as far as it can. We must now conduct the case-by-case analyses of the impacts of point and non-point source discharges on ambient water quality that, in many cases, we have deferred. These geographically-targeted analyses will help us define the actions that remain to achieve our clean water goals.



Dredging in Great South Bay, NY. Photo by Ian Stupakoff.

As EPA Region II looks to the future, we've embarked on an ambitious strategic planning effort. At the heart of that effort is the geographic targeting of waters that continue to experience use

impairments and other adverse ecosystem impacts. At the federal level, we intend to play a leadership role in the clean-up of the major interstate and international waters in the region; we will look to the states to play that role on intrastate waters.

In the New York metropolitan region, major interstate waters are Long Island Sound, the New York-New Jersey Harbor, and the New York Bight. We have comprehensive planning efforts underway for each. The Administrator of EPA has convened Management Conferences to develop Comprehensive Conservation and Management Plans for the Sound and the Harbor, and, at EPA's request, the Management Conference for the Harbor has also agreed to develop a Restoration Plan for the New York Bight. The most significant problems confronting the Sound-Harbor-Bight system are caused by nutrients, pathogens, floatables, toxics and the destruction and degradation of aquatic habitat. The Management Conferences are far enough along in dealing with some of these problems that we can gain some insight into how we can use geographic targeting, and case-by-case analyses of point and nonpoint source discharges and their impacts to help up define the next generation of actions to improve water quality.

Nutrients in the Sound

Each summer, one-half to two-thirds of Long Island Sound experiences bottom water dissolved oxygen concentrations less than the established standard of five milligrams per liter. Hundreds of square miles experience severe hypoxia, with bottom water dissolved oxygen concentrations less than three milligrams per liter. These low levels of dissolved oxygen cause significant adverse ecological effects. Dissolved oxygen levels above the established standard of five are generally considered to be protective of most Long Island Sound marine life. When oxygen levels plummet, mobile species flee for more hospitable environs and immobile species die.

Based on research conducted under the auspices of the Long Island Sound Study (LISS), we know what's causing the hypoxia problem: excessive discharges of the nutrient nitrogen. This nitrogen fuels the growth of planktonic algae which die, settle to the bottom and decay, using up the Sound's precious oxygen resources. Each summer, the waters of the Sound stratify, with the warmer, fresher, less dense water sitting on top of the colder, saltier, denser water, separated by a density gradient called a pycnocline. Oxygen, which enters the Sound primarily from the atmosphere or from photosynthesis in surface waters, cannot pass through the pycnocline in sufficient quantity to offset the oxygen consumed by the decaying algae. Oxygen levels plummet, and hypoxia results.

So where is the nitrogen coming from? The Sound receives a load of approximately 90,800 tons per year. Forty-four percent of that load is naturally occurring, but 56 percent is associated with man's activities.

The most significant anthropogenic sources of the nitrogen load to the Sound, in order of importance, are:

- ❒ Municipal discharges,
- ❒ Fluxes of nitrogen across the Sound's boundaries with the Harbor and the Race,
- ❒ Tributaries in Connecticut (which transport both point and nonpoint sources of nitrogen to the Sound),
- ❒ Coastal runoff, and
- ❒ Atmospheric deposition.

The costs of controlling these loads is potentially astronomical. For example, the LISS estimates the capital cost of full-scale biological nutrient removal at 45 coastal plants alone at $5.8 billion. The LISS is, therefore, proceeding incrementally to address the problem.

- ❒ The first step, a freeze, at 1990 levels, on point and nonpoint sources of nitrogen, was announced in November 1990.
- ❒ The next step, cost effective, in-Sound load reductions, may be announced as early as November, 1992.
- ❒ Additional measures, including solutions other than in-Sound nitrogen reduction, such as the installation of tide gates on the upper East River or the relocation of discharges outside the Sound, will be assessed during the continuing process.

The Long Island Sound Study shows that nutrient control issues are best addressed at regional rather than at state or national levels. Some water bodies experience nutrient problems and some don't. Some waterbodies require the control of one nutrient (*e.g.* phosphorus in the Great Lakes) and some water bodies require the control of another (*e.g.* nitrogen in Long Island Sound). The only practical approach to determining whether the substantial costs of nutrient control are warranted for a particular water body, therefore, is to conduct a water body-specific analysis.

The burden of assessing technological and economic feasibility must, therefore, be borne regionally, in this case by the Management Conference that has been convened by the Administrator. It should be noted, however, that opportunities for information sharing at the regional level abound. The Long Island Sound Study has drawn extensively on the work of the Chesapeake Bay program, and future coastal nitrogen reduction programs can draw on the work of the Long Island Sound Study.

Toxic Metals in the Harbor

A number of toxic metals are found in New York-New Jersey Harbor waters at levels above the most stringent existing or proposed water quality standards. Recent data gathered under the Harbor Estuary Program, using trace metal clean techniques, show widespread exceedances for copper and mercury, and isolated exceedances for lead, nickel and zinc. The Harbor Estuary Program has, therefore, embarked on a program to define the maximum loadings of these metals that the estuary can continue to receive while still attaining water quality standards. These "allowable" loadings will then be allocated to individual point and nonpoint source discharges as waste load allocations and load allocations respectively.

The Harbor Estuary Program's preliminary conclusions with respect to copper raise major public policy issues.

- ❒ Reductions in total point and nonpoint copper loadings to the estuary on the order of 80 to 90 percent would be required to meet the proposed 2.9 micrograms per liter total recoverable copper standard for New Jersey 95 percent of the time.
- ❒ Substantially, lower reductions would be required to meet the current 2.9 micrograms per liter dissolved copper standard fon New York.

In order to develop sound public policy for toxic metals, the Harbor Estuary Program has agreed to develop a site-specific water quality standard for copper that will properly account for the relative bioavailability of its various forms. Furthermore, work has begun to assess the technological and economic feasibility of the potentially high levels of copper reduction that would be required to meet that standard.

It is clear from the work of the Harbor Estuary Program that the next round of controls on toxic metals is best developed at the regional level, based on waterbody-specific analyses of load reduction requirements and costs.

Great South Bay, NY. Photo by Ian Stupakoff.

Floatables in the Bight

Those of us living in the New York metropolitan region remember the wash-ups of floatable materials that closed the beaches along the Jersey shore in 1987 and the beaches along Long Island's south shore in 1988. The cost of these closures has been estimated in the billions of dollars.

Under the auspices of the New York Bight Restoration Plan, a Short-Term Floatables Action Plan has been developed. At the core of the plan is a straightforward program to spot slicks of floatables in the Harbor, before they enter the Bight through the Sandy Hook-Rockaway Point transect, and to pick them up using specially equiped Corps of Engineers vessels. Pickups occur primarily after rainfall events, when floatables enter the Harbor from combined sewer overflows and discharges of stormwater, and after exceptionally high tides which serve to re-suspend previously deposited debris.

The Short-Term Floatables Action Plan has helped to reduce the load of floatables entering the Bight, thereby lessening the load of floatables washing up on beaches along the Jersey and Long Island shores. However, the Management Conference has recognized that the long-term solution to the problem lies in preventing floatables from entering the Harbor, rather than in collecting them after they have formed slicks in the Harbor. The Long-Term Floatables Action Plan recommends the actions that will be required to accomplish this result. The challenge is to obtain the commitments of the responsible governmental entities to implement those recommendations.

Again, it is clear, from the work performed under the auspices of the New York Bight Restoration Plan, that regional approaches can effectively address problems that have resisted more general attention at the state and national levels.

Conclusion

Twenty years after the passage of the Clean Water Act, we can take pride in what we've accomplished. We've made real progress in controlling municipal and industrial point source

discharges. Using the authorities contained in other statutes, we've eliminated most ocean dumping activities; we've banned some particularly noxious chemicals, and we've cut the atmospheric emissions of others. The environmental results have been quite striking.

Twenty years after the passage of the Clean Water Act we also recognize that many problems remain. We have hypoxia in Long Island Sound. We have elevated levels of toxic metals in the Harbor. We have not yet eliminated the discharge of floatables to the Sound-Harbor-Bight system. And, we have not fully addressed a number of other problems that I have not discussed, such as the bioaccumulation of persistent toxic organics in the food web, the continued discharge of pathogens during periods of wet weather, and the continued destruction and degradation of aquatic habitat.

As illustrated in our approaches to dealing with nutrients in the Sound, toxic metals in the Harbor, and floatables in the Bight, the problems that remain will frequently respond better to regional, rather than to state- or nation-wide solutions. As we look to the next 20 years, we need to target the waters that continue to experience use impairments and other adverse ecosystem impacts and work cooperatively to develop regional approaches to restoring them to full ecological health. As we monitor the results of targeted efforts, common themes will begin to emerge — themes like pollution prevention and the use of market-based approaches to minimize the costs of pollution abatement.These themes will influence other regional efforts, and they will influence future amendments to the Clean Water Act and other environmental statutes.

Bibliography

1.Environmental Quality, The Fourth Annual Report of the Council on Environmental Quality, September 1973.

2.1973 Report of the Interstate Sanitation Commission.

3.Environment Law Handbook, Eleventh Edition, Government Institutes Inc., 1991

4.A Historical Perspective Engineering and Scientific, Donald J. O'Connor, in Cleaning Up Our Coastal Waters: An Unfinished Agenda, 1990

5.Conditions in New York-New Jersey Harbor Estuary, Dennis J. Suszkowski, in Cleaning up our Coastal Waters: An Unfinished Agenda, 1990.

6.Status Report and Interim-Actions for Hypoxia Management, Long Island Sound Study, 1990.

