CLEAN WATER ACT ISSUES

THE CLEAN WATER ACT IN RETROSPECT

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Introduction

The Federal Water Pollution Control Act Amendments of 1972 (PL *92-500),* with modest changes in 1977, 1982, and 1987, has been the framework for water pollution control in the United States for the past 18 years. That legislation, now referred to as the Clean Water Act, along with the Clean Air Act of 1970, the Resource Conservation and Recovery Act of 1976, and the Safe Drinking Water Act of 1974, is among the major accomplishments of the environmental movement of the 1960s and 70s.

When PL 92-500 was passed in 1972 in the still bright afterglow of Earth Day, it was an overhaul of water pollution control in the U.S., replacing what was once almost the exclusive domain of state governments with a dominant Federal role, acting through the U.S. Environmental Protection Agency. This paper takes a look at the question: how substantial were those changes? Now that Federal policy is directed toward decentralization - toward greater state responsibility, the answer to that question could provide some evidence about the future of water quality management. Special attention is given to those provisions pertaining to planning and water quality standards, financing, effluent limits, and enforcement. The general status of state programs before 1972 is characterized by several sources, and for greater specificity, frequent reference is made to the program in one particular state, namely North Carolina.

Planning

In his detailed coverage of the history of the legislative process that led to PL 92-500, Lieber (1975) comments on the complexity of the issues, debates, and the politics that gave birth to the Act. Two and a half years elapsed from the first hearings on April20, 1970 to the override of the Presidential veto on October 13,1972 when it became law. The Senate Public Works Committee and its Air and Water Subcommittee held 33 days of hearings and compiled over 6400 pages of testimony from 640 individuals and organizations. More than 425 pieces of testimony were accepted during the House's 38 days of hearings, and it took a 424-page report to explain the bill. The bill itself is 89 pages of fine print, a very complex piece of legislation that generated hundreds of law suits over its interpretation.

In this brief review, attention is focused on only a few of the major provisions of the act. One of those is planning. Under PL 92-500, planning was to be accomplished under several sections of the act, but the relationships among those activities were not entirely clear. Among its other requirements, the act called for:

+ Comprehensive program planning for the prevention of pollution of navigable waters and groundwaters - Section 102;

+ State program plans to assist the Environmental Protection Agency in the prevention, reduction, and elimination of pollution -Section 106;

+ Preparation of plans for waste treatment facilities - Section 201;

+ Development of area-wide waste treatment plans - Section 208;

+ Completion of Level B basin plans by the Water Resources Council for water and related land resources; and

+ State continuing planning for water quality standards and implementation plans - Section 303.

Some of these activities had precedents in earlier state and federal policies. Minervini (1979), in his study of water quality planning requirements in federal legislation prior to 1972, noted that the Water Pollution Control Act of 1948 directed the U.S. Public Health Service work cooperatively with state and interstate water pollution control agencies, municipalities and industries to prepare comprehensive programs for reducing pollution of interstate waters and their tributaries. He also pointed out that implementation of these programs was to be voluntary, that no statutory deadlines were established, the degree to which pollution was to be reduced was not specified, and that the means by which reductions were to be accomplished were not given. Although funds to implement a federal loan program for construction of waste treatment plants were never appropriated, Section 5 of the Act provided that no loan could be made unless the project was included in a comprehensive pollution abatement program. Federal grants to state and interstate agencies were authorized for investigations of pollution from industrial sources, an authority that was broadened in 1956 to include other types of wastes, and eventually became Section 106 of the 1972 legislation.

The Water Pollution Control Act Amendments of 1956 not only brought forward the comprehensive program requirement as a precondition on federal assistance, the requirements for such a program were expanded. To use Minervini's paraphrasing, the plan prepared by a state or interstate agency had to, among other requirements:

(1) provide for administration of the plan;

(2) provide for agency reports to meet the reasonable requirements of the Surgeon General; and

(3) set forth the plans, policies, and methods to be followed in carrying out the plan.

Construction grants, authorized under Section 6 of the 1956 Act, were restricted to projects that: (a) conformed to a state water pollution control plan; and (b) were ranked in priority above other eligible projects.

The Water Quality Act of 1965 continued and expanded the planning requirements. That legislation required the states to establish water quality standards and "implementation" plans for interstate waters. These planning and ranking requirements were carried over to Sections 106 and 303(e) of the 1972 Act.

Standards and implementation plans in Section 303 were mandatory on the states, but a survey of state water pollution control programs (McKee and Wolf, 1963) indicated that at least 20 states already had reasonably comprehensive programs in place by 1962. For instance, although it was not necessarily a leader among the states, North Carolina had implemented a statewide comprehensive pollution control program in 1951. State laws protecting public water supplies from pollution date back to the late nineteenth century, but legislative initiatives toward a comprehensive statewide program of pollution control did not begin until 1945. That first initiative produced a preliminary study of stream pollution in the state, and later action by the General Assembly in 1947 led to the initiation of a series of river basin surveys. It took several more years of legislative debate and maneuvering before the basic law on water pollution was passed in 1951 (Howells, 41-68; Long,

11). Several provisions of that legislation (NC Gen. Stat. Art. 21-Chap. 143) are noteworthy in this discussion. It required the responsible administrative agency to:

(1) develop and adopt a series of stream classifications and related water quality standards for the purpose of classifying waters of the state;

(2) to survey all waters of the state and to identify those that should be classified for purposes of pollution control; and

(3) to assign to each identified water that classification that is consistent with its present or potential future "best usage." (Long, 12)

A six-class freshwater and four-class tidal saltwater water classification system was developed. Water quality standards were written for each of the 10 classes in 1953. Long reported in 1962 that over the first decade of this program, 81 percent of the states waters had been classified, and that plans had been approved for the construction of 256 projects for the collection and treatment of industrial wastes and domestic sewage.

As Schoenbaum (1972) noted, when the Water Quality Act of 1965 was passed, North Carolina already had a well-developed program in existence, and that legislation did not change the basic pattern of regulation. The same could be said for maybe one-half of the states, but for the other half who had either no water quality standards or only minimal guidelines, that Act brought about substantial change. Thus, it may be fairly concluded that Federal requirements for water quality standards and implementation plans in the 1965 and 1972 legislation had important but hardly revolutionary impacts on water pollution control.

PL 92-500 added a significant new dimension to the array of planning activities, however, with its incentives for metropolitan level planning. Minervini (1979) pointed out that Senator Muskie of Maine, Chairman of the Subcommittee on Air and Water Pollution of the Senate Public Works Committee and dominant congressional leader in these matters throughout this period, was also highly influential in his advocacy of areawide comprehensive planning for all federally-assisted programs affecting metropolitan areas. He had been influential in passage of the Demonstration Cites and Metropolitan Development Act of 1966, and he wrote the Intergovernmental Cooperation Act of 1968. Under the 1965 Act the Senate had encouraged a 10 percent bonus for construction grants that conformed to comprehensive regional development plans, and that incentive was substantially increased in Section 208 of PL 92-500. That provision authorized $300 million for 100-percent federally funded grants to metropolitan agencies for the preparation of areawide waste treatment plans.

Despite the key role that was envisioned for areawide planning when the act was being formulated, it played a relatively minor part when the act was implemented. EPA chose to follow the path established by the states with primary emphasis on state program planning under Section 106 and basin level implementation plans under Section 303(e), and virtually all of the planning was done by state staff with federal financial assistance. Funds for the Level B plans in Section 209 were never appropriated.

Financing

In the late 1960s Congress was becoming impatient with the pace of progress under the 1965 Act. The view that water quality was deteriorating had become an "uncontested truth" in Washington, despite the absence of facts and documentation to back up that position (Lieber, 141). Many popular publications, including books by Nader's Raiders, Barry Commoner, the Club of Rome, and the government's own Council on Environmental Quality, were influential in convincing many that environmental quality was getting worse, and additional measures were necessary.

Increasing financial incentives was seen as a key to accelerating progress. Before 1972, the Federal government was contributing less than $1 billion annually to the construction of wastewater treatment plants. Soon after President Nixon's environmental message in February 1970, the administration introduced a bill (S.1103) that called for Federal construction grants of $2 billion a year. That bill provided for a minimum Federal contribution of 30 percent and a maximum of 55 percent of the cost of building new publicly owned facilities (30 percent with an implementation plan, 40 percent if a state contributed 25 percent, 50 percent if the same state also had Federally approved water quality standards, and 55 percent if facilities were also a part of a metropolitan plan). By the time PL 92-500 passed in 1972, authorized Federal expenditures had been tripled to $6 billion a year, and the Federal share of construction costs had been increased to 75 percent.

This unprecedented level of Federal funding for waste treatment facilities amounted to one of the largest public works program in the history of the country, second only to the interstate highway program. By infusing this large amount of capital, the national rate of expenditures for pollution control facilities was increased, but by focusing only on Federal expenditures, the picture of total expenditures was distorted. Data compiled by the Congressional Budget Office showed that prior to 1972 local government expenditures for waste-water treatment had been running at a fairly uniform rate of $4 billion a year (constant 1982 dollars). Financing from state sources was practically non-existent at that time. With the substantial increase in the Federal share to 75 percent in 1972, local governments simply reduced the rate of outlay from their own funds, and although total public expenditures increased to a peak of about $7.5 billion in 1977, that peak was less than twice pre1972 rates. More recent data compiled by Farber and Rutledge (1989) indicate that the rate of expenditures for all water pollution control facilities declined sharply between 1978 and 1983 to below the 1972 rate as Federal appropriations were reduced. Rates have been increasing since 1983 as local governments have again assumed the primary responsibility for financing new facilities. State contributions rose to over $0.5 billion by the mid 1980s, accounting for over 10 percent of local expenditures (Moreau, 1988, based on multiple data sources).

Effluent Standards

One of the more fundamental changes in Federal policy that was embodied in PL 92-500 was the shift from water quality standards to effluent standards as the foundation for the strategy to control pollution from point sources, namely Publicly Owned Treatment Works (POTWs) and direct industrial dischargers. From 1948 to 1972 it had been federal policy to encourage states that had not already done so to adopt water quality standards. Achievement of those standards was the goal of water pollution control, and a violation of those standards was sufficient cause to bring an enforcement action against any party who was suspected of being responsible for the violation. Water quality standards were retained as a part of the strategy in PL 92-500, but the foundation for controlling pollution from point sources was shifted to technology-based effluent limitations. POTWs were to meet standards of secondary treatment by 1977, and by 1983 they were to satisfy standards represented by best practicable waste treatment. Industries that discharged directly to streams were to meet effluent limits based on best practicable treatment (BPT) by 1977 and best available technology by 1983. Deadlines and criteria for effluent standards have been modified since 1972, but the use of such standards as the foundation for controlling point sources remains unchanged.

The shift from water quality standards to technology-based standards was and still is subject to criticism from those who advocate economic efficiency in meeting water quality standards (for example, see Freeman, p. 131). As noted by McKee and Wolf:

> Effluent standards have the advantage of simplicity and ease of administration, for

> they are well defined and equitable among industries. Their primary disadvantage lies in the uneconomical use of the assimilative powers of receiving waters. (30)

One of the legacies of PL92-500, however, is uncertainty about its real objective. A stated goal was to eliminate the discharge of all wastes into the nation's streams by 1985, but the operational goal was to achieve and maintain water quality at levels suitable for fishing and swimming. If technology-based effluent limits are intended as a means of satisfying water quality standards, then arguments that they are not necessarily economically efficient are valid. However, if effluent standards are simply an interim step toward zero discharge, or if they are used to enhance equity among dischargers, then the efficiency argument is less relevant.

Although the adoption of effluent standards as a basis for national policy was hardly an incremental change, the use of effluent standards had many precedents among the states. At least six states had some form of effluent standards in 1962 (McKee and Wolf, 33-51) with Pennsylvania being cited (30) as having been a pioneer in the development of standards that specify the amount of pollutant that may be discharged by specific industries and by specific process within industries. Standards of that type had been in use since the 1940s when specific limits on oil and cyanides were established (Heath, 1972).

Pennsylvania, as well as other states, also had effluent limits that specified the degree of treatment or percentage removal of a pollutant from a waste. North Carolina's pollution control statute of 1951 required all dischargers to obtain a permit from the State Stream Sanitation Committee. The Committee was given the power to grant permits with conditions **"...** by preventing so far as reasonably possible, any pollution or any increase in pollution ... from any new or enlarged sources." (1951 Session Laws, 537*).* That power was used to establish a policy of incorporating percentage reduction limits in the permits (Schoenbaum, 14).

Enforcement

Only a few states were using effluent standards in 1972, however, and their adoption nationwide in PL 92-500 was a highly significant change in strategy for controlling water pollution. Not only did it impose uniform limits based on advanced technology, but it revolutionized the enforcement process. The National Pollutant Discharge Elimination System in Section 402 required that no one could discharge waste to any stream without obtaining a permit, and that permit included the effluent limits. Anyone found not in compliance with that permit would be subject to an enforcement action.

Prior to 1972 the Federal enforcement process was so unwieldy as to be virtually non-existent. The Federal Water Pollution Control Act of 1956 established a three-step enforcement procedure. In Step 1, either the Federal government or a state, acting on evidence that pollution was causing interstate damage to health or welfare, could request an enforcement conference. If the findings from that conference justified additional action, a hearing could be called after a six-month time period. If findings from the hearing justified further action, enforcement action could be brought in court after another six-months and with consent of the governor of the affected state (Davies, 41). Modest changes in enforcement policy were made in 1961 and 1965, but over the period 1956-71, only 53 conferences were called, of those only 4 went to hearing, and of those only one case was taken to court (Lieber, 20).

The policy of using discharge permits as the basis for enforcement strategy was the subject of considerable debate and experimentation over the two years of legislative action on PL 92-500. In the 1960s the courts began to rediscover Section 13 of the Rivers and Harbors Act of 1899, more commonly known as the Refuse Act. That law was originally intended to protect navigation by prohibiting the disposal of any kind of material other than "liquid refuse flowing from streets and sewers," but the courts expanded its interpretation to

include wastewater discharges from industrial sources. In December 1970 the Nixon administration used that law to establish by executive order a permit program, administered by the U.S. Army Corps of Engineers with the assistance of the U.S. Environmental Protection Agency. Failure to comply with permit conditions was sufficient grounds for Federal law suits, and a number of suits were filed against different types of industries at a variety of locations throughout the country (Howells, 142).

Lieber (24-25, 37) cites a number of reasons why the Refuse Act permit program was a fiasco. Industries tended to oppose regulation that would increase their costs; states opposed it on grounds that they were excluded from the process, and they claimed, at the time that permit provisions of the 1972 act were being discussed, 45 states already had industrial permit programs (Lieber, 37); some environmental groups opposed it because it was seen as a license to pollute and because municipal sewage was exempt from its coverage. Administrative bottlenecks were created as the number of applications swamped an inadequate staff, and two court decisions in 1971 and 1972 severely hampered its utility. One decision required that complete environmental impact statements accompany each permit while the other held that an industry could not be held liable for damages done prior to creation of the program.

A new water pollution control law was being formulated by Congress against that backdrop of experience with the Refuse Act. The first Senate version introduced for consideration in 1970 did little to change the 1956 law, and in the second version introduced in February 1971, the procedure was modified to allow the Administrator of EPA to take either the judicial route or to issue abatement orders coupled with civil penalties. The bill introduced by the Nixon administration deleted the three-step procedure in the 1956 Act, but replaced it with an almost equally cumbersome administrative procedure. What emerged in the final Senate bill was a very strong Federal enforcement role that required EPA to either issue an order of compliance or initiate a civil suit when a violation of effluent limits in a permit were found to occur. Penalties for noncompliance were severe. The House accepted the Senate version for the most part, but gave the states initial responsibility for enforcement, and the House version prevailed in the final version of PL 92-500 (Lieber, 32,34-35,47,70,79).

Probably no other change in policy brought about by PL 92-500 had more effect on water quality management programs than those relating to enforcement. Several parts of the legislation were connected to enforcement, include the coupling of effluent limits with discharge permits and a modified procedure that enabled EPA or the states to take direct and immediate action against a violator. Those changes created a distinctly different set of expectations about enforcement actions and the power of government to effectuate those actions. Estimation of any improvements in water quality that can be attributed to PL 92-500 remains an elusive task (Freeman, 114-120; Smith et al. 1987), but the change in enforcement activity is clear.

Consider again the case of North Carolina. Water pollution control in that state was “explicitly and consistently” a voluntary approach. The stream sanitation act of 1951, after granting relatively strong powers to the Stream Sanitation Committee, went on to state that the intent was to encourage voluntary action. The Committee was to exercise its powers only after cooperative efforts had failed to produce acceptable results within a reasonable time. State Senator J. Vivian Whitfield, the principal legislative advocate for the 1951 Act and later Chairman of the Committee for 12 years, held the view that the state should stay out of court at all costs (Heath, 1972).

Some credited that approach with substantial progress while others have viewed it differently. Howells (86-98) characterized progress in this period as being slow despite the number of treatment plants that were being constructed or planned. He cites lack of progress with several

major cities, industries, and smaller communities as evidence for his viewpoint. Schoenbaum (1972) was even less charitable, pointing that only a few dischargers were ever subjected to enforcement actions. Several factors were cited, including: (a) surveillance systems were inadequate, making detection of violations and proof of cause almost impossible; (b) most detected violations were ignored; and (c) the legal staff was woefully shorthanded. Only one case went to court from 1964 to 1968.

The enforcement climate in North Carolina, as well as in other states, has changed dramatically. By the mid-70s North Carolina had 15-20 civil penalties per year. Over the past several years that number has steadily climbed from 61 cases in 1986 to 93 cases in 1989; in 1990, new computer reporting systems led to 430 cases (Tedder, 1991). Not all of these changes can be attributed solely to changes in statutes, of course. Changes in public attitudes and a concommitant rise of environmental concerns on political agendas have provided the necessary public support for a more aggressive enforcement process.

Summary and Conclusions

This analysis suggests that suggests that of the several changes in water quality management brought about by PL 92-500 that have been considered in this paper, changes relating to enforcement may have been the most revolutionary. Provisions of the law relating to planning incorporated a new initiative for regional or areawide plans, but EPA chose to place its primary reliance on a model that had evolved from prior state experience and Federal-state relationships over the preceding 15 years. Increased financial assistance provided under PL 92-500 provided an initial boost to outlays for wastewater treatment facilities, but the national rate of expenditures never quite doubled pre-1972 levels. Local governments appear to have recovered from the withdrawal of Federal funds, and while states have made important contributions, their contributions have never reached more than 10-11 percent of local government expenditures.

Important changes have occurred in enforcement processes -- changes that were made possible by enactment of PL 92-500 and may not have occurred at the state level otherwise. Much has been done to bring point sources into compliance. Water quality conditions in 1988 (EPA, 1990) were such that point sources accounted for a relatively small share of impaired waters, municipalities causing 16 percent of the total, industries 8.5 percent.

Much work remains to be done, however. The 1990 EPA report estimates that of the 519,000 miles of streams assessed in 1988, 30 percent did not meet their designated use. Siltation and nutrients are identified as the principal causes of pollution, and agriculture is identified as being by far the largest source of impairment, accounting for 55 percent of all impaired stream mileage. Addressing these problems may require substantial new initiatives in planning, financing, and enforcement strategies.

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THE CLEAN WATER ACT: AN ECONOMIST's APPRAISAL

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Introduction

The water in our lakes, rivers, and streams supports a wide range of uses. Water can be withdrawn for drinking and other domestic uses, for industrial processes, or for irrigation. It can support fish populations that are the basis of commercial exploitation and recreational fishing. It can be used for boating and swimming, and it can be used to flush away the wastes from factories and municipal sewers. Most of these uses are to varying degrees dependent on the quality of the water. Yet the use of a water body as a waste receptor can seriously degrade water quality and impair or even preclude other uses.

A Ralph Nader task force report, "Water Wasteland," published in 1971, helped to dramatize the poor state of some of our water bodies. At least in part in response to that report, Congress enacted the Federal Water Pollution Control Act of 1972. This law was revised in 1977 and again in 1987 and is now known as the Clean Water Act (CWA).

In this paper I describe the key features of the CWA, review what is known about what has actually been accomplished in controlling discharges and in improving the quality of our nation's waters, and present an economic assessment of water pollution control policy.

The Law

The law established two primary objectives. The first is the elimination of all discharges of pollutants into navigable waters by 1985. The second calls for attaining "fishable and swimmable" waters by 1983. The principal means for achieving these objectives are the establishment and enforcement of technology-based effluent standards. These standards are quantitative limits imposed on all dischargers where the quantities are based on the present technology. To put it simply, standards are set based on what can be done with available technology rather than what should be done to achieve ambient water quality standards, to balance benefits and costs, or to satisfy any other criterion. Since production processes, quantities and composition of waste loads, and treatment technologies vary substantially across industries, separate discharge standards must be developed for different industries. These standards are referred to as "effluent limitations."

Effluent limitations become the basis for discharge permits to be held by all dischargers. These permits limit the allowable discharges of the individual polluters to the quantities that are consistent with the relevant technology-based effluent limitation. Permits were initially to be issued through the regional offices of EPA. If a state agency satisfies certain conditions, however, it can take over responsibility for issuing permits and enforcing their terms.

The CWA also includes significant provisions dealing with non-point sources of pollution and providing financial assistance to municipalities for construction of municipal sewage treatment systems. But space limitations preclude any discussion of these issues.

This **paper is adapted from my contribution to Paul R. Portney (ed.) Public **Policies** for Environmental **Protection. Washington: Resources** for the **Future. Readers interested in a more** detailed **treatment of** these **topics and a full set of references** should **consult** this **source.***

Accomplishments

It has been estimated that as of 1977, about 80 percent of industrial dischargers complied with their effluent limitations and that by 1981, 96 percent of these sources would be in compliance. The compliance rate for municipal dischargers was substantially lower. It has also been estimated that this level of compliance by industry would result in an approximately 65 percent reduction in industrial discharges of oxygen demanding organic material and an 80 percent reduction in suspended solids.

The term "compliance" as used by EPA generally means the installation of treatment equipment capable of meeting the effluent limitations when properly operated. These data do not say anything about actual discharges. To determine the degree of effective compliance, it is necessary to examine the discharges of polluters and to compare them with the terms of their permits and relevant effluent limitations.

The U.S. General Accounting Office (GAO) attempted to do this for an 18 month period in 1981- 82. The GAO had to rely on discharge data supplied by the dischargers rather than independent measures; thus the degree of effective compliance may be overstated. Nevertheless, the GAO study indicated a significant noncompliance problem. They examined the discharge data for about a third of all industrial and municipal dischargers in six states. Eighty-two percent of the sources had at least one month of noncompliance during the 18 month period. Moreover, about 24 percent of the sample was in "significant noncompliance" with at least four consecutive months during which dischargers exceeded permitted levels by at least 50 percent. The performance of municipal sources was poorer than that of industrial sources, and this was especially true in the case of significant noncompliance.

It is important to try to determine whether the CWA has resulted in levels of water quality across the country that are better than they would have been, other things equal, without these laws, and if so, by how much. None of the available data can answer this question conclusively; but we can draw some inferences from several sets of data. These data are of two types: predications of changes in water quality in response to changes in discharges based on water quality models that hold other things, such as the level of economic activity, constant and observations of actual changes in water quality.

Researchers at Resources for the Future (RFF) have made a major effort at modelling the effects of the 1972 law on several measures of water quality. The RFF water quality network model is based on inventories of waste generated at point sources and estimates of actual removal rates as of 1972. The inventories of wastes generated and discharged are combined with a model of pollution transportation to predict values for four water quality parameters at over 1,000 locations in the continental U.S. Estimates of increased treatment levels because of the law can be used to predict changes in discharges and, hence, water quality measures across the country.

The study examined two scenarios. The first was based on the estimated actual 1972 discharges of polluting substances and predicts the percentage of locations achieving assumed water quality standards. About 83 percent of all locations was predicted to have been meeting the standard for dissolved oxygen in 1972. Also, in this scenario relatively few locations were predicted to have attained the assumed standard for phosphorus and nitrogen.

In the second scenario, the model predicted water quality at each location assuming all point sources of pollution to be in compliance with the relevant effluent limitation. The model predicted increases in the number of locations meeting the standards for each of the four water quality parameters; but the absolute and percentage increases are surprisingly small. The model predicted only a 6 percent increase in the number of locations satisfying the dissolved oxygen standard. But this is in large part because of the high percentage of loca-

tions already meeting the standard. On the other hand for those two parameters where there is greatest room for improvement, phosphorus and nitrogen, the law has a relatively small effect on the number of locations in violation. This is because the point sources affected by the law are relatively unimportant sources of these pollutants. In summary, to the extent that this model accurately predicts water quality, it appears that the CWA has had relatively little affect on water quality in many areas.

Measures of water quality such as dissolved oxygen or total phosphorus may not have much meaning to most people. What matters most to them is how changes in such measures affect various uses of the water body. One such use of rivers and lakes is recreational fishing. To the extent that reduced pollution results in more recreation opportunities and higher quality recreation, fishermen are made better off. Researchers at RFF have developed a method for classifying water bodies by the quality of fishing opportunities they present and for translating changes in water quality as predicted by the RFF water quality network model into changes in the availability of water for various categories of fishing.

Using the estimates of actual discharges in 1972, the model predicted that only 4.2% of the waters covered by the model fell into the unfishable category in 1972. The implementation of the CWA was predicted to increase the total fishable area by only 0.35**%.** The major benefit of the law came from improving the quality of fishing in already fishable areas.

These results from modelling exercises are consistent with actual observations of water quality and the analysis of water quality monitoring data. One comprehensive analysis of trends in a large number of water quality measures covered the period 1974-198 1. Stations showing improvements in bacteria and dissolved oxygen levels outnumbered stations showing declines (substantially in the case of bacteria); but fewer than 20% of the stations showed improvements in these measures. As for phosphorus and suspended sediments, the percentage of stations showing improvements (11% and 14% respectively) were approximately equal to the percentages showing declines (13% and 13% respectively). Stations showing increasing trends in nitrates outnumbered those showing decreases by *4.5* to one. The authors attribute this largely to increases in fertilized agricultural acreage and to atmospheric deposition of nitrates in eastern watersheds.

Economic Issues

From an economic perspective, not all interventions in behalf of environmental protection are desirable per se. Some may cost more than they are worth — not only in terms of private market values but also in terms of individual and social welfare. Governmental intervention to control pollution is justified on grounds of economic efficiency if the beneficial effects (broadly defined) to society as a whole from such action outweigh the costs. Examinations of costs and beneficial effects should become an integral part of the process of establishing pollution control objectives.

Unfortunately, there have been no studies of the aggregate national benefits of the CWA that deal in a fully satisfactory manner with all phases of the relationship between policy induced reductions in pollution and the values of improved uses of our waters. Lacking any fully satisfactory national aggregate benefit estimates, the analyst who wishes to make a benefit-cost comparison for the CWA must do so through some kind of synthesis and extrapolation from the most soundly based of existing studies.

I prepared such an estimate of national benefits for the Council of Environmental Quality in 1979. It was based on a review of approximately twenty empirical studies. Estimates of benefits were provided for four broad categories: recreation, nonuser benefits stemming from aesthetic and ecological changes, improved productivity of commercial fisheries, and a variety of diversionary uses including municipal and industrial water supplies.

The national benefits to the U.S. population in 1985 were estimated to be at least $5.7 billion per year (in 1984 dollars), although they could be as high as $27.7 billion per year. The most likely value is $14.0 billion per year. Of this total, about half is due to improvements in water-based recreation opportunities.

Based on data from the Council on Environmental Quality and the Environmental Protection Agency, a reasonable estimate of the annual costs of complying with the CWA for the year 1985 is roughly $25-30 billion (in 1984 dollars). This is substantially higher than the most likely estimate of the benefits to be realized in 1985. In fact, the range of the estimates for benefits ($5.7-27.7 billion) barely overlaps the bottom end of the estimated range for costs. On balance, therefore, it appears that the benefit-cost relationship for the CWA is unfavorable.

This suggests that it is important to seek ways that present policies could be modified to improve the benefit- cost relationship. Broadly speaking, there are two such avenues to be investigated.

The first involves lowering targets or pollution control requirements where, at the margin, the costs of current controls substantially exceed the benefits. If we were to adopt the principle that policies should be designed to maximize the net benefits from pollution control activities, then effluent limitations on individual dischargers would emerge as the result of a two-part analytical process. The first part would involve the establishment of a set of water quality standards for each water body so that the incremental or marginal benefits of raising water quality to that point just equal the marginal costs of doing so. In those cases where marginal pollution control costs were high, the resulting water quality standards might be lower than the fishable-swimmable national target. But in other cases this economic benefit-cost approach might lead to very high standards for water quality.

The second part would then involve determining the individual effluent limitations necessary to meet the water quality standards for each water body. These requirements might vary across dischargers not only because of differences in industrial processes and control technologies but also because of differences in costs and impacts on water quality. This approach to policy making could save resources by imposing fewer stringent effluent limitations where the marginal costs of achieving fishable-swimmable water quality were greater than the marginal benefits of doing so.

The second avenue involves seeking ways of reducing the costs of achieving the existing goals, that is, by improving the cost-effectiveness of pollution control policy. By cost-effectiveness economists mean meeting water quality standards at the lowest possible total cost. The importance of achieving cost-effective pollution control policies should be self evident. Any cost savings that can be achieved frees resources that can be used to produce other goods and services of value to people. If some change in the allocation of cleanup requirements among dischargers results in a lower total cost of controlling pollution without degrading water quality, then society is clearly better off.

A pollution control policy is cost-effective only if it allocates the responsibility for cleanup among sources so that the marginal cost of improving water quality at any location is the same for all sources. Differences in the marginal costs of improving water quality can arise both from variations in the marginal cost of reducing discharges across sources and from differences among sources in the effect of discharges on water quality.

A major criticism of technology-based standards from an economic standpoint is that they are virtually certain to result in higher than necessary total costs for any particular level of water quality. There is nothing in the logic or the procedures for setting technology-based limits to assure that the conditions for cost minimization will be satisfied. Since the marginal cost of control is not systematically considered, technology-based standards are not likely to result in equal marginal costs across

sources. There is ample evidence that marginal costs of control do vary widely across sources now.

There are several modifications of present policy that would go a long way toward improving its cost-effectiveness. The one most favored by economists in the past has been to place a tax or charge on each unit of each pollutant discharged and to allow each discharger to choose the degree of cleanup that minimizes its total cost (cleanup cost plus tax bill). The effluent charge strategy provides a certain and graduated incentive to firms by making pollution itself a cost of production. And it provides an incentive for innovation and technological change in pollution control. A properly designed system of effluent charges will also be cost-effective because all sources will equate their marginal costs of control with the charge.

Another approach with essentially the same incentive and cost minimizing effects is a system of tradeable or marketable discharge permits. The pollution control agency could issue a limited number of pollution permits or "tickets." Each ticket would entitle its owner to discharge one unit of pollution during a specified period. The agency could either distribute the tickets free of charge to polluters on some basis or auction them off to the highest bidders. Dischargers could also buy and sell permits among themselves.

A small step toward obtaining the economic advantages of tradeable discharge permits is the application of the "bubble" concept to water pollution control. In a major industrial facility such as an integrated steel mill there may be several separate activities or processes, each subject to a different effluent limitation. Many of these activities discharge the same substance. Yet the marginal costs of control may be quite different across activities. As a result, the total cost of controlling the aggregate discharge from the plant is often higher than necessary. In such cases, plant managers should be allowed to adjust treatment levels on different activities if they can lower total treatment costs as long as the total amount of a pollutant discharged from the plant does not exceed the aggregate of the effluent limitations for individual processes. EPA is now allowing such bubble tradeoffs at integrated steel mills if the tradeoffs result in a net reduction of the total amount of pollutants discharged. Present law should be modified as necessary to facilitate similar intraplant trades in all industrial categories.

Conclusions

Three major themes can be traced through this discussion of water pollution control policy. They are: the importance of comparing benefits and costs, the value of seeking more cost-effective control programs, and the potential role for economic incentives such as charges or marketable discharge permits.

We saw that in aggregate it appears that the costs of the present policy substantially outweigh the benefits. Yet if the goal of fishable-swimmable water quality is to be met everywhere, even more costs will have to be incurred, If it is accepted that the resources presently devoted to water pollution control are scarce, involve opportunity costs, and may have more valuable uses in other activities, then a reconsideration of some water quality goals may be in order. This may mean accepting less than fishable-swimmable quality water where the costs of obtaining it are inordinately high.

We have argued that one way to improve the benefit-cost relationship of the existing policy is to seek more cost- effective means of achieving given standards. The emphasis on equal treatment of dischargers or uniformity of cleanup requirements has meant that the cost of reaching present water quality objectives are substantially higher than necessary. This means fewer of society's resources are available for other valuable uses. More emphasis should be given to the development of cost-effective means of achieving targets. We have discussed the potential role of charges or marketable discharge permits in moving toward a more cost-effective pollution control policy.

Finally, progress toward attaining water pollution control objectives has been slow. Time-tables have not been kept, and deadlines have been reached and passed without full compliance with the legislated objectives. These shortfalls in implementation are due in substantial part to the complexities of the task. But a major share of the responsibility for the slow pace of progress must be assigned to the inappropriate incentive structures created by the regulatory approach to pollution control. There are many opportunities for restructuring incentives through marketable discharge permits or effluent charges.

RESTORING AND MAINTAINING THE INTEGRITY OF THE NATION'S WATER: AN ASSESSMENT OF THE CLEAN WATER ACT

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Introduction

The federal Clean Water Act is intended to "restore and maintain the chemical, physical and biological integrity of the nation's water" (Clean Water Act, 101(a), United States Code, Vol. 33, 125 1(a)). Despite the billions of dollars that have been spent to control water pollution, the available measures of water quality present an uneven picture: improvements in some areas and deterioration in others (Conservation Foundation, 91). Some have concluded that the predominant focus on regulating the discharge of effluents from discrete sources, so-called "point source" pollution control, must be broadened to reflect the more complex nature of the factors affecting water quality. This article provides a brief overview of the evolution of the Clean Water Act and its major provisions and discusses several areas where improvements are needed.

Evolution of the Clean Water Act

In a series of enactments between 1948 and 1965 Congress moved cautiously toward establishing a national strategy for water pollution control. The early strategy involved support for studies and encouragement of interstate cooperation. The 1965 act provided for the creation of water quality standards for interstate streams.

By 1972 Congress was ready to establish a comprehensive national program for water pollution control. It chose to pursue its goal of clean water primarily through technological controls on all discharges of pollutants from discrete sources such as pipes. Discharges of effluent from point sources may occur only subject to uniform control standards imposed in a National Pollution Discharge Elimination System (NPDES) permit. Water quality standards are retained but are given a secondary role in achieving the objectives of the Act. The substantial additional amendments in 1977 aimed primarily at "fine tuning" the fundamental framework established in 1972. Considerable emphasis was placed on the control of toxic pollutants.

In 1987 Congress again responded primarily to specific concerns with the existing act and did not alter its basic approach. It did establish a stronger program for bringing municipal and industrial storm water discharges under control, and it made a move in the direction of addressing "nonpoint source" pollution. The next section summarizes the basic federal water pollution control framework now in effect.

The Legal Framework

1. NPDES Permits., The federal statutory provision governing water pollution control set forth a detailed set of national requirements. At the center is the NPDES program under which every point source discharge is regulated. Permits limit discharges according to "best technology" standards of performance for particular categories of sources. The Clean Water Act invites the states to administer the NPDES program under specified minimum requirements and 37 states have accepted.

In retrospect, clearly Congress understood the water quality problem in 1972 as one of industrial and sewage pollution. Its simple remedy to

this problem was to subject industrial and municipal discharges to progressively more stringent, technologically based effluent limitations until the pollution was effectively eliminated. All similar sources of discharge would be treated equally according to standards or guidelines developed by the Environmental Protection Agency (EPA). The burden placed on municipalities would be eased through a generous grants program for construction of the necessary treatment facilities. The "command and control" technique available through requiring all point source discharges to obtain an NPDES permit would assure compliance with the law. Perhaps the stated goals of "fishable, swimmable" water by 1983 and no discharge of pollutants by 1985 even seemed realistic.

In fact, EPA has struggled mightily with establishing effluent standards. The 1972 act required EPA to establish guidelines within one year concerning the degree of effluent reduction attainable under the 1977 standard of "best practicable technology" and the 1983 standard of "best available technology economically available" for all equivalent categories of discharges. The act recognized 27 categories of industrial sources and, by 1975, EPA had distinguished 200 categories of industrial processes that required separate guidelines (Rodgers, 407). The 1977 act extended the compliance deadline in several respects and the 1987 act further extended certain compliance requirements. One basis for these extensions was the inability of EPA to develop the requisite guidelines in a timely manner.

Rodgers (447) has commented that "[p]ublically owned treatment works (POTW) are very much the soft underbelly of the federal point source cleanup program." The compliance of these facilities with Clean Water Act requirements generally has been poor, and Congress has responded primarily by weakening the requirements. Under the 1972 act, POTW were to utilize secondary treatment by 1977 and were to operate under a "best practicable waste treatment" standard by 1983. The secondary treatment requirement has been extended up to 1988 in some cases, and the best practicable standard became important primarily in relation to the massive construction grants program supporting new municipal treatment facilities.

Congress, however, has been increasingly tough on dischargers whose wastes go to a POTW. Such wastes must be pretreated if necessary to avoid a special burden on the normal sewage treatment process. Certain pollutants may not be included in discharges going to POTW.

2. Control of Toxic Pollutants. Congress has given special attention to the control of toxic pollutants in the Clean Water Act. The 1972 act contains a general policy that the discharge of toxic pollutants in toxic amounts be prohibited. Toxic pollutants are defined very broadly. For all listed toxics, effluents standards are to be established at a level that ensures "an ample margin of safety."

EPA was supposed to produce proposed effluent standards for listed toxic effluents within six months following the passage of the 1972 act. With little progress apparent by 1977, Congress adopted some major changes that allowed EPA to utilize an industry-by-industry, technology based best available technology approach as an option to the pollutant-by-pollutant, health based approach.

Concern that stream water quality standards were being violated in some cases even with toxic effluents limited to the best technology standard led Congress in 1987 to establish a special program for toxics control. Areas of noncompliance due to toxics are to be identified as are the specific sources of the toxic contamination. A compliance strategy is to be formulated that will bring the area into compliance within three years.

3. Water Quality Standards. Water pollution control is not an end in itself but a means to an end that is to allow water to support valuable uses. Water quality standards are the means by which uses of water are designated and protected. Water quality criteria, essentially the levels of pollutants in a given volume of water, can be established for

a water body to protect desired uses. Congress initiated this approach in 1965 and continued it in 1972. States are required to establish designated uses for all surface water including for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes. The criteria established to protect the designated uses commonly reflect the guidelines prepared by EPA. States are to revisit their water quality standards every three years.

Dissatisfaction with the experience of trying to control water pollution through use of water quality standards led directly to the emphasis in the 1972 act on specific controls of discharges. Water quality standards set a goal for protecting a water body but they do not become operable until the standard is exceeded. Activities causing water quality impairment up to the standard are acceptable. The public enforcement agency carries the burden of discovering the causes of any water quality violation and then devising a control strategy. There is no generalized set of rules describing the manner in which the control burden should be allocated.

Nevertheless, as the technical and economic limits of point source water pollution control are being reached, there is renewed interest in water quality-based approaches. The Clean Water Act provides that point sources may be subjected to more stringent requirements than "best technology" if necessary to meet water quality standards (Clean Water Act, 301(b)(1)(c)). In water-quality limited stream segments, states can establish a "total maximum daily load" of pollutants that will achieve water quality standards and then assign a permissible share to individual dischargers. Another provision requires applicants for federal licenses or permits for activities involving water discharges to obtain a certification from the affected state that the discharges will comply with state water quality standards (Clean Water Act, 401(a)). EPA regulations require state water quality programs to include provisions to prevent degradation of existing water quality (1) where necessary to maintain existing uses and (2) where necessary to maintain certain high quality waters.

4. Nonpoint Source Control. In 1972, Congress certainly understood that not all pollution came from specific or discrete sources. At the same time, it might be fair to say that Congress simply did not know what to do about nonpoint source pollution. Under Section 208 it created a planning process by which states were to identify various nonpoint pollution problems and then were to devise means to control these problems "to the extent feasible." In 1977 Congress recognized "best management practices" as the standard for controlling nonpoint pollution sources.

In 1987, Congress added Section 319 to the Clean Water Act. This section picks up the pace slightly by requiring the states to submit an assessment report to EPA that (1) identifies state waters not meeting water quality standards because of nonpoint source pollution, (2) identifies the general and specific nonpoint sources causing the problems, (3) describes processes for identifying best management practices that can address the identified problems, and (4) identifies programs for controlling nonpoint source pollution. Then states are to develop a management plan for the control of these sources.

5. Dredge and Fill Permits. Under Section 404, the Secretary of the Army (Corps of Engineers) issues permits for any discharge of dredged or fill material into navigable waters. The primary thrust of this provision is to regulate activities that affect wetland areas but the reach is much more broad. Major amendments in 1977 narrowed the scope of the 404 requirement by excluding a variety of activities including farming and timber cutting. A general or "nationwide" permit mechanism was introduced to cover activities with "minimum adverse environmental effects." The courts have interpreted "navigable waters" very liberally to include all waters of the U.S. including wetlands.

In deciding whether to issue a permit the Corps engages in a "public interest" review process involving a balancing of the benefits against the

detriments. A curious and uneasy relationship with EPA is mandated with EPA given the authority to establish "guidelines" concerning protection of ecological values that the Corps must follow. EPA also is given a final veto authority if it determines that the discharge "will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas" (404(c)).

An Assessment of the Clean Water Act

According to Pederson (70), "[n]inty-six percent of streams and 64% of lakes meet the water quality standards that have been set for them, almost all of which call for water quality sufficient to support fish and wildlife." While there have been only limited improvements in water quality, the overall level of quality appears to be good. This suggests that the primary tasks of water quality law should be to maintain existing water quality while bringing about improvements in those areas not meeting desired quality standards.

The point source program is now well implemented and, at least for industrial sources, appears to be working well. There appears to be room, however, for improvement in the operation of municipal sewage treatment facilities. The use of uniform, technology-based effluent standards very likely is economically inefficient but is unlikely to be changed at this point.

It is increasingly evident that water quality improvement will depend on control of nonpoint source pollution. Gould (463) states that "[n]onpoint sources cause the predominant amount of pollution in sixty-five percent of streams and rivers in the United States not meeting water quality standards." Agriculture is the major cause of nonpoint source problems, causing loadings of sediment, nutrients, pesticides, and other contaminants to move into surface and groundwater sources.

Particularly in the western U.S. it will also be necessary to come to grips with the manner in which water use itself affects water quality. Getches, MacDonnell, and Rice (1990) have characterized these effects as depletion degradation, physical alteration, pollution migration, and incidental pollution. Some of these effects are considered nonpoint source problems, but many are completely outside the reach of the Clean Water Act.

The Clean Water Act's "fishable/swimmable" goal could be given real meaning by making that a national requirement. In fact, apparently most water in the U.S. already meets this standard. Making this a requirement would force states to focus their programs on those areas in greatest need of improvement. The states should be given considerable flexibility in how they bring problem waters into compliance. Solutions should be tailored to meet the needs of individual situations. Recognizing that there are situations in which the fishable/swimmable standard is not feasible, there should be a process by which states can set alternative standards.

Congress should adopt EPA's antidegradation policy and firmly incorporate this requirement into the Clean Water Act. The object should be to protect the existing and achievable uses of water. Special protection should be afforded very high quality waters.

The nature and extent of nonpoint source problems should become better understood as a consequence of the state assessments required under Section 319. Effective action seems unlikely, however, since the provision requires little more than had previously been required. The simple expedient of making the fishable/swimmable standard a requirement would force the states to deal with nonpoint sources that keep water from meeting this standard.

Conclusion

The United States has invested hundreds of billions of dollars in water pollution control since 1972. "Clean water" continues to be an important national priority. We have committed ourselves to

a basic regulatory strategy that is unlikely to change in a major way in the foreseeable future.

The goal of the Clean Water Act is to restore and maintain the integrity of the nation's waters and to make these waters usable at a level that supports fisheries and recreation. It is time to take the next step and make this goal a requirement.

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FINANCING UNDER THE CLEAN WATER ACT: THE MOVE FROM FEDERAL GRANTS TO STATE LOANS*

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Introduction

The Clean Water Act of 1987 changed dramatically the way that the nation's *$83.5* billion in wastewater treatment needs (to meet population in year 2008) will be financed (U.S. EPA, February 1989). The Construction Grants Program that provided more than *$57* billion to local governments for treatment plant construction since 1972 was phased out and replaced by State Revolving Funds (SRFs). SRFs are authorized to provide a range of loan assistance to local governments for wastewater treatment plant construction, estuary protection, and non-point source pollution projects.

Congress created the SRF Program to develop financial capability at the state level as a tradeoff to reduced federal commitment. As states and local governments must increasingly find resources to compensate for federal retrenchment, in the area of environmental protection as elsewhere, SRFs could prove to be an important new mechanism to help fill the gap between investment needs and resources available. At the same time, the move to SRFs increases state and local financial responsibilities. Their ability to sustain SRFs and to meet wastewater treatment needs depends on the broader picture of resources available and competing demands for those resources. SRF's effectiveness in meeting wastewater treatment needs is also linked to the regulatory and statutory framework for SRFs.

This article outlines the history of financing wastewater treatment facilities, provides an overview of the SRF program, and discusses some of the issues that will affect the ability of the SRFs to meet our nation's wastewater treatment needs.

The views and positions expressed in this article are those of the aut hor and do not represent the posit ion of the GAO.

Trends in Financing Wastewater Treatment Plants

The federal government began investing in wastewater treatment plant construction in the 1950s. Two factors supported a federal financial role. First, the huge capital outlays associated with the plants made it difficult for many local governments to finance the facilities on their own. In addition, the health and environmental benefits of improving wastewater treatment are not confined within local or state borders. When the Federal Water Pollution Control Act of 1956 authorized federal grants for the construction of wastewater treatment plants, the small federal role was considered necessary and important.

By 1972, however, Congress perceived that state and local governments were not investing enough money in wastewater treatment plant construction, and as a result, needs were growing rapidly. The Clean Water Act passed that year included a much expanded financing role for the federal government. The Act authorized $18 billion in construction grants to local governments through 1976. At that time, Congress considered the federal financial commitment a temporary subsidy of states to meet the large and growing investment needs for wastewater treatment.

The 1972 Clean Water Act also required wastewater treatment plants to provide secondary treatment of wastewater, further increasing investment demands. While the federal government

provided approximately $4 billion in grants each year, it was not enough to solve the wastewater problem as Congress had intended. Many local governments, especially small communities, were at the bottom of a long list of communities applying for grant assistance. By 1980, EPA estimated that governments would have to spend $119 billion to meet the needs of all eligible sewage facilities in the country. If stormwater collection and treatment systems were included, EPA estimated that another $112 billion would be required (U.S. EPA, January 1981).

The federal budget concerns of the 1980s caused Congress to look carefully at the relatively large outlays of the Construction Grants Program. At the same time, the grant program was criticized because the availability of "free" money caused local governments to undervalue less capital-intensive, and sometimes more appropriate, solutions to meeting their wastewater treatment needs.

Furthermore, responsibility for paying for the facilities was removed from the primary beneficiaries, as federal dollars were paying for a large percentage of local wastewater treatment facilities. As a result, local governments were underinvesting in operation and maintenance. They did not have the same incentives to protect their investment as if local funds had paid for plants. In fact, this large-scale underinvestment was confirmed in a 1981 report by the U.S. General Accounting Office (U.S. General Accounting Office, 1981). GAO's report indicated that half of the municipal treatment plants studied were not charging users enough to cover operation and maintenance costs. Only eight percent of the plants were setting aside funds for plant replacement. Furthermore, sixty-three percent of plants surveyed indicated that they would request additional funding from the federal government for plant replacement.

Creation of the State Revolving Loan Program

In the 1987 amendments to the Clean Water Act, Congress decided to create a permanent source of funding at the state level to pay for construction of wastewater treatment plants. The Construction Grants Program would phase Out over four years, to be replaced by State Revolving Funds. The SRFs are authorized to provide various types of loan assistance to local governments. Uses of the funds are expanded from those authorized in the Construction Grant Program to include estuary protection and non-point source pollution control, in addition to financing construction of wastewater treatment facilities.

Recognizing the continued importance of the federal role in ensuring adequate wastewater treatment, Congress authorized federal capitalization grants of $8.4 billion until 1994. States are required to contribute a 20 percent match for each capitalization grant awarded. The local financial obligation is larger than under the Construction Grants Program as they must repay assistance offered through the SRF. However, interest rates are subsidized and costs eligible for assistance are expanded from those authorized under the Construction Grants Program.

Congress restricted the use of the federal capitalization grants to ensure that secondary treatment requirements of the Clean Water Act were met as a priority. In addition, reporting and monitoring requirements were added to the authorizing legislation to protect the federal investment and to ensure the financial integrity of the SRFs. The two most important reporting requirements are the Intended Use Plan and Annual Report. States must submit an Intended Use Plan each year outlining how the funds will be used, leveraging plans, and other important details about projects to be funded. At the end of the year, states must submit Annual Reports with information on how the money was actually used and the financial status of the fund.

EPA has attempted to reduce the burden of reporting on the states by requiring a one-time administrative agreement, setting forth the general operating procedures of the fund. The agreements do not have to be revised each year unless states change the general structure of their programs.

Congress intended states to develop programs to meet their own needs with a minimum of intervention by the federal government. As a result, EPA will have a different role vis a vis state and local governments than it had in the Construction Grants Program. EPA's objective is to act as a facilitator of state programs. The agency has provided a range of guidance documents and training seminars for states, to assist in program development and financial management. After 1994, when the capitalization grants end, EPA's role will diminish further.

Establishment of State Revolving Funds

States are slowly developing their State Revolving Loan Fund Programs. While many states had similar programs in place before the 1987 Clean Water Act, others were less experienced in administering a revolving loan program. Most states have received two or more capitalization grants; one state, Tennessee, has received four grants. At the end of Fiscal Year 1990, all 50 states and Puerto Rico had received at least one capitalization grant. However, many state programs are not in final form. States created SRF frameworks in order to secure capitalization grants but plan to implement details of the program' over time.

One reason for the slow start in implementing programs is that it was necessary for states to market the SRFs to local governments that were accustomed to the idea of federal grant subsidies. States had to convince communities that their only option for EPA subsidies henceforth was loan assistance. Some states have offered additional special incentives to cities to encourage their application for SRF assistance. To improve their loan portfolio for leveraging purposes, for example, states may offer low interest rates to financially strong cities so that they will participate in the SRF Program.

EPA expects that the flexible statutory and regulatory framework will result in state programs uniquely structured to meet needs faced by particular states. In fact, as states have begun to finalize their programs, important differences have emerged. For example, financial strategies differ based on demands for resources. States with large investment needs, such as New York, have implemented aggressive plans to leverage additional money for the fund by issuing bonds secured by the federal capitalization grants. Other states that do not have a large demand for wastewater treatment investment, including several mid-Western states, do not plan to leverage additional resources.

In contrast to the diversity in the structure of SRFs, trends in the use of funds have emerged, both in the types of projects funded and the communities that receive assistance. First, very few states have offered assistance for non-point source pollution projects and none for estuary protection. Washington is one of the few states that has established a "set-aside" policy for non-point and estuary projects to ensure that a minimum percentage of SRF resources are spent for these needs. While many states plan to devote SRF resources to these needs at some point in the future, wastewater treatment needs in most states far surpass needs identified in the areas of non-point source pollution and estuary protection. However, it is likely that states underestimate non-point and estuary needs. These programs are new and the extent of problems facing states is not clear. In addition, non-point and estuary pollution have been difficult to address due to the lack of focus on non-point pollution sources in the past. Non-point sources are significant contributors to estuary pollution problems. As a result, states are more likely to direct the fund towards wastewater treatment facilities. While SRFs are presented by EPA as an important source of funding for non-point and estuary protection projects, it may be necessary to examine alternatives to help meet these needs.

A second issue that has been raised regarding the use of funds is that a disproportionate number of the communities receiving assistance are large cities, given the percentage of all cities that are large nationally. This may be due, in part, to the fact that SRFs are limited to providing loan assistance. States cannot provide grants through the SRFs. As with any loan, communities that are most able to repay are most competitive for the limited SRF resources. Reinforcing this situation is the need for states that leverage to establish an attractive loan portfolio so that they can issue bonds at the most favorable rates. Providing loan assistance to marginally qualified communities can damage states' ability to leverage funds in the bond market. In addition to the increased potential for loan defaults, the subsidy to less advantaged communities might have to be higher, thereby reducing the rate at which the fund "revolves" or replenishes. Finally, Congress established a 20-year limit on loan terms, which has an important impact on user charges. The 20-year loan term reduces the ability of less advantaged communities to qualify for assistance and is considered low in comparison with 28-30 year loan terms that exist for some state assistance programs for wastewater treatment facilities.

The "small community problem" in securing finance for wastewater treatment facilities is not a new one. Under the Construction Grants Program, small towns received many fewer grants than they should have, given their number and population. In many cases, this is because small communities could not raise enough money to cover their share of the construction costs. In 1981, EPA reported that communities under 5,000 were particularly affected by a disparity in grant awards based on community size (U.S. EPA, January 198 1). The communities under 5,000 received only *55* percent of the grants awarded even though they represented 80 percent of all communities. Furthermore, they received only 12 percent of the dollar value of all awards, although they contained 31 percent of the national population.

The cumulative health and environmental impacts on small communities of the unbalanced distribution of federal subsidies is not well understood. However, the disparity could be worsened under the SRF Program due to the potential bias in the loan program toward providing assistance to wealthier communities.

Other Factors Affecting the Ability of SRFs to Meet Needs

Several other factors will affect the success of SRFs. Some of these factors raise issues that relate to the statutory and regulatory framework for SRFs and others deal with broader concerns.

Statutory and regulatory issues that affect the SRF deal primarily with requirements that increase state administrative costs or project costs for local governments. Among these are requirements applicable to all projects that receive federal funds, such as applying Davis-Bacon wage provisions to treatment works construction. Other requirements are specific to the Clean Water Act and have been carried forward from the Construction Grants Program, such as requiring that applicants for assistance study opportunities for using innovative and alternative treatment technologies.

States argue that these requirements increase costs unnecessarily, precluding less advantaged communities from receiving SRF assistance and requiring states to offer higher subsidies to offset the costs of federal requirements. States view SRFs as their own and argue that they should be allowed to develop programs to meet their particular needs without federal intervention. On the other hand, the federal investment in the SRFs and broader interest in maintaining their financial integrity support the view that led Congress to place certain restrictions on the use of funds. Most of the restrictions, in fact, are tied to the capitalization grants and not to state contributions or to interest earned on the fund.

Another statutory requirement that affects the ability of SRFs to meet wastewater needs is the limitation on offering assistance to treatment works

that are publicly-owned. Therefore, privately-owned wastewater treatment plants are not eligible for the same subsidies as publicly-owned plants. This restriction and the disincentives to private investment that were introduced in the Tax Reform Act of 1986, such as lengthened depreciation schedules, reduce incentives for private companies to invest in wastewater treatment plants. While private operation and maintenance of plants is allowed as a condition of the assistance, even partial private ownership of a plant disqualifies them from SRF assistance. This is particularly discouraging given the vast investment needs that currently exist and raises questions regarding the ability to meet secondary treatment requirements of plants that are currently owned by private companies.

The Broader Context for Financing Under the Clean Water Act

The ability of states and local governments to meet the new financial responsibilities associated with the move from Construction Grants to SRFs can only be understood in the context of overall trends in environmental spending. Increasing demands on state and local resources will mean that demands for wastewater investment will have to compete with a growing number of other demands for environmental expenditures.

EPA examined trends in spending by each level of government, and found that, if current trends continue, EPA's share of total environmental expenditures will fall from 18 percent in 1981 to 8 percent in 2000 (U.S. EPA, May 1990). While this study projected that states' share of environmental expenditures will stay about the same overall, a study of state expenditures indicates large funding shortfalls for water quality programs (U.S. EPA, October 1989). In the area of water quality management, including expenditures associated with the Safe Drinking Water Act and the Clean Water Act, EPA's Office of Water estimated a state funding shortfall which increases yearly and will reach approximately $409 million in 1992.

The state shortfall is partially due to the fact that EPA grants to states have decreased. In 1982, EPA grants made up 49 percent of state expenditures for water quality programs, but by 1986, had fallen to 33 percent of state budgets for these programs (U.S. EPA, May 1990). Two factors indicate a more serious state financing problem. First, these data do not include the impacts of phasing out the Construction Grant Program. Second, EPA grants as a percentage of state budgets have decreased in other program areas as well. For hazardous and solid waste programs, for example, EPA grants fell from 76 percent of state budgets in 1982 to 40 percent in 1986.

The impact of increased financial demands on the ability of local governments to meet waste-water investment needs is also important. If local governments cannot meet the local share of costs for wastewater treatment plant construction, SRF funds will not be used or will only be used by a small group of wealthier communities. EPA's study of expenditures for each level of government projects that local governments' share of total environmental spending will increase from 76 percent in 1981, to 87 percent in 2000. In constant dollars, local government expenditures on the environment will rise from $26.3 billion in 1981 to $53.7 billion in 2000.

Summary

Establishment of the SRF Program has met one of Congress' principal objectives in amending the financing procedures in the Clean Water Act, reducing the federal responsibility for wastewater treatment plant construction. From an efficiency perspective, local investment decisions will probably improve as a result of the move from grants to loans. Local governments have a greater incentive to adequately operate and maintain their facilities, if the pressure on user charges is not too great. Also, less capital-intensive solutions to wastewater treatment needs may be sought where appropriate. However, the success of SRFs in meeting authorized needs depends on a number of factors, internal and external to the fund. Some of the limita-

tions identified may argue for a more flexible statutory framework and others suggest the need for a comprehensive examination of state and local financial responsibilities for environmental protection.

Moving to SRFs does not resolve the fundamental problem for governments in providing wastewater treatment facilities; vast investment needs are competing for increasingly limited resources. Creation of a state funding mechanism shifts the ultimate financial responsibility from Congress to state legislatures. Therefore, the success of the SRFs will depend, in large part, on the ability of states to meet the financial demands associated with SRFs and on the ability of local governments to meet the increased financing responsibilities.

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THE CLEAN WATER ACT: ACCOMPLISHMENTS

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Introduction

Water, our most precious and vital natural resource, has long been the subject of national debate. Congressional interest in the protection of water dates back to the early 1940s. Early legislation was primarily a statement of goals and direction, as opposed to the contemporary legislative and prescriptive mandates we now encounter. Over time, a strong Federal, State, and local partnership has evolved.

The Federal Program

The mix of interest and politics was never more prevalent than during the creation of the 1972 Federal Water Pollution Control Act (The Clean Water Act) and Earth Day in 1970 which brought a new national consciousness and creation of the U.S. Environmental Protection Agency (USEPA).

The new statute imposed a patchwork of technology based controls, water quality standards, planning requirements, compliance deadlines, penalties, and a municipal construction grants program. Congress provided for, but perpetually underfunded, grants for State management of the national program. The Act put into place a long range goal for zero discharge and called for fishable/swimmable waters throughout the country. It was anticipated that within 10 years, all sewerage facilities would have secondary treatment and that all waters of the United States would indeed be fishable and swimmable. But, the total cost of accomplishing that objective was not well understood.

As the money began to flow at the Federal, State and local levels, as well as in the private sector, programs began to take shape, and the Clean Water Act became a model for environmental legislation. By the mid 1970's, States reported to Congress on the status of their programs under Section 305(b) of the Act. However, the data the collected and consolidated proved to be inadequate when the first major assault was launched against the program in 1981.

It came from the top, when President Ronald Reagan declared in his budget address, "I will not request, nor will I accept funding for the construction grants program until and unless significant reforms are legislatively instituted." In 1981, Congress responded swiftly by reforming and downsizing the program and in 1987 by increasing pollution control requirements.

The State's Evaluation of Progress

The Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), which represents the officials who manage the water programs in the States, decided that a national report card on the nation's accomplishments was in order. ASIWPCA launched America's Clean Water: The States' Evaluation of Progress 1972-1982. The Association brought together a steering committee of senior State and USEPA officials to design a reporting format that would be both concise and standardized among the States. States used a combination of the following to reach their conclusions about water quality:

+ Long-term trend monitoring records,

+ Short-term intensive surveys, and

+ Professional judgments and direct observations.

The results were phenomenal and revolutionized the 305(b) reporting process. Even with substantial increases in the number of waste sources, pollution was being reduced. Most waters maintained their quality despite the pressures of wastes from more people, more industry, and more complex pollutants. Other waters showed dramatic improvements, while regrettably, some degraded. As more traditional problems were addressed, new problems — such as toxic pollutants and groundwater contamination — were appearing on the horizon.

The State documentation indicated that in the decade between 1972 and 1982, when the U.S. population grew by 11% and water use increased for industry and recreation:

+ 47,000 stream miles and 390,000 lake acres had improved in quality,
+ 296,000 miles and 10 million acres maintained quality,
+ 11,000 miles and 1.7 million acres degraded, and
+ Changes in another 90,000 miles and 4.2 million acres were unknown.

Designated Uses —As A Driving Concept — All waters by law must have designated "beneficial uses" that must be protected and achieved. These uses establish the level of quality that drives water pollution control. States set criteria to protect those uses, applying USEPA guidelines based on a range of scientific information on chemical or habitat conditions that must be met in order to maintain the use. Together, uses and criteria constitute water quality standards which USEPA must approve. States evaluate water quality based on the extent to which those uses are supported. The most recent information complied for the 1988 305(b) report indicates:

Degree of Designated Use Support in the Nation's Assessed Waters

	River Miles	**Lake Acres**	Estuary **Square Miles**
Do not support uses	10% (53,499)	10% (1,591,391)	6% (1,488)
Partially support uses	20% (104,632)	17% (12,701,577)	23% (6,078)
Fully support uses	70% (361,332)	74% (12,021,044)	72% (19,110)
Assessed	519,412	16,313,962	26,628
Total in U.S.	1,800,000	39,400,000	36,000

Reducing Municipal Pollutants—The most widely used measure of municipal pollution is the extent to which the organic content of the waste depletes oxygen in the receiving water. Between 1972 and 1982, States found that the amount of oxygen-demanding pollutants entering the nation's wastewater plants grew by 12%. During the same time span, the amount released by these plants into waterways dropped by 46%. Had treatment capabilities not improved at a faster rate than the nation's population and pollution were growing, States collectively estimate that 1982 discharges would have been 191% greater than the levels actually discharged. Since 1982, attention has also turned to toxics. Industrial sources discharging to municipal plants must "pretreat" their wastes. Municipalities must increasingly monitor for toxics and urban sources (e.g. streets and households) are becoming a more prominent concern.

What Has It Cost? Since 1972, a total of $56.2 billion was spent in capital construction of publicly owned treatment plants. And, the States and USEPA determined in the 1988 "Needs Survey" that over $80 billion was still required. With only a modest $260 per capita expenditure for municipal wastewater system capital costs, significant improvements in water quality can be demonstrated nationwide between 1972 and 1982. Of the approximately 224 million people in the U.S. in 1982, States found:

+ 142 million were served by secondary treatment or by more advanced levels *(57* million more than in 1972);

+ The population served by sewer lines discharging raw wastewater to streams dropped from *5* million in 1972 to 1 million; and

+ The number of people requiring but not receiving public wastewater collection and treatment dropped from 21 million to 14 million.

Treating Industrial Wastewater — Industry responded positively to the mandates of the Clean Water Act. Since 1972, industrial dischargers have invested heavily to reduce their water pollution. While information on total expenditures was not available for each State in the ASIWPCA report, there are numerous indicators of improved water quality because of reduced discharges. Under the Act, industries must meet discharge limits based on the "best practicable" and "best available" treatment technologies as defined by USEPA. If these are not adequate to achieve water quality standards, more stringent controls must be applied. One key measure of progress in the industrial cleanup effort is increased compliance with State and Federal discharge limitations, especially for plants with the largest wastewater flows.

Controlling Nonpoint Source Pollution —States have given increased attention during the past 10 years to nonpoint source pollution — the diffuse runoff of pollutants from sites such as forests, mines, city streets, and agricultural land. As the more traditional sources are controlled, these more pervasive sources are better detected and understood. State and local governments are continually evaluating the extent of these problems and use regulatory and non-regulatory control programs, citizen/consumer education and projects to promote use of the "best management practices" (BMPs) to reduce or prevent runoff. Because the nature of the problem varies markedly from site to site and over time, State control programs are highly variable. In a 1985 report, ASIWPCA found that waters impacted (either threatened or impaired by nonpoint sources) and needing BMPs include 165,000 river miles, 8.1 million lake acres, and 5,400 estuarine square miles. In both rivers and lakes, agriculture is the major source of pollution, followed by resource extraction in rivers and hyromodification and urban runoff in lakes. Generally, the cooperation of a myriad of agencies at the Federal, State and local levels is necessary to address them.

Agriculture — Agricultural nonpoint pollution is generally addressed through voluntary programs. Cost-sharing is used in critical areas to promote installation of suitable controls. Coopera-

tive programs that coordinate activities of the State water pollution control agency, U.S. Soil Conservation Service and local conservation districts are being used to advantage in many areas. With passage Of the 1985 and 1990 Farm Bills, greater priority in the U.S. Department of Agriculture will be given to environmental protection in allocating resources and farm subsidies.

Urban - Control of urban runoff is primarily a local responsibility. But, States are increasingly adopting legislation to require stormwater management, safe disposal of leaves and household chemicals/waste, proper use of road salting, etc.

Mining and Construction - Mining and construction activities are commonly subject to State regulation. Both active and abandoned mine sites must be addressed. Federal government is actively involved, and in some instances, Federal reclamation programs are being used to control drainage from abandoned mines. Over a dozen States report they use some type of erosion and sediment control legislation to mandate reduction of construction site runoff.

Looking Ahead

Great progress has been made in national water clean-up during the past decade due to the combined efforts of State, Federal, and Local agencies who have carried out the Congressional mandates since 1972. With public support coupled with municipal and industrial compliance, we have:

+ a plethora of programs in place that are expanding at all levels of government,

+ better water quality in many streams and lakes,

+ more waters that support designated uses,

+ more recreational use,

+ more peopre served by adequate wastewater treatment,

+ more dischargers that comply with their treatment requirements, and

+ greater public awareness and interest in sustaining past gains and making future progress.

Clearly, however, much remains tobe done. Some communities are still in need of adequate wastewater treatment. Proper operation, maintenance and replacement of facilities already built and in use must be assured— since many are aging. Technology has advanced. The effects of toxic pollutants must be better understood and their release controlled. Nonpoint source pollution must be reduced and the protection of groundwater must be expanded. Water program managers recognize the possibility that further progress in water quality improvement may be both more difficult and more cosfly to achieve than our accomplishments to date.

Next Steps

To ensure the necessary public focus, AS1WPCA has joined with America’s Clean Water Foundation (ACWF) and 65 other national organizations to commemorate the 20th anniversary of the Clean Water Act.

The overall effort is supported by a Board of Governors which includes President Jimmy Carter, Senator Edmund Muski, Senator Howard Baker and Gilbert Grosvenor. In addition, President Bush recently signed a Congressional Resolution proclaiming 1992 as The Year of Clean Water. ACWF projects fall into five categories:

1. Citizen Involvement and Awareness: Increase public participation activities and expand public awareness, interest, and support for clean water programs.

2. Youth Education: Develop broad-based environmental education opportunities for

3. Innovation and Technical Exchange: Promote exchange programs for environmental professionals and government leaders to share information and expertise.

4. National Status and Trends Report: Complete an ASIWPCA National Status and Trends Report, 1972-1992 for Congress and the public.

5. National Celebration: Commemorate the 20th anniversary of the Clean Water Act in U.S. communities throughout 1992, the "Year of Clean Water."

Summary

The American people have invested billions of dollars in protecting and enhancing our nation's precious water supply. Many more billions will need to be invested to assure pure fresh water for the generations to come. Even so, public opinion polls clearly indicate that we are determined to keep our water clean. The National Commemoration, supported by the technical underpinning of the AS1WPCA Status and Trends Analysis, will provide a comprehensive basis upon which to build personal commitment and long term stewardship for the very substance of life — water.

Water pollution is a broad term, often conjuring up images of spills, raw sewage, chemicals spewing from factory pipes, and medical wastes washing down storm sewers and onto public beaches. But there are other problems that can be more widespread and less obvious.

Nutrients — Nitrates found in fertilizers and phosphates found in detergents overstimulate growth of aquatic plants, depleting dissolved oxygen and cutting off light. This seriously affects the respiration of fish and aquatic invertebrates, decreases animal and plant diversity, and inhibits recreational use. Lakes and estuaries are particularly vulnerable.

Sediments — When it rains, silt and other suspended solids wash off plowed fields, construction and logging sites, urban areas, and strip-mined land— carrying with them• attached pollutants. When the enter waters, fish and plant productivity is reduced.

Bacteria and Viruses — Certain waterborne bacteria, viruses, and protozoans can cause human illnesses such as typhoid, dysentery and skin diseases. They enter waters via a number of routes, including sewers, stormwater drains, septic systems, runoff from livestock pens, and boats that discharge sewage.

Organic Enrichment — Organic material enters the, water in many forms — sewage, leaves and grass clippings, or runoff from urban streets, livestock feedlots and pastures. As natural forces breakdown this organic material in water, oxygen dissolved is depleted. When the level drops too far, many types of fish and bottom dwelling animals cannot survive.

Toxic Chemicals/Heavy Metals — Metals (such as mercury, lead, and cadmium) and toxic organic chemicals (such as PCBs and dioxin) may originate naturally and come from industries, city runoff, mining, landfills, etc. They can cause aquatic disease or reproductive failure and pose human health risks.

Pesticides/Herbicides — Rainfall and irrigation can wash pesticides and herbicides used on farm land and residences into ground and surface water. Contaminants can be persistent and may accumulate in fish, etc. to levels that pose a risk to human health and
the environment.

Habitat Modification — Loss of habitat occurs when waters are modified by farming, deforestation, channelization, dredging, et. Vegetation can be lost, bottom dwelling organisms and spawning beds can be smothered or scoured, and water temperatures can increase

Other— There are other pollutants, such as salts from irrigation runoff and sea water intrusion into ground and surface waters. Abandoned mines and air deposition (acid rain) can alter the toxicity of chemicals in water and render lakes and streams unfit for aquatic life