Surface Water Quality in Minnesota: The Translation of Goals and Policies Into Results

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FOREWORD

This bulletin is published in furtherance of the purposes of the Water Resources Research Act of 1964. The purpose of the Act is to stimulate, sponsor, provide for, and supplement present programs for the conduct of research, investigations, experiments, and the training of scientists in the field of water and resources which affect water. The Act is promoting a more adequate national program of water resources research by furnishing financial assistance to non-Federal research.

The Act provides for establishment of Water Resources Research Centers at Universities throughout the Nation. On September 1, 1964, a Water Resources Research Center was established in the Graduate School as an interdisciplinary component of the University of Minnesota. The Center has the responsibility for unifying and stimulating University water resources research through the administration of funds covered in the Act and made available by other sources; coordinating University research with water resources programs of local, State and Federal agencies and private organizations throughout the State; and assisting in training additional scientists for work in the field of water resources through research.

This bulletin is number 72 in a series of publications designed to present information bearing on water resources research in Minnesota and the results of some of the research sponsored by the Center. This Bulletin is concerned with problems of implementing public policies and goals to improve surface water quality in Minnesota.

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Publication Abstract:

The study focuses on problems of translating public policy goals relating to surface water quality into reality. Surface water pollution is seen as a result of economic incentives. Broad policy alternatives for addressing surface water pollution are examined. Judicial measures for dealing with water pollution problems are discussed, along with their
limitations and the necessity for specific legislation. Water quality legislation at the Federal and State (Minnesota) level is reviewed. The mechanics of water quality administration is discussed, with emphasis on the Minnesota Pollution Control Agency. Problems and progress under the Water Pollution Control Act Amendments of 1972 are discussed. Changes in enforcement tools are emphasized. Other problems relating to surface water pollution control are discussed including the funding gap and the zero-discharge controversy.

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Any errors, either of omission or commission, are the sole responsibility of the author. Any views, judgments, or recommendations should be attributed to the author and do not necessarily reflect the views of employees of any public agency referred to in this publication.
Within the short span of several years, "The Environment" has become a major topic of public discussion and controversy. That the topic is complex is an understatement, for the issues raised are many and confusing. "Experts" (if this term has any meaning) as well as laymen, disagree on what the relevant issues are, let alone what to do about them. Enthusiasts and exponents of various solutions to environmental problems articulate their views with great conviction.

To further complicate matters, there is no generally accepted definition of what is logically included under the rubric of "the environment." Carried to its logical extreme, it includes nearly everything in the universe. The necessary breakdown into component parts results in proposed solutions to one set of problems which complicate or cause problems elsewhere.

The literature on "the environment" has become voluminous. It is nearly impossible to classify it, let alone keep current with it, comprehend it, or assimilate it.

If one thing is clear, it is that no person, interest group, academic discipline, or school of thought has the total answer to environmental problems. Although the environment is generally discussed in physical terms, the physical parameters are affected by the actions of man by his use of resources in the production, exchange, and consumption of goods. Thus, the social sciences, as well as the physical and biological sciences, are relevant to understanding environmental problems.

This publication deals with one aspect of environmental quality, namely problems of translating public goals and policies with respect to surface water in Minnesota into tangible results. It is hoped that this publication will help to focus attention in a constructive way on some issues which deserve public attention, as well as serve as a useful source of information on surface water quality problems in Minnesota. The objective is not to attempt to resolve issues of public controversy, but to help to understand problems which arise in attaining public policy goals.
Perhaps the most important reason for controversy over these issues is the public nature of the problem. Any one individual does not affect water pollution or any other issue as a whole. This is in contrast to a private problem. If an individual has a leaky roof and refuses to fix it, the consequences are limited to that individual—i.e., the problem is private. However, if this same individual discharges untreated sewage, the problem becomes public. The consequences of one’s activities affect many other people.

To solve a public problem normally means that someone must be restricted from doing what he wants to do, or he is forced to do something he does not want to do. This inevitably leads to controversy as individuals will very likely oppose requirements to pay additional taxes, invest in pollution control equipment, or change method of operations. Business firms or municipalities may be constrained in their actions and suffer adverse economic effects. Even if it is agreed that conditions must be improved, the controversy over what to do, how to proceed, and who should bear the costs is considerable and often impedes solution to problems.

People are universally opposed to pollution. Furthermore, there are considerable costs attached to water pollution. Yet, we continue to have it, and problems for change generate considerable controversy.

Why do we have water pollution if everyone is opposed to it? Basically, it is because economic units (as individuals, as business firms, as units of local government) have incentives to pollute. More correctly, in the absence of socially imposed rules in the contrary, they have more incentive to pollute than they have incentive not to pollute.

To understand this, we must realize that the driving force behind actions of economic units is individual incentive. A basic assumption underlying satisfactory performance of a free enterprise economy is that each individual acting in his own self-interest will automatically further the welfare of society. Under certain conditions, this assumption is true. Many basic economic decisions regarding the allocation of resources and answers to basic economic question of what to produce, how to produce, and level of resource use, are made very efficiently and effectively through the private sector. Many of these decisions, which are in the best interests of individual economic units, are also in the best interests of society as a whole!

However, there are some exceptions. Some decisions made by individual economic units (whether they be individuals, business firms, or units of government) may not be in the best interests of society as a whole.

There are two basic weaknesses to the price and market system which result in decisions which are unfavorable for environmental quality and pollution control. First, there are certain goods which are not profitable or economically feasible to produce through the private sector, such as sewage collection and treatment, research on waste disposal, and public monitoring and enforcement activities related to pollution control. Second, there is the matter of pricing and output of goods, the production and/or consumption of which causes pollution. To the extent that costs of pollution are incident on society as a whole, rather than on the producer, the decisions made by the individual economic unit may not be in best for society as a whole.

Although this discussion is oriented toward a capitalistic, industrial economy such as that of the U.S., it should be emphasized that the same problems relating to incentives can and do occur under other economic structures. The origin of the problems and solutions relating to resource allocation and "validating the rules" apply to cases where there is more central planning, as well as to economies such as that of the U.S.
A problem related to incentives is the "common property" or "public resource" problem where individual economic units do not have sufficient incentive to prevent depletion of the resource. These shortcomings are related to water pollution. Let us examine these in greater detail.

Private and Public Goods

The motivating force behind decisions on producing goods in a private enterprise economy is the hope and expectation of profits. This motive has indeed been successful in encouraging the development and production of many of the goods and services which we enjoy in such abundance.

However, there are some goods and services from which the benefits cannot be captured by a private entrepreneur, and hence, the production of these goods provides no incentive to the private entrepreneur. Examples are public education, many types of research activities, and pollution control facilities. The net result is that the private enterprise system, left to itself, would produce an abundance of "private goods", but a scarcity of "public goods."

There are several distinguishing characteristics of public as opposed to private goods. Private goods are produced and marketed through the private sector of the economy. They are produced and sold in small enough units that they can be financed and purchased by individual consumers or private business. The usefulness of these goods is limited largely to the individual purchaser. Private goods include food, clothing, housing, automobiles, appliances, and services such as haircuts, dental work, and legal advice.

In contrast, public goods are those which are produced and sold in such large units that they cannot generally be purchased by the individual economic unit in the marketplace and must be financed publicly. Furthermore, the utility or usefulness is not limited to those people who pay for their acquisition. Examples of public goods include weapons used for national defense, public education facilities, public parks, roads, and waste treatment plants.

The significance for purposes of this study is that many items in the area of environmental quality are public goods. Examples include public parks, playgrounds, and forests; sewage systems and waste treatment plants; municipal garbage collection and refuse disposal; research on pollution problems; monitoring and testing of water and air quality, and many other items.

An individual or business firm cannot normally expect to capture the benefits of a research project in pollution control, nor does it benefit a single person to pay taxes to support a waste treatment plant unless the entire community participates. Nor does a single person have the incentive, or can he be able to finance a public park or national forest. Since the benefits accrue to the public at large, it must necessarily be the responsibility of some level of government to acquire and maintain these items.

The problem of providing public goods for pollution control and other purposes has in recent years been compounded by a phenomenon known as Pollner's law. Pollner's law states that as a society increases in affluence, the demand for public goods will increase relative to the demand for private goods. This happens for several reasons.

In a traditional rural society, the major share of output is for necessities—food, clothing, and shelter, which are essentially private goods. However, increasing industrialization is accompanied by urbanization. The process of urbanization makes necessary the collective performance of functions such as water supply; collection of sewage, garbage, and trash; police and fire protection; and provision of streets and roads. In the traditional society, these functions either were needed on a more limited scale, could easily be provided individually, or were not needed at all.

With greater affluence and urbanization, however, collective efforts for provision of these functions becomes necessary. Also, with higher incomes, there arises greater demand for these public amenities. This is why there seems to be a perpetual shortage of these goods, and there never seems to be enough tax revenue to pay for them. It is in these factors which make it difficult to pay for some of the pollution control and environmental quality measures even though many people express a greater desire for these amenities.

Social Costs

A major market failure which results in a less than desirable allocation of resources stems from external diseconomies, sometimes referred to as social costs. Social costs are those incurred by a specific economic unit and passed along to society as a whole.

Producers have incentive to produce at lowest monetary costs. Monetary costs are those costs realized by the producer which show up in their private accounts. There are, however, other costs which are not realized by the producer, which are not reflected in the price of the product or in the price system in general, and which are borne by the public as a whole. The emission of pollutants into the air and water is the classic example of social costs.

Consider as an example an industry producing a product such as paper. The firms within that industry strive to produce at the lowest possible cost in monetary terms. Thus, to the firm, it is cheaper (in terms of their private accounts) to discharge untreated effluents into the water and into the atmosphere than it is to expend money for waste treatment.

The "costs" of discharging the untreated wastes are not borne by the firm, but by the public in general in the form of polluted water and air. These are real costs even though they may be difficult to measure in dollar terms.

In the absence of rules or regulations to the contrary, the firm has no incentive to take these costs into account. The net result is that
the full costs of production are not reflected in the price of the product. Since the firm is not required to treat wastes, costs of production are lower, and more of that product is produced than if the industry was required to produce in such a way that less pollutants were emitted.

Thus, again, deficiencies in environmental quality relate directly to incentives. If it is more profitable for a firm or individual to pollute than not to pollute, there is no reason to expect the firm to voluntarily stop, when to do so would be to put itself at a competitive disadvantage. For solution, we must then look to the incentive problem—to attempt to adjust output to account for social costs.

The "Fugitive Resource" Problem

Certain kinds of water pollution and environmental problems result from incentives relating to indefinite use of incomming property rights. This occurs in instances where resources belong to the general public. The resource becomes the property of an individual when he "catches" it.

An example of a fugitive resource is fish and game which are the property of the public in general. In particular the resource belongs to no single individual unless or until he "catches" it. When the fisherman lands the trout or the hunter kills the deer, the resource becomes the sole property of the individual.

Note that under such conditions, the individual acting by himself has no incentive to practice conservation measures. To defer capture of the resource only increases the possibility that some other hunter or fisherman will