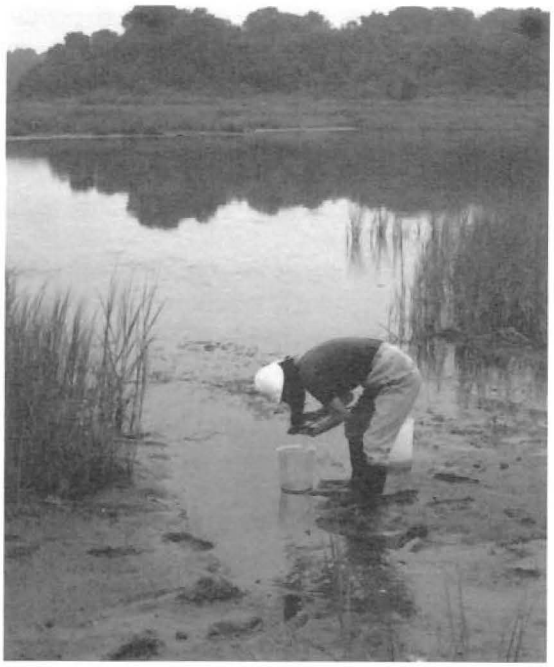
7.New York Bight Restoration Plan, Phase I Preliminary Report and Work Plan, April 1989.

Center at Stony Brook Offers Short Course

The Marine Sciences Research Center, State University of New York at Stony Brook, will sponsor a two-day course, "Doing Business on Long Island," September 23 and 24 at the center. The course is designed to help company executives, developers, and government administrators who plan to start or expand operations on Long Island understand and comply with environmental rules and regulations. Fee for the two-day conference, including all course materials, breakfasts, and lunches, is $400 before August 15 and $450 from then until September 10. Interested persons may call (516) 632-8714 or Fax (516) 632-8820.

Dean J. R. Schubel, director of the Marine Science Research Center, said recently, "Given the many rules enacted to protect Long Island's sensitive environment and the many layers of government on Long Island, rules and regulations can be difficult to understand, and filing compliance applications can be cumbersome and time consuming. These barriers can discourage and even impede new businesses from starting up on Long Island. The short course is designed to overcome these barriers by conferring 'insiders' knowledge' to participants."

Instructors for the course include Harold Berger, retired Region I director of the New York State Department of Environmental Conservation; Aldo Andreoli, former director, Division of Environmental Quality, Suffolk County Department of Health Services, and R. Lawrence Swanson, director of the Waste Management Institute of the Marine Sciences Research Center.



Student taking water sample from Flax Pond, State University of New York at Stony Brook. Photo by R.George Rowland.

Eyes on the Target

Returning to the Goals Of the Clean Water Act

By Robert W. Adler

Robert W. Adler is Senior Attorney, Natural Resources Defense Council. The views in this article are those of the author and the Natural Resources Defense Council. However, they derive in part from "A National Agenda for Clean Water," which has been endorsed by more than 300 organizations in the National Clean Water Network.

Introduction

There is much to be said for keeping one's eyes on the target, and for readjusting our aim when the target has been missed. As Congress considers reauthorization of the Clean Water Act twenty years after its enactment in 1972, it should remember the goals it set two decades ago, to see where we have fallen short of the mark. From a shorter perspective, it should assess whether the revisions it enacted in 1987 have been honored. It will learn that while progress has been made in some areas of water pollution control, mainly at the end of the pipe, neither the broad 1972 aspirations nor the more focused goals of 1987 have been met. Legislative changes are needed to keep the national clean water program on track.

The 1972 Goals and Purposes

The objective and goals of the 1972 Clean Water Act have been the subject of considerable discussion elsewhere, and need be reviewed only briefly. Most broadly, in section 101(a) the Act sought as its principle objective to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." To accomplish this purpose, subsections 101(a)(1) - (3) established subsidiary goals and policies:

(1) the elimination of the discharge of pollutants (zero discharge) by 1985;

(2) the attainment of water quality sufficient to support the "protection and propagation of fish, shellfish and wildlife" and contact recreation — the so-called "fishable and swimmable" goal — wherever attainable by 1983; and

(3) the prohibition of the discharge of "toxic pollutants in toxic amounts."

We have fallen far short of the mark in our ability to attain these goals. In some cases, there are still considerable differences of opinion as to what some of these principles mean. There is little disagreement that restoring and maintaining physical, chemical and biological integrity should continue to be the major target of water quality programs. Our purposes is not abstract regulatory compliance, but the health of our aquatic ecosystems and the populations (including humans) that rely on these systems. Yet while the Act's 1972 legislative history clarifies that "integrity" refers to protecting all aspects and life cycles of balanced, indigenous aquatic populations, some question whether this means that we can and should return our aquatic ecosystems to their pristine state before any artificial interference. (It is always easier to agree in principle than in specific application.)

To a large extent, however, this policy debate has not even been engaged in the real world. While federal and state water quality programs under the Act have devoted considerable attention and resources to addressing chemical pollutants and chemical measures of water quality, with the exception of efforts to protect wetlands under section 404 very little effort has been devoted to the "physical" and "biological" aspects of integrity.

Most water quality standards, for example, measure chemical but not physical or biological indicators of ecosystem health. Only recently have the Environmental Protection Agency (EPA) and states begun to develop biocriteria that measure aquatic ecosystem health against a standard of biological integrity. Yet the means of implementing and enforcing these criteria are as yet uncertain. Even chemical criteria typically measure only water column chemistry, ignoring the accumulation of pollutants in sediment and biota. Similarly, criteria are lacking to measure both the physical and hydrological, as well as chemical, impacts of polluted runoff from both urban and rural lands. These serious limitations must be considered when interpreting state and federal progress reports under section 305(b) of the Act, which have described increasing compliance with water quality standards, hence implicitly attainment of the goals of the Act.[1]

Discharge permits issued under the Act also have focused largely on chemical integrity. Recently, EPA and states have begun to issue permits that require "whole effluent toxicity" (WET) testing, under which the effect of the entire effluent on indicator species is measured using bioassays, rather than focusing exclusively on the impacts of individual chemicals acting alone. While a major step forward, this approach has limitations. For example, it relies on proper indicator species selection, can measure toxicity over only short periods, and cannot fully reproduce instream conditions. Moreover, many permits require WET procedures only as a test, followed by a vague requirement to engage in toxicity reduction, rather than a enforceable permit conditions. And the WET process has resulted in judicial challenges (so far unsuccessful), and legislative proposals to limit the use of WET as enforceable permit limits.

The most significant effort to protect aquatic

ecosystem integrity as a whole has been under section 404 of the Act, which requires a permit from the Army Corps of Engineers (COE) in order to discharge dredge and fill material into waters of the United States. While used as the principle regulatory method of protecting wetlands, this program has fallen short of that goal.

According to the U.S. Fish and Wildlife Service, for example, while the rate of wetlands loss has slowed due in part to the Clean Water Act and in part to federal farm policy legislation (principally the 1985 Food Security Act), from the mid-70s to the mid-80s the Nation lost an estimated 2.6 million acres of wetlands.[2] Other aquatic systems, however, have not even received this degree of effort. Clean Water Act programs have not addressed issues such as construction on floodplains and on coastal and lakeshore habitat, channelization and other alteration of rivers and riparian habitat, and changes to instream spawning and rearing habitat due to siltation and the hydrological effects of increased runoff flows.

Of the three ancillary goals of the Act, the most controversial has been zero discharge. Ignoring demonstrated success in achieving zero discharge in some industries, some argue that zero discharge is an unrealistic goal and not an economically efficient approach to environmental regulation. For now, however, this debate seems downright futuristic, as we are not even close to its attainment. Reports pursuant to the Toxics Release Inventory of the Community Right to Know Act (enacted as Title III of the Superfund Amendment and Reauthorization Act) indicate that over 740 million pounds of hazardous pollutants were discharged into U.S. surface waters and sewers.[3] Even larger volumes of "conventional" pollutants continue to be discharged every year.

Nor have we come close to achieving the "fishable and swimmable" goal of the Act, despite its 1983 target date. As noted above, the manner in which we measure attainment of this goal is highly incomplete due to serious gaps in water quality standards. But even accepting these measures, EPA's most recent biennial water quality report to Congress shows that most water bodies have not even been assessed for compliance with the 1983 goal, and of those that have been, a substantial percentage do not support or only partially support designated uses.[4]

The final goal, elimination of the discharge of "toxic pollutants in toxic amounts," is harder to gauge given the inevitable dispute over what is a "toxic amount." Disputes rage about the toxicology of chemicals such as dioxin in parts per quadrillion, appropriate risk levels for cancer and other health and environmental effects, exposure pathways and consumption levels, etc. But once again, these theoretical disputes must give way to reality, as there is substantial evidence, again reflected in EPA's most recent water quality report to Congress, that a large number of water bodies are adversely affected by toxic pollutants.[5]

Thirty-one states reported toxics in fish at levels in excess of FDA action levels, with 47 states using some form of fishing advisories and bans with more than 1,000 bans or advisories nationwide in 1988-89; 29 states reported sediment contamination by toxic pollutants; and 37 states reported fish kills resulting from chemical pollutants with almost 26 million fish killed in 1988-89.

In short, we are clearly a long way from achieving even the interim goals of the 1972 Clean Water Act, much less the overriding objective of restoring and maintaining the chemical, physical and biological integrity of the Nation's waters.

The 1987 Water Quality Act

In its 1987 Clean Water Act Reauthorization, known as the Water Quality Act of 1987 (WQA), Congress acknowledged many of these problems. While the full reach of the last reauthorization is beyond the scope of this article, three substantive issues dominated the agenda:

(1) the realization that little had been done to address water quality impairment from contaminated runoff (known by the technocracy as "nonpoint source pollution")
(2) the continued discharge of large quantities of toxic pollutants from industrial and municipal sources; and
(3) the need to reinvigorate water quality-

Centrifuges at the sludge dewatering facility on Wards Island, NY. Island Wide Photo.

based permitting requirements, which had languished in favor of the predominantly technology-based approach adopted by EPA and the states under the 1972 law.[6]

To address polluted runoff from agricultural and urban land, Congress added sections 319 and 402(p) to the Act. Section 319 required all states to conduct a detailed assessment of the degree to which their waters are impaired due to polluted runoff, and to develop comprehensive management plans to correct the identified problems. The assessments varied considerably in quality, but generally confirmed that polluted runoff was the principle cause of a large percentage of the Nation's water quality impairment, yet were subject to far less remedial action than pollution from point sources.

The management plans submitted under section 319 also varied considerably in quality. As a whole, however, they reflect a "business as usual" approach to addressing polluted runoff. Part of the blame rests with Congress: the statute contained no firm criteria for an acceptable management plan, leaving the states with little guidance on what to do and EPA with little basis to reject poor plans; and the Administration failed to request and Congress failed to provide the funding levels promised in the law for state implementation. EPA was also late in issuing guidance for state plans, and in reviewing plans once submitted.

Section 402(p) extended deadlines for issuance of permits for discharges of contaminated stormwater from both industrial and municipal sources. EPA regulations implementing this provision were late, and extended permit deadlines far beyond what was authorized by the statute. More important, EPA's rules narrowed the scope of sources subject to the permitting requirement, and failed to prescribe specific controls necessary to curb these discharges. On June 4, 1992 the U.S. Court of Appeals in San Francisco rejected several of these loopholes.[7]

Congress did adopt a more aggressive approach to polluted runoff control, at least with respect to coastal waters, in its reauthorization of the Coastal Zone Management Act in 1990. Rather than leaving the identification of polluted runoff controls exclusively to the states, as it had under section 319, Congress directed the federal government, through EPA and the National Oceanic and Atmospheric Administration (NOAA), to identify a series of best management practices (BMPs) to address various sources of polluted runoff, along with state management measures to ensure effective implementation of these BMPs.

Recognizing variability in land uses in different parts of the country, this approach does not require the same BMPs to be adopted by all coastal states. Rather, states may choose from the menu of approaches suggested by EPA and NOAA, based on the approaches that are most suitable in that state. Failure to adopt and properly implement a program, however, results in partial withdrawal of funding under section 319 and the CZMA.

Regarding toxics and water quality-based controls, Congress responded with a three-pronged "beyond BAT" strategy embodied in section 308 of the 1987 WQA ("BAT" is "best available technology" economically achievable — referring to the technology-based standard for control of toxic pollutants from industrial dischargers.) :

(1) EPA was directed to complete by 1991 its issuance of industry-wide effluent limitations (*i.e.*, BAT first had to be completed before anyone could go beyond it);

(2) states were required to adopt, within three years, water quality standards for toxic pollutants causing or potentially causing water quality impairment; and

(3) states were to identify in a series of increasingly comprehensive lists all water bodies impaired by toxic and other pollutants (so-called toxic hotspots) and to develop "individual control strategies" to address remeining toxic pollution from point sources discharging to those impaired waters. As interpreted by EPA, individual control strategies translate to new permits incorporating permit limits strict enough to ensure compliance with water quality standards for toxic pollutants.

There have been serious problems with the implementation of all three prongs of this beyond-BAT strategy. By the statutory deadline for completing all of the remaining BAT effluent guidelines, EPA had not issued a single rule, despite the fact that four out of five direct industrial dischargers were not yet subject to BAT rules.[8] A court ruled in April, 1991, in response to a lawsuit brought by NRDC, that EPA was in default of its obligations under the statute.[9] On January 31, 1992, the court approved a consent decree under which EPA will write new or revised regulations for at least 21 major industries over the next decade. Even so, we are still a long way from subjecting all industrial point sources to nationally-consistent requirements to control discharges of toxic pollutants.

Similar delays and problems have arisen with respect to EPA and state implementation of the water quality-based approach to the control of toxic pollutants. Most states delayed their adoption of new water quality standards, and many have not done so at all. In such cases EPA is required to step in and issue standards for the delinquent states, but has been reluctant to do so,

pleading concerns about states' rights. Faced with a threatened lawsuit by NRDC, however, EPA finally issued a proposed rule to fill these gaps, and is expected to finalize this rule shortly. Worse, EPA issued a regulation interpreting the individual control strategy requirement to apply only to the shortest of the lists required by the statute, meaning that only roughly 600 of the almost 18,000 water bodies identified as impaired by toxic pollutants would be subject to individual control strategies. In September, 1990, the U.S Court of Appeals in San Francisco rejected EPA's interpretation of the law.[10] EPA is expected to revise its regulations to respond to the court ruling in July, 1992.

Returning to the 1972 Goals

The question from here is how to reset our sights to improve our chances of attaining the sound, basic objective and goals articulated by Congress in 1972. In some cases, this requires an incremental shift in approach; in others, we need only fine tune our strategy to achieve these goals more quickly and effectively; in some cases, Congress needs to instruct EPA and the states more emphatically to do what they were supposed to all along.

Polluted Runoff

Given the overwhelming evidence that polluted runoff is the largest yet least seriously addressed source of water quality impairment, there is little point in revising the Clean Water Act unless this problem is addressed seriously. Congress has tried nonregulatory, planning approaches to polluted runoff for two decades, but these approaches have largely failed. Nor have we developed the same range of on-the-ground and programmatic tools to address polluted runoff as we have for pollution from point sources. The time has come to adopt a reasonable mix of regulatory and nonregulatory approaches to polluted runoff. This program should include at least the following components:

(1) Current water quality standards do not address many pollutants and effects characteristic of polluted runoff, such as nutrients, eutrophication, chemical and physical effects of sedimentation, most pesticides currently in use, and hydrologic impacts. EPA and the state should be required to adopt water quality criteria and standards addressing these impacts. Sources of polluted runoff that cause violations of these standards should be subject to enforcement action (although proper implementation of approved BMPs should be a defense against such enforcement). And state section 319 plans should not be approved unless they are designed to achieve compliance with these standards within a reasonable period of time.

(2) The flexible but mandatory BMP approach adopted in the 1990 CZMA amendments should be expanded to apply to all states. Penalties for state failure to implement these programs should be expanded to include loss of transportation and other federal funds. Ultimately, where states fail to implement adequate programs, EPA should be required to do so.

(3) Current divisions between point sources and polluted runoff must be redefined. For example, EPA's regulatory exemption for concentrated livestock operations, identified by EPA as one of the largest sources of agricultural pollution, should be refined to cover only extremely small operations. The current statutory permitting exemption for irrigation return flows should be modified as well. While it may not be logical to treat these sources in the same manner as industrial point sources, they should be permitted on a system-wide basis, similar to municipal stormwater programs under section 402(p).

(4) Congress should expressly require EPA to make municipal and industrial stormwater permits meaningful by defining minimum on-the-ground management practices to prevent contaminated runoff from urban and industrial areas. The related but critical problems of combined sewer overflows, in which discharges of raw sewage and contaminated stormwater can cause serious human health and environmental problems — such as the closure of thousands of acres of shellfish beds and miles of beaches along the East Coast, should be tackled as well. These overflows should be subject to an expeditious elimination program.

Industrial Toxics

The failure of existing CWA programs to eliminate toxics in toxic amounts, or to achieve the Act's zero discharge goal for even the most pernicious industrial toxics, has led some commentators to argue that Congress should turn to bans and phase-outs of the most toxic and persistent pollutants.[11] In fact, S.1081, introduced last year as the Senate CWA reauthorization bill, directs EPA to ban completely the discharge of prescribed toxic pollutants, including dioxin (more precisely, the release of 2,3,7,8-TCDD) and mercury, and also orders the agency to identify other equally toxic and persistent pollutants for the same procedure. Ultimately, only

this straightforward, no-nonsense approach will achieve the Act's zero discharge goal with respect to toxic pollutants.

Until such a bold approach can be implemented fully, short-term strategies are necessary:

(1) Congress should force EPA's hand by identifying specific industries that require effluent guidelines by specific dates; alternatively, Congress can ratify whatever deadlines are ordered or approved by the Court in the case described above;

(2) The current, inefficient process by which states and EPA must be arm-twisted into issuing water quality standards for toxics should be replaced by a system under which EPA's water quality criteria are presumptively applicable nationwide, unless states adopt stricter standards. EPA should be required to establish criteria for sediment and biota as well, also nationally applicable unless superceded by stricter state standards. These standards should be implemented through enforceable permit conditions so that toxics that do not remain suspended or dissolved in the water column are properly controlled;

(3) Congress should clarify that all point sources that discharge into impaired waters must be given stricter, water quality-based effluent limits by a date certain;

(4) The current presumption that point sources have a "right" to discharge so long as they meet applicable permit limits should be reversed (as intended by the original Act), such that permit applicants must demonstrate a "need to discharge" following a detailed environmental audit that evaluates every opportunity to prevent pollution through material and process changes and other means. Except where proprietary data such as trade secrets would be divulged, the results of these audits should be public; and

(5) Industries that discharge toxic pollutants into sewers should be subject to the same technology-based controls as direct dischargers (as well as stricter controls where necessary to protect plant workers, receiving waters, and sewage sludge).

Physical and Biological Integrity

The Act must be revised to give at least equal attention to physical and biological, as to chemical, integrity. While EPA and states have had ample authority to protect physical and biological integrity under the Act, with a few exceptions they have not acted aggressively to do so.

Recently, following the lead of states such as Ohio, EPA has issued guidance on how to use biological indicators to measure aquatic ecosystem integrity, rather than simply instream chemical parameters. Correctly, EPA indicates that these measures should be used so supplement, rather than to replace, numeric water quality standards.[12] However, so far this approach has been used to identify problems with ecosystem integrity, but it is not clear how it will be used to support additional regulatory action. Congress should embrace biocriteria as a supplement to numerical criteria, but require EPA to adopt such criteria in enforceable form, *i.e.*, specify that such criteria should be quantifiable where possible, and that violations of biocriteria must trigger additional controls on the activities responsible for the impairment.

Another important step is to broaden the scope of section 401 of the Act, under which applicants for federal licenses and permits must seek certification from the host state that the project will result in compliance with water quality standards and other requirements. Water quality-related requirements imposed by the state as a condition of certification must be imposed in the permit or license. Unfortunately, however, some courts have restricted application of this provision to chemical water quality standards, impairing the rights of states to keep their eyes on the real target — aquatic ecosystem integrity.

Section 401 should be amended to clarify that it applies to polluted runoff, physical habitat impairment, and other effects that are not purely chemical in nature. Moreover, to ensure that this provision is used rather than ignored, state latitude to waive certification should be eliminated.

As noted, wetlands protection under section 404 is the single example where the CWA has been used effectively to protect aquatic habitat. But while the rate of wetlands loss has slowed, it is still a staggering 300,000 acres per year. This is due largely to the fact that many wetlands-altering activities are not covered by the authority in section 404, which is limited to the discharge of dredge and fill material into wetlands. Activities such as draining are not covered by the Act. Many activities are exempted altogether or subject to weak or nonexistent protection under general or nationwide permits. (The full scope of amendments needed to correct these important defects are addressed in an article by James T. B. Tripp, Counsel, Environmental Defense Fund, *Water Resources Update*, Spring, 1992.)

Other Gaps and Defects

It is impossible to outline in this brief article the full range of changes needed to achieve the original goals and purposes of the Act. Many other issues should be addressed during the forthcoming reauthorization, including:

Ground water: While the original Act made reference to ground water in several places, it did not adopt the same comprehensive approach to ground water protection as to surface water. Even where, ground water was specified, such as the mandate in section 304 to issue ground water quality standards, EPA has failed to take action, hiding behind the facade of "states' rights." Ground water is just as much a national resource as surface water, with many important aquifers crossing state boundaries. And in most respects the two resources are hydrologically connected. The CWA should be amended to subject ground water pollution to the same strict regulatory program as surface water.

Water conservation: Water supply is becoming a major problem all around the country — not just in traditionally dry areas. Congress has been reluctant to tackle this issue, however, again citing the historic role of states in regulating water supply. But water quality and water quantity are inextricably linked in many respects, for example, where excess withdrawals from surface waters degrade already stressed systems, or where excess urban water use contributes to combined sewer overflows. While the federal government should not replace 200 years of state water rights law, there are legitimate and essential federal roles, such as the issuance and enforcement of minimum national plumbing efficiency standards, and the requirement that publicly-owned treatment works (POTWs) adopt least-cost water conservation plans before building or expanding sewer system capacity.

Enforcement and Funding: All of the above steps are critical if we are to see attainment of the Act's original goals. None of them will be achieved, however, unless adequate enforcement authority and implementation funds are made available. For example, EPA recently issued a report recommending specific enforcement authority needed to ensure that the law is properly implemented, although this report was initially suppressed by the White House.[13] Many penalties under the Act have been imposed at levels below the savings achieved through noncompliance, and the Supreme Court has narrowed the ability of citizens to go to court to enforce the law when the government fails to do so.

Similarly, funding levels have been inadequate to implement some of the most basic programs of the Act, such as the section 319 program to address polluted runoff. Additional funds are needed both to support the Act's planning, permitting, and enforcement programs, and to build needed infrastructure such as CSO and stormwater controls, and sewage treatment plants in small, low-income communities.

Conclusion

Clearly, the goals of the 1972 Clean Water Act were ambitious. But no responsible policy makers have suggested that the public deserves clean water and healthy aquatic ecosystems less in 1992 than they did two decades ago. Yet, while impressive progress has been made in some areas, we are still disturbingly far from reaching those goals.

Some argue that the solution is to lower our sights. But problems are never solved by weakening resolve or lowering expectations. None of the above suggestions represent a radical restructuring of the existing law. In some cases, they call expressly for what was suggested implicitly in the original law, or simply direct EPA once again to do what Congress called for all along. In others, they call for fine-tuning of existing programs, or incremental improvement of strategies designed to move us further or more quickly in the direction we headed in 20 years ago. Without these changes, we will never achieve the important goals we set for ourselves in the 1972 law.

Notes

1. For a comprehensive review of the current limitations of water quality standards see Water Quality Standards for the 21st Century, Proceedings of a Conference (EPA, May 1991).
2. Thomas E. Dahl, *et al.*, Wetlands Status and Trends in the Coterminous United States, Mid-1970s to Mid-1980s (FWS 1991).
3. EPA, September, 1991. Toxics in the Community, The 1989 Toxics Release Inventory National Report (EPA 560/4-91-014).
4. National Water Quality Inventory, 1990 Report to Congress (EPA 1992). The 1990 report shows that only one-third of river miles in the country was assessed. Of these, almost 38 percent did not fully support designated uses. One-half of lake acreage was assessed, of which 56 percent was polluted or threatened. Two-thirds of estuarine area was assessed, of which 44 percent did not meet designated uses fully.
5. For example, states reported that about 15 percent of all river miles, 39 percent of lake acres, and 19 percent of estuarine waters monitored were adversely affected by toxics, along with about one-quarter of all estuarine areas. Great Lakes states reported toxic effects for an incredible 98 percent of shoreline miles.
6. This is not to say that EPA and the states' interpretation of the prior law was correct. The 1972 law required the stricter of technology-based and water quality-based controls to apply, but the latter was implemented infrequently. See U.S. General Accounting Office, Water Pollution: More Action Needed to Improve the Quality of Heavily Polluted Waters (January 1989).
7. NRDC *v.* EPA, Nos. 90-70761, 91-70200 (9th Cir.) (June 4, 1992). The court invalidated EPA's stormwater permitting exemptions for small construction sites and so-called "light industry." The court also found illegal EPA's attempts to delay statutory permitting deadlines.
8. EPA, 1988. Report to Congress: Water Quality Improvement Study.
9. NRDC and Public Citizen V. Reilly, Civ. No. 89-2980 (RCL) (D.C.D.C.).
10. NRDC *v.* EPA, 915 F. 2nd 1314 (1990). The court rejected outright EPA's position that atates did not even have to identify all point sources contributing to toxic pollution and remanded to the agency to review which of these sources were subject to the control strategy requirement.
11. Oliver A. Houck, The Regulation of Toxic Pollutants Under the Clean Water Act. 21 ELR 10528 (Sept., 1991).
12. EPA, Biological Criteria, National Guidance for Surface Waters, EPA-440/5-90-004 (April 1990).
13. EPA, Draft Report to Congress pursuant to Section 314(b) of the Water Quality Act of 1987. NRDC recently sued EPA to force the release of this report to Congress. NRDC *v.* EPA, Civ. No. 91-5235 (D.N.J.). In response, EPA agreed to release a modified version of the report.

New Era for Water Quality
The Focus Moves From Control Of Pollution to Its Prevention

By Salvatore Pagano

Salvatore Pagano

The current Clean Water Act provides far-reaching authority to control and prevent water pollution through the use of various mechanisms, including water quality standards, technology standards (both pre-treatment and direct discharges), and secondary treatment. Those involved are to be commended for making remarkable progress. This was accomplished by:

- ❑ Focusing on point sources
- ❑ Relying on EPA technology guidance and regulations
- ❑ Using program grants efficiently

Over the past 20 years, we've largely conquered the "easy" problems and gone a long way toward studying and/or developing strategies to conquer the tougher ones such as nonpoint source pollution and controlling toxics. Now, as the professionals ready themselves to resolve these tougher problems, program funding is reduced, EPA technical guidance lags, and site-specific projects take priority over broader strategies.

Complicating further progress are federal demands to allot limited resources to relatively low priority environmental payoff areas such as stormwater permitting. We've gotten away from the basics of protecting and enhancing water quality and that's diverting valuable resources.

We can and should stay on course with our original plan to resolve point source problems and water quality problems. It's this latter area I wish to explore further.

Nonpoint Source Pollution

The statistics are clear -- the large majority of remaining water quality problems are caused by nonpoint source pollution. Much greater attention must be given to implementing the Nonpoint Source Management Programs required of the states by Section 319 of the Act. For most states, these programs were approved as recently as 1990. The blueprints for solving nonpoint source problems are tailored to the particular problems of each state. There are a variety of causes including:

- ❒ urban runoff
- ❒ contaminated sediments
- ❑ atmospheric deposition
- ❑ agricultural runoff
- ❑ construction activity.

We need both funding to implement our programs and continued attention to implementing the plans already approved under Section 319. We do not need another new approach. Further, we need the EPA to provide technical guidance through development of best management practices (BMPs) which the states and local municipalities can use. The objective is to solve water quality problems and prevent further problems by encouraging and, in some cases, requiring the use of technically sound BMPs. For example, the new Clean Air Act amendments require a technology approach to air emissions and, in fact, serve as BMPs because the net effect will be to reduce air transport and atmospheric deposition which is a nonpoint source pollutant.

Stormwater

Issuing permits for thousands of stormwater discharges under the NPDES program will not solve the water quality problems that stormwater runoff may create. Why? Because the problem can't be solved at the end of some pipe. The problem is upstream and diffuse, requiring BMPs to control and prevent pollution at the source before it gets into the storm sewer. A broad brush NPDES permit program won't work in this case. Again, technical BMPs need to be developed and local communities trained in their use.

Contaminated Sediments

Contaminated sediments are another source of nonpoint pollutants. Do we need sediment criteria? It would probably help in the long run since criteria can serve both as an early warning system for future problems and as end points for cleanup missions — but criteria alone cannot solve current problems.

We need better technology for stabilization, destruction, and decontamination schemes; we need funding to implement cleanup where technology is available; and, we need the public to understand the solutions to the problems. We can and will complete the Phase I and Phase II

Salvatore Pagano, P.E., is director of the Division of Water, New York State Department of Environmental Conservation.

studies for the areas of concern (AOC) in the Great Lakes, but we will be successful only when we implement the Phase IIIs. Since 42 of the 43 AOCs in the Great Lakes basin indicate contaminated sediments as a source of water quality problems, we have a major challenge ahead. We need EPA technical support and we need Congressional financial support.

The cause of contaminated sediments in the Great Lakes and nationwide in major river systems, inland lakes, marine waters and bays, are largely anthropogenic (man-made) chemicals. These chemicals have common characteristics. They are toxic; they are persistent; they bioaccumulate in aquatic organisms. Since we know what caused the current problems we should be prepared to do something to prevent further occurrences. Congress did do something. It passed the Toxics Substances Control Act (TSCA).

How well is it implemented? I have my concerns. I believe it is inexcusable to continue to allow the manufacture, use, generation and transport of such chemicals throughout society. These chemicals are much too risky environmentally. We need pollution prevention techniques in-place rather than reliance upon expensive, complex remediation measures. EPA should be directed to develop a program to phase out or sunset persistent toxic chemicals that bioaccumulate in order to avoid the kinds of mistakes made in the past.

Coastal Waters

Coastal waters, whether marine or freshwater, have problems in addition to contaminated sediments and persistent toxic chemicals. There are nutrient, dissolved oxygen, bacterial and heavy metal concerns as well. These problems are documented through National Estuary Program studies such as those in Long Island Sound and the New York-New Jersey Harbor. Congressional support in funding these studies is well deserved and appreciated. The problems are complex and the solutions will be costly. Congress needs to continue to give special attention to these waters and to authorize the resources necessary to implement the recommendations which arise from these studies.

Some of the coastal pollutant sources are also typical of most large cities. These are the combined sewer overflows. New York's experience shows that EPA's current policy and strategy for controlling CSOs is on target. We should continue to move ahead to solve water quality problems on a priority case-by-case basis. CSO controls need to be tailored to the conditions at a given location, based on the severity of the problem as well as on structural or non-structural feasibility. It would be wrong to attempt to prescribe technology solutions to all CSO concerns.

Summary

We have entered a new era of water quality protection. We aremaking the transition from the pollution control phase to the pollution prevention phase. While we must continue vigilance with regard to point sources, we also must solve much tougher problems. Nonpoint source pollution, with all it encompasses (stormwater, contaminated sediments, air deposition, agricultural runoff, *etc.*), is much more demanding because of its diffuse nature. To help solve these problems it is necessary that:

1. The states receive the funding to implement water quality programs. Increase and combine all water quality program grants to allow the states much needed administrative flexibility,

Filter fabric sediment control for a construction site. Photo, courtesy of Orange County (NY) Soil and Water Conservation District.

Dewatering facility on Wards Island. East River to the east, New York Central Railroad to west, Bronx in background. Photo by Bernstein Associates, Mount Vernon, NY.

and continue water quality project grants such as those that exist for Great Lakes areas of concern and the National Estuary Program.

2. EPA provide the states with the technical support needed to implement nonpoint source programs and that EPA update and complete the prescribed best available technology and pretreatment standards.

3. The scope of the stormwater program be narrowed, making it a water quality driven program rather than an end of pipe permit program. Limit permit issuance to discharges where water quality problems are documented.

4. EPA and the states focus on ambient water quality and achieving water quality standards. Merge program priorities and resources where problems exist. Hold the states accountable through water quality assessments, like those in Section 304, and reporting requirements as outlined in Section 305.

5. TSCA be used to ban persistent toxic chemicals that bioaccumulate by directing the phasing out of selected chemicals on a priority basis.

New York State Center For Hazardous Waste Management

Buffalo Center Funds Six Projects

The Executive Board of the New York State Center for Hazardous Waste Management has approved research and development awards for six one-year projects. A brief description of each project follows.

"Optimizing the Incineration of Aqueous Liquid Hazardous Wastes," C. Thomas Avedisian, Cornell University

The primary focus of this project is to examine the influence of water in the waste stream on spray fired incineration. The results from this experimental work will bear on treatment of aqueous-based hazardous wastes for destruction within spray-fired incinerators. The influence of water can be both beneficial and detrimental to the combustion process. This research will seek to define the optimum water content for alcohols representative of a class of hazardous wastes encountered in industrial incinerators. Partner: National Institute of Standards and Technology.

"Precipitation and Colloidal Properties of Ammonium Fluoride Mixed Precipitates as Applied to Semiconductor Manufacturing Wastewaters," Anthony G. Collins, Clarkson University

This research has particular relevance to the waste generating group of New York industries classified under the industrial code 36 (electronic and other electric equipment). The production of semiconductor chips is an important industry and the reduction of hazardous wastes from such industrial sites will help insure the growth of this industry. This project, which is aimed at waste reduction, will seek to develop a method for precipitating and separating hazardous constituents from semiconductor wastewaters, thereby reducing waste volume, disposal costs, and the long-term liability costs associated with disposal. Partner: IBM.

"Development of a Test Protocol for Assessing the Remediation of Heavy Metal Contaminated Soils by Soil Washing Procedures," John E. VanBenschoten, SUNY at Buffalo

Heavy-metal contaminated soils are found at many inactive hazardous waste disposal sites and at active industrial manufacturing sites. The costs associated with excavation of these soils, solidification and burial at a landfill are frequently prohibitive. Separation of the metals from the soil greatly reduces the volume of hazardous waste to be managed. This project will investigate extraction procedures for removal of metals from soils, with the objective of establishing a workable protocol that will aide in conduct-

ing treatability studies of soils contaminated with heavy metals. Partner: E.I. du Pont de Nemours & Company Incorporated.

"Vitrification of Ash from Waste-to-Energy Incinerators, Part II: Cold Crown Melting and Parameters for Scale-Up," Dale Wexell, Corning Inc.

Vitrification is a viable way to treat fly ash from municipal solid waste (MSW) incinerators (or other solid hazardous wastes), so that heavy metals are immobilized, leaving a non-hazardous glass product. Using its patented cold crown vertical melting furnace and expertise in glass chemistry and fabrication, Corning will continue to investigate the feasibility of vitrifying sample MSW incinerator fly ash into a non-leaching glass material suitable for land disposal and possibly for use in glass-based ceramic products. The objectives of this project are to demonstrate cold crown vitrification of at least two MSW ashes, identify and quantify evolved gaseous species from the ash vitrification process, and establish the melting parameters and air pollution controls necessary for vitrification scale-up (i.e., 20 to 100 lb/hr).

"Application of Continuous Flow UV Mutation Device for the Enhancement of Chlorinated Organic Biodegradation," A. Scott Weber, SUNY at Buffalo

The biological degradation of hazardous wastes continues to be a preferred waste treatment technology because of its relatively low cost and the potential for complete mineralization of the waste to harmless end products. This project will explore the efficacy of promoting beneficial mutation of bacterial species to enhance the degradation of chlorinated organic compounds. The utility of a continuous flow mutation/selector (CUMS) reactor system utilizing ultra violet radiation will be demonstrated. The results of this one-year project should provide an indication of the feasibility of this method for enhancing the degradation of chlorinated organics. If successful, improved biological reactor systems will be available for treating these troublesome recalcitrant waste streams. Partner: Occidental Chemical Corporation.

"Modification of a Plant Process to Produce a Useful Material from a Hazardous Solid Waste Generated by the General Electric Silicone Products Division at Waterford, New York," Stephen E. Wiberley, Rensselaer Polytechnic Institute

This project continues to investigate environmentally sound and commercially attractive uses of the solid waste generated in the manufacture of silicone. Previous findings have indicated that a large portion of this process waste (isolated from a clarifier) may be used as a replacement for cement in mortar and concrete. Preliminary testing of concrete samples containing the clarifier solids as a cement substitute has produced a higher compressive strength and lower permeability than typical concrete. This project will continue to research the application of these clarifier solids as a partial replacement for cement. The project involves the investigation of plant process changes in the management of the waste streams that may lead to successful recycling, greatly reduced quantities for landfilling, and the development of a beneficial reuse of a significant portion of the waste stream. Successful completion of this project will serve as a model for university/industry collaboration at the process level leading to significant waste reduction. Partner: The General Electric Company.

Hazardous Wastes Topic Of October Conference

The Rensselaer Polytechnic Institute Department of Civil and Environmental Engineering will sponsor the seventh annual conference, Hazardous Wastes — Science and Management, October 6-8 at Canoe Island Lodge on the shore of Lake George at Diamond Point, NY. A representative of the U.S. Environmental Protection Agency will speak at the opening dinner October 6. Other conference speakers from government, business, and academia will discuss educational needs, progress in analytical and modeling methods, lead in the environment, waste minimization, cleanup of contaminated sites, risk assessment, and progress in ongoing research in hazardous waste management.The dinner speaker October 7 will present a non-technical topic.

For information and registration forms, contact Bev Ryan, Civil and Environmental Engineering, Rensselaer Polytechnic Institute, Troy, NY 12180-3590 or call (518) 276-6381. Alternatively, call Don Aulenbach at (518) 276-6190 or FAX (518) 276-8554.

"WastePlan" Available

The New York State Energy Research and Development Authority (NYSERDA) will distribute the solid waste planning software, "WastePlan," to local governments in New York State. Researchers at the Cornell Waste Management Institute applied "WastePlan" to solid waste management issues in Tompkins County, NY and reported that the software makes it possible to test and compare results of several management approaches in advance. Interested persons may call Joseph Visalli at NYSERDA, (518) 465-6251, ext. 205.

Notes and Announcements

Turning Over an Old Leaf

The Cornell Waste Management Institute offers a seven-minute video for adults, "Turning Over an Old Leaf: Municipal Yard-Waste Composting, the 20 Percent Solution." The video shows the environmental and finincial value of keeping yard wastes out of disposal facilities, with emphasis on how recycling yard wastes through composting and chipping can save money. To order the video, contact the Cornell University Resource Center, 7-8 Business and Technology Park, Ithaca, New York 14850.

The Best Trash Programs From Cooperative Extension

In response to the growing impact of solid waste management issues on local communities and the resulting opportunity for Cooperative Extension agents to clarify the issues and complex options, the Extension Service - United States Department of Agriculture adopted a national initiative in Waste Management in 1990. Under the initiative, the Cornell Waste Management Institute (CWMI) received a grant to develop a book, "Implementing Waste Management Projects at the Local Level: 17 Extension Case Studies for Agents and Other Educators."

Cooperative Extension agents throughout the United States were interviewed in a search for waste management programs that met three criteria: innovation, broad-based community participation, and success. The case studies will be useful to communities challenged by hard-to-manage waste problems.

The book is divided into five sections: Education and Awareness Programs, Cleanup and Collection Days, Organic Waste Management, Recycling, and Municipal Solid Waste. The book is available from Cornell University Resource Center, 7-8 Business and Technology Park, Ithaca, NY. 14850. The cost is $9.95 per copy.

Youth Education

An estimated 75 percent of New York state classrooms include discussion of solid waste management, assuring that future decision-makers will be aware of the issues. At the end of the school year, it was gratifying to see students demonstrate projects based on issues they had explored in their classrooms. Students entered waste related projects in competitions associated with Earth Day, science fairs, statewide contests, and other events. Many schools now analyze their waste streams to find ways to change habits and purchasing practices in order to reduce waste.

One of the most exciting educational programs is peer teaching, students teaching students — it works! In Delaware County, NY a group of high school students participated in Cornell Cooperative Extension workshops and then taught other students. The teaching students gained confidence and experience, and the recipients learned about solid waste issues.

Contact the Cornell Waste Management Institute for information about programs and resources that meet many solid waste issue needs.

Photo above by Ian Stupakoff shows the pressure for development around Great South Bay, NY. Seasonal and all-year residents, pleasure boaters, and those who visit the coast only briefly all need services. (Note the sewer pipe warning.)

Industrial Pollution Control in India

Dr. Daryl Ditz, a senior research associate at the Cornell Waste Management Institute, recently completed a seven-month project on industrial pollution control in India. His research was sponsored by the Indo-American Fellowship Program, with support from the National Science Foundation, the Fulbright Foundation, and the Government of India. He explored hazardous waste management policy and practice, focusing on chemical and allied industries in several states. Despite India's serious environmental problems, Ditz is optimistic about the prospects for prevention and better control of industrial pollution. The research identified domestic and international mechanisms for the diffusion of less polluting technology and revealed the growing role of citizens' groups and other non-governmental organizations in catalyzing environmental action in India.

Construction/Demolition Study

The Cornell Waste Management Institute and Westchester County, NY will cooperate in the "Westchester County Construction/Demolition and Waste Management Study."

Topics to be investigated include current and projected levels of "C&D" waste generation, recycling, the potential for increased recycling, other waste reduction methods, processing capacity, future processing needs, quality control, market development, and educational programming.

Jamaica Bay — A Case Study

Implementation of the Clean Water Act

By Anne S. West-Valle, R. Lawrence Swanson and Cynthia J. Decker

With the implementation of the Federal Water Pollution Control Act -- also known as the Clean Water Act (CWA) -- many bodies of water have experienced a marked improvement in water quality. In the New York metropolitan area, some measures of the water quality of the East River and New York Harbor have been greatly improved as a result of increased sewage treatment, reduction of industrial outfalls and industrial waste pretreatment. Jamaica Bay lies almost entirely within the bounds of New York City (Figure 1). It is one of the most heavily urbanized bays in the country and has not experienced such marked improvements, although its degree of degradation was not as great as some of the other waterways in the Harbor. We will examine the environmental quality of Jamaica Bay as it is useful to understand the difficulties and complexities of achieving basin wide water quality goals primarily through technological improvements.

History

As with most embayments on the United States Atlantic coast, Jamaica Bay has a history of use and abuse by humans. In the early part of this century, it was one of the greatest shellfishing areas on the East Coast, and its shores were lined with summer communities, vacation homes and various amusement spots. Thousands of people from the surrounding city converged on the Bay to take advantage of abundant seafood and to enjoy the Bay's natural beauty and recreational opportunities. Simultaneously, the City of New York was discarding millions of liters of raw sewage and thousands of kilograms of solid waste into the Bay's waters and surrounding lowlands each day.

Compounding these waste impacts was the effort of the New York City Department of Docks and Ferries to develop the Bay as an international port and shipping center. This latter effort led to the draining, filling and developing of the peripheral marshes, the bulkheading of many streams, and the dredging of many natural channels. Disposal of sewage effluent and garbage into the Bay resulted in poor water quality and contamination of the shellfish with human pathogens; the physical alterations destroyed the Bay's natural ability to absorb and/or flush contaminants; and increased use of the peripheral areas of the Bay resulted in habitat destruction and chemical contamination.

The Clean Water Act

The CWA goal of swimmable and fishable waters by 1983 was to be achieved mostly through improvements in control technologies. The parameters used to measure these improvements are levels of nutrients, metals, coliform bacteria, and toxic substances in water, sediments and organisms. Other measures include floatable debris, and biochemical oxygen demand (BOD) and dissolved oxygen (DO).

For waters to be swimmable, human pathogens must be controlled. Levels of such pathogens are measured in New York State using coliform bacteria counts. In addition, the waters must be aesthetically pleasing. Control of floatable debris is necessary to entice bathers into the water.

For waters to be fishable, they must be able to support a diverse ecosystem, and the fishes must also be edible. Parameters that can measure a the ability of a body of water to support life include concentrations of nutrients, BOD, and DO. The levels of metals and select organic contaminants in the waters, sediments and the tissue of organisms, indicate the safety of eating any biota the

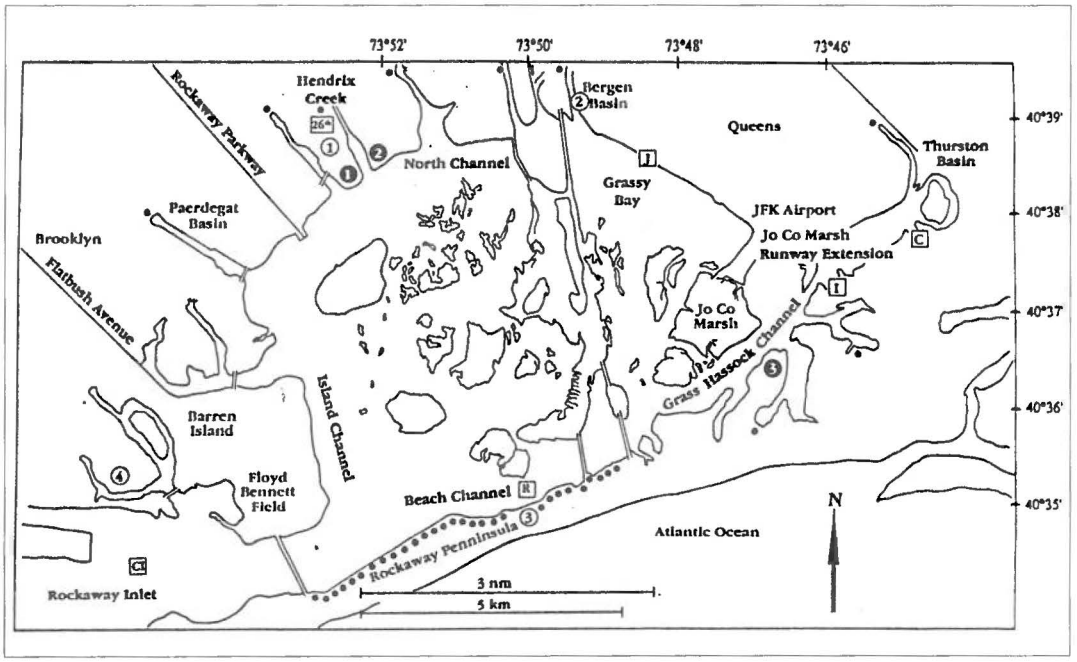


Figure 1.
Jamaica Bay

Sewage Outfalls
I Inwood
C Cedarhurst
J Jamaica
CI Coney Island
26th 26th Ward
R Rockaway

WPCP Legend
1 26th Ward
2 Jamaica
3 Rockaway
4 Coney Island

Landfill
1 Pennsylvania Ave.
2 Fountain Ave.
3 Edgemere

Major CSOs

Anne S. West-Valle

waters can support.

Many of these measures of environmental quality have been monitored by the New York City Department of Environmental Protection (NYC DEP) for at least the past twenty years as part of its New York Harbor Water Quality Survey. The monitoring data are measures of the effectiveness of the City's implementation of the CWA in Jamaica Bay. Examination of these measures can be useful in helping to improve any revisions of the CWA.

Water Quality

Water quality varies considerably in Jamaica Bay with distance into the Bay from its mouth at Rockaway Inlet. It is poorest along the northern edge of the Bay and in Grassy Bay which is at the northeast end, adjacent to John F. Kennedy International (JFK) Airport. This in part is due to the presence of sewage treatment plants (STPs), major combined sewer overflows (CSOs), urban runoff and closed landfills (Figure 1). Poor circulation in the Bay also exacerbates the problem.

(1) Coliform Bacteria

The presumed presence of human pathogens in marine waters is estimated by determining total and fecal coliform bacteria concentrations. Shellfishing and bathing waters are classified according to criteria based on coliform counts. A gradual decline in total coliform concentrations in most areas of New York Harbor has been observed over the last 20 years. This trend is less pronounced in Jamaica Bay, possibly due to the fact that nearly 100 percent of the sewage effluent going into the Bay in the last 20 years has been secondarily treated while only 80-90 percent of sewage effluent discharged into the Harbor between 1970 and 1989 was treated. Thus, there was less opportunity for pronounced improvement. Coliform levels measured in most areas of the Bay are within acceptable levels to permit swimming; most levels in the creeks entering northern Jamaica Bay are not.

(2) Floatables

Floating marine debris, consisting of plastic, wood, paper, glass, rubber, metal and organic waste materials, are a persistent problem in Jamaica Bay. There are several sources of this material in the New York-New Jersey area:

1) combined sewer overflow and storm water discharges;
2) landfills and transfer stations (they are now closely controlled and monitored);
3) driftwood; and
4) shoreline litter from beach use, recreational fishing, etc.

There are several closed landfills on the perimeter of Jamaica Bay. In spite of these closures, these areas may remain potential sources of floating debris well into the future. For example, the action of water at the base of the Pennsylvania Avenue landfill is eroding materials into the Bay. Rising sea level, as recorded over the last century in the region, will continue to destabilize the landfill, thus providing a continuing source of floatable material in the next few decades.

The primary sources of floating debris for Jamaica Bay are the CSO and storm water discharges. The NYC DEP has developed a comprehensive CSO Abatement Program to deal with problems associated with these discharges.

Planning for abatement facilities is being conducted in four major areas of the New York Harbor complex, including Jamaica Bay. A Tributary CSO Abatement Program has been developed, and planning is underway for Paerdegat Basin, a major tributary to Jamaica Bay. A demonstration project employing the **Flow Balance Method** for capturing floatables has been underway in the Fresh Creek area of Jamaica Bay since 1988. This low-cost project has demonstrated that floatable debris originating from CSO discharges can be captured (USEPA, 1991), and there are plansfor a major expansion to be completed.

In addition to the CSO Abatement Facilities, the U. S. Environmental Protection Agency, in its Floatables Action Plan, has recommended that the City of New York purchase a skimmer vessel for the cleanup of floatable debris in Jamaica Bay. Such a vessel would be particularly effective in the calm, relatively shallow waters of the Bay (USEPA, 1991).

(3) Dissolved Oxygen

Many marine organisms show signs of stress when DO drops below 3 mg/l (a condition which has been termed hypoxia). Some organisms even show signs of stress when the level drops below 4 mg/l. Records from the Harbor Water Quality Survey indicate little change in DO concentrations in Jamaica Bay since the survey was initiated in 1926 (although it is not clear at what depths the early samples were taken).

From 1970 to 1990, mean summer DO values varied between 6-8 mg/l for surface waters and 5-7.5 mg/l for bottom waters (NYC DEP, 1991). Mean summer DO in the bottom waters declined in the early 1970s, followed by a period of improvement from the mid- to late 1970s. By the early 1980s, this trend reversed and the mean summer DO values at the bottom have declined steadily (Keller *et al.*, 1991).

While levels currently are not hypoxic, this downward trend is certainly not a sign of improving water quality.

Anne S. West-Valle is assistant to the director, Dr. R. Lawrence Swanson, of the Waste Management Institute, Marine Sciences Research Center, State University of New York at Stony Brook.

(4) Biochemical Oxygen Demand

BOD is a measure of the amount of oxygen consumed by microorganisms in the metabolic process of converting organic matter into stabilized end products. BOD measurements in the Bay fluctuate seasonally, reflecting the varying organic content in the waters.

There is also considerable variability in the BOD of the sediments in different parts of the Bay. Levels of BOD reflect the degradability of the organic matter in the sediments. The small creeks and basins off North Channel (Figure 1) receive discharges from CSOs and STPs and consequently have sediments with the highest levels of BOD. The organic content of the sediments near the discharge sites in 1968-1969 was so high that anoxic conditions prevailed at the sediment-water interface, as reflected by the complete absence of benthic animals.

Average BOD concentrations in 1989 ranged from 1.8 to 3.7 mg/l in the bottom layer of water and from 1.9 to 2.6 mg/l in the surface layer (NYC DEP, 1991). From 1970 to 1987, BOD levels have decreased slightly, but the decrease was not statistically significant. In general, BOD levels in the Bay are higher, indicating poorer water quality, than other areas of the New York Harbor.

(5) Nutrients

As with most marine systems, the limiting nutrients for phytoplankton in Jamaica Bay are nitrogen and phosphorus. Excess inputs of these, however, can result in harmful blooms or changes in algal community structure. In 1969, it was estimated that nutrient levels in Jamaica Bay were 20 times as high as needed to sustain maximum crops of algae. Approximately 92 percent of the nitrogen and phosphorus entering Jamaica Bay is from the effluent of STPs. Thus, concentrations of these nutrients increase in Grassy Bay, site of the outfall for the Jamaica Water Pollution Control Plant.

Long-term trends suggest that nitrate and nitrite levels have dropped since 1974 in most areas of the Bay. A less distinct trend is evident if data from 1974-1978 are excluded. Three of the four NYC STPs that empty into the Bay were being upgraded during this period. These operations may have had an influence on the release of nutrients to the water because plants are often bypassed during parts of upgrading construction.

(6) Metals and Organics

Metals in some chemical forms can be toxic or cause acute or chronic health impacts in marine organisms. In some cases, metals can be bioaccumulated or biomagnified in the food web, eventually causing adverse effects in people. Sediment metal concentrations in Jamaica Bay are generally enriched, as compared to other embayments in the United States. Between 1947 and 1977, the flux of copper, cadmium and lead to Jamaica Bay sediments increased, while fluxes of chromium and nickel remained fairly constant. Comparisons of 1971-1973 data with 1981-1983 data show a general decrease in sediment metal concentrations, which may in part be a result of implementation of the CWA. However, the largest decrease was for lead, which may be due to the phasing-out of leaded gasoline at the end of the 1970s.

The copper concentrations in Jamaica Bay sediments increased between the early 1970s and the 1980s. Copper concentrations in mussel tissue also significantly increased between 1986 and 1988. This has been attributed to the expansion of a major STP that empties into the Bay. Copper in sewage effluent is often attributed to leaching from household piping. Copper is also common in industry and is a component of algacides, fungicides and anti-fouling paints.

Approximately 49 percent of the cadmium in the Bay is from residential waste water (Klein *et al.*, 1974). Cadmium is leached from New York City's drinking water distribution pipes and also comes from the improper disposal of household chemicals. Additionally, it is used in paint pigments, as a plastic stabilizer and in batteries.

A number of organic compounds are present in Jamaica Bay sediments and biota; some compounds in shellfish are in excess of U. S. EPA criteria. Polychlorinated biphenyls, petroleum hydrocarbons, polynuclear aromatic hydrocarbons and several pesticides are persistent pollutants in the Bay. Most of these pollutants come from CSOs and from JFK Airport.

Jamaica Bay and the CWA

In general, impairments to use of Jamaica Bay by humans because of poor water quality have occurred, and persist. These impairments include the loss of a major shellfishery; limited use of the Bay's waters for swimming and other water-contact sports; a reduction in recreational fishing; and health risks from eating more than minimal quantities of finfish and shellfish. Historically, poor water quality has affected the biota of the Bay. The disappearance of oysters in the Bay and the closing of hard clam beds to fishing are the most obvious losses caused by the decline in the quality of ambient water.

Certainly, some aims of the CWA have been achieved. Most of the waters of Jamaica Bay have been classified by the Interstate Sanitation Commission as suitable for swimming. The New York City Health Code, however, prohibits bathing beaches in all areas of Jamaica Bay. In 1970, the NYC Department of Parks had plans for nine

Cynthia J. Decker

Cynthia J. Decker is a Sea Grant Scholar at the Office of Naval Research in Arlington, VA.

beaches and seven marinas along the western and northern shores of the Bay (National Academy of Sciences, 1971). The full potential of these beaches will not be realized unless the major CSOs near these sites are treated; current plans of the NYC DEP may address this issue.

The overall health of the Jamaica Bay ecosystem can probably be considered marginal but certainly better than most parts of the New York-New Jersey Harbor Estuary. Water quality appears marginal-to-satisfactory, with some parameters improving, some not. Contaminants in sediments are present at alarming levels in much of the Bay and may eventually have a negative impact on the living marine resources.

The implementation of the CWA by NYC DEP may not address one of the root causes of reduced water quality in Jamaica Bay — the historical change in water circulation patterns.

Physical modifications of the Bay are quite obvious and may have negated many potentially positive results of water treatment technologies. Flushing time has increased nearly three-fold since the early part of the century. Dredging and filling of channels, bulkheading of shorelines, and development in the peripheral marshes have been mentioned. The most recent change is the construction of a JFK Airport runway extension into the Jamaica Bay Wildlife Refuge. The most likely result of increasing the residence time is to decrease the flushing rate for contaminants.

While physical alterations appear to have had a most dramatic impact on the ecological functioning of the Bay, the redistribution and substantial increase of fresh water input has probably had a significant impact as well. "Fresh" water comes from a storm sewer system that extends beyond the Bay's natural drainage basin. The amount of sewage effluent added to Jamaica Bay is 1.9 times that of the original annual drainage to the Bay from precipitation (West-Valle, *et al.*, 1991). This additional fresh water may have altered the natural water structure of the Bay, causing it to become more estuarine in character. Water column stratification may now be more intense and long lasting, contributing to such problems as oxygen depletion in near-bottom waters. Future versions of the CWA must provide for consideration of physical aspects of treatment technologies as well as chemical and biological.

Through the CWA, the sources of contamination were to be reduced and the problems they created alleviated. The CWA mandated reduction in levels of nutrients, metals, coliform bacteria, and toxic substances, to result in an overall improvement in general water quality. It was also the intention of the CWA to clean up coastal waters to make them "swimmable and fishable" by 1983. Ironically, though the CWA has required improvement in treatment technologies, it may not be effective in addressing more fundamental alterations to a coastal system, such as the physical changes that seem to contribute to the problems in Jamaica Bay.

It is clear that the goals of the CWA can probably not be achieved for Jamaica Bay through improvements in treatment technologies alone. Human uses of the Bay have changed its fundamental character, and it is unlikely that the original ecology and ecological functioning of the Bay can be regained without drastic alteration of previous physical alterations. Perhaps the next question concerning the Bay is whether the goals of "swimmable and fishable" are achievable with reasonable costs and a minimum of human dislocation. The steps being taken by NYC DEP may result in a swimmable Bay. A return to the shell- and finfishery of the early 1900s will require much more careful planning and considerably more effort and money.

Acknowledgements

The authors thank David Tonjes and Marci Bortman for their helpful comments and contributions to this article. The basis for the article is *Use Impairments of Jamaica Bay,* a report prepared for the U. S. Environmental Protection Agency, Region II as part of the New York Bight Restoration Program. The opinions do not necessarily reflect US EPA policy and are solely those of the authors.

References

Keller, A.A., K.R. Hinga, C.A. Oviatt. 1991. Nutrients and organic enrichment. Final Report to EPA Region II on Module Four of the NYNJ Harbor Estuary Program.

Klein, L.A., M. Lang, N. Nash and S.L. Kirschner. 1974. Sources of Metals in New York City Wastewater. A Report by the New York Water Pollution Control Association. Department of Water Resources; New York, NY. 21 pp.

National Academy of Sciences. 1971. Jamaica Bay and Kennedy Airport: A Multi-Disciplinary Environmental Study. Vol. 2. Washington, D. C. 149 pp.

New York City Department of Environmental Protection. 1991. New York Harbor Water Quality Survey 1988-1990. Bureau of Clean Water, Division of Scientific Services, Marine Sciences Section, Wards Island, NY. 52 pp (plus appendices).

United States Environmental Protection Agency. 1991. Comprehensive Plan for Addressing Floatable Debris in the New York Bight. Floatables Work Group, New York Bight Restoration Plan, Region II, New York, NY. 47 pp (plus appendices).

West-Valle, A.S., C.J. Decker, R.L. Swanson, J. Olha, T. Echelman, A. Mooney, A. Valle-Levinson, S. White, J. Winsch and R. Young. 1991. Use Impairments of Jamaica Bay. Summary Report for the US Environmental Protection Agency, Region II, New York, NY. 187 pp.

How Much Regulation Is Enough; How Clean Is Clean on the Farm?

Wetlands Issue a Major Concern

By David J. Allee and Leonard B. Dworsky

Dr. David J. Allee is a professor of resource economics in the New York State College of Agriculture and Life Sciences, Cornell University. Dr. Leonard B. Dworsky is a professor of civil and environmental engineering in the Cornell University School of Engineering.

Introduction

We have argued that there are four basically different types of policy tools: information, bribes, coercion, and restructuring of decision making. Federal programs designed to deal with pollution from dispersed or nonpoint sources have sought packages that minimize the use of coercion. However, the cross compliance rules between environmentally desirable practices and price supports, pesticide labeling restrictions, and limitations on measures included in water projects are coercive in character. Except for the expansion of the USEPA role in wetlands protection, mostly through its role in the "404" program where the Corps of Engineers operates the permit process, this is not the work of the Clean Water Act.

Wetlands

The wetlands issue appears to be the major focus of the farm groups who argue that restraints on the drainage of wet soils restrict output and world competitiveness in a major way for a negligible return in habitat and water quality improvement. Along with the concerns of the urban land development interests this appears to have led to a classic controversy over the redefinition of "wetland."

Political stability on the wetland issue may be very hard to achieve, given the very large potential capital gains from non-farm land development and the long standing animosity between water fowl and farm groups. It is clear to us that water management projects that evenhandedly treat habitat and cropland qualities as joint management objectives are not common, but may offer significant gains.

At the larger system level, the North American Migratory Water Fowl Plan is a step in the right direction, responding to the relevant treaties and serving as a focal point for some impressive private support groups. It has only minimal linkage to the Corps' "404" permit and water management activities, with the Upper Mississippi being a significant and pioneering exception. But, more to the point for this article, there is far too little integration of this planning effort into the farm establishment. For example, developers with land in the mud flats of San Francisco Bay or an irrigation district in the San Juaquin Valley would be hard pressed to find out in any useful detail how objectives for the Western Flyway might affect their future plans. For another example — several cycles of program planning under the Resource Conservation Act of 1977 have come and gone with little in the way of a joint approach to the wetland problem. As is so often the case, experimentation and coordination stimulated from the local level may lead to the formation of a more coherent federal policy. Examples could include the case of the Upper Mississippi and what may be developing around the five refuges being proposed along the Saint Lawrence River in New York.

Non-point and Return Flow Pollution

According to some Congressional observers,

Swamps, bogs, and fens provide benefits that we have only recently begun to value.

it might pay for farm interests to put more effort into the evolution of programs to deal with the loss of silt, nutrients, and pesticides from farm land and the concentrations of these and other contaminants appearing in the water that leaves irrigated land. All of these pollutants have their non-farm sources as well. Indeed, the idea of municipalities trading pollution reduction opportunities with farmers, who can achieve goals for streams more cheaply, may provide some interesting incentives for innovation. But, even in these cases, the expectation for the immediate future is that state and local developments will probably take the lead in terms of innovations in regulation.

Federal Regulation

Federal experimentation with more regulation in these areas will be on hold while the results of the US Department of Agriculture's part of the recent Presidential Initiative for Water Quality have time to work themselves out. The USDA Initiative uses research, technical assistance, and education, plus some cost sharing, along with the organization of watershed projects at different levels of intensity. Given the crude and expensive nature of water quality monitoring, and the politically important symbolic value of regulatory programs being in place, hot future arguments over whether the Initiative has been effective enough can be anticipated. But perhaps not in an election year? When there are other targets more easily sought?

A number of states have experimented with adding regulatory features to soil and water conservation efforts in the name of water quality. Iowa may be the best known. It gave neighbors a way to call attention to a non-cooperating land user who then had to adopt conservation practices if cost sharing was available. Iowa has more recently added an innovative groundwater protection program that taxes fertilizer sales to fund programs intended to reduce the risk of contamination. The largely state administered Coastal Zone Management Program has developed some innovative regulations for non-point control. State innovations like the water quality potential under the Arizona Groundwater Law or "Proposition 65" in California are well worth watching. Another source of innovations is apt to be the state administered Well Head Protection Program and other activity stimulated in part by the Federal Safe Drinking Water Act, with a significant local life of its own in many states.

New York City's Catskill system provides an example that may be seminal. The requirement of either slow sand filters or of equivalent protection by regulatory means has the potential, along with growing concern over the risk from all kinds of toxic chemicals, to revitalize New York's program of watershed rules. This approach to water supply protection predates chlorine but in the late 1800's responded to the then new understanding of disease vectors. The price tag for the cash strapped city will be $4 to $6 billion for the filters — enough incentive to fuel some innovation in watershed management. Even here, a largely voluntary program has been worked out for farmers and may be for septic systems, etc., with what many hope will be liberal cost sharing by "The City." But the back stopping of regulatory authority in place or as a potential provides the context for these negotiations. What is a coercive authority anyway, but an opportunity for bargaining for compliance? Isn't the creditable threat of a rule enough?

Photo of farm in New York state, courtesy of the Cornell Waste Management Institute.

Guest Comment

New York State Shows Benefits Of the Federal Clean Water Act

Thomas C. Jorling

From New York City to the Great Lakes, New York State bears witness to the benefits of the federal Clean Water Act.

Twenty years ago, one-fourth of the sewage of City residents entered New York Harbor untreated, and much of the remainder received only primary treatment. The rainbow sheen of bilge discharge covered the water of the harbor. Bacteria were the only living things that flourished. The City turned its back on its ramshackle, neglected and smelly waterfront.

Today, the City once more values its waterfront. The waters are alive with abundant and diverse creatures. Those sensitive indicators, amphipods, now account for 50 percent of the benthic fauna. Cormorants, rapacious fish eaters, abound. Herons and egrets nest, even along the industrial Kill van Kull and Arthur Kill. After most of a century, the waters are again clean enough to support marine borers, as shown by the rapid disintegration of pilings that stood for decades untreated.

How did the Clean Water Act bring us this tremendous change in a relatively short time?

The Clean Water Act of 1972 marked a sharp departure from previous water pollution control legislation in terms of who was in charge, what were the goals, and the techniques mandated to achieve those goals. The Act elevated the responsibility and funding for cleaning up our waters from the state level to federal government. It also changed the basis for discharge reduction from apportioning individual responsibility to aiming for elimination of discharges altogether. Through requiring Best Practicable Technology and then Best Available Technology, the Act encouraged technological development in water pollution control.

In 1972, President Richard Nixon vetoed the Clean Water Act, knowing that these changes would be costly. (Indeed, for New York City alone, the construction and upgrading of 14 sewage treatment plants carries a $4 billion price tag.) However, the nation agreed with Senator Edmund Muskie, who asked:

> *Can we afford clean water? Can we afford rivers and lakes and streams and oceans which continue to make possible life on this planet? Can we afford life itself? Those questions were never asked as we destroyed the waters of our Nation, and they deserve no answers as we finally move to restore and renew them.*

Senator Muskie's vision was vindicated; we are restoring the waters. The end product of the logic of cost avoidance could have been the eastern European model of surface waters too polluted for any use at all.

Today we see emphasis on goal and standard setting as state-sponsored estuary and basin programs spring up everywhere. Now that the waters are cleaner, there is a return to impacts-based discharge reduction. Responsibility for implementation and funding falls on the states. Congress has eliminated the Municipal Construction Grants Program, which funded the vast majority of the nation's sewage treatment infrastructure, and the State Revolving Loan Program now provides low-cost loans to municipalities.

But, I think the most satisfying Clean Water Act development isthe fact that we are now beginning to get close to a dream glimpsed more than two decades ago at the start of the long process of setting up industrial pre-treatment, SPDES permits, stream classification, technology-based limits, and other water pollution control programs.

The Senate Committee on Public Works, as it began drafting the Clean Water Act, stated:

> *The Committee's goal is a policy for adequate management of all forms of environmental pollution and for effective protection of the environment. A policy for air pollution only, a policy for water pollution only, a policy for solid waste disposal only, will not suffice. A broad policy and a coordinated effort are imperative.*

The recognition that we would need to minimize waste and prevent pollution was there at the beginning, but it is only recently that we have been able to start programs that will accomplish these goals. EPA has built up offices encouraging these programs. In New York State, under the leadership of Governor Mario Cuomo, we now have legislation mandating multimedia waste minimization and pollution prevention, beginning with the facilities with the greatest emissions. DEC has moved very effectively to implement the program. Several of the state's largest emitters of pollution have been able to reduce their emissions significantly over the past five years.

What about the future? Cleaning contaminated sediments in Great Lakes areas of concern and upgrading the management of the far less contaminated sediments of New York Harbor will drive the non-point source programs, the final step in restoring water quality.

Thomas C. Jorling is commissioner of the New York State Department of Environmental Conservation.

Waste Management
Research
Report

123 Bray Hall
SUNY College of Environmental Science
and Forestry
1 Forestry Drive
Syracuse, NY 13210
(315) 470-6644

ADDRESS CORRECTION REQUESTED

NON-PROFIT ORG.
U.S. POSTAGE
PAID
SYRACUSE, N.Y.
PERMIT NO. 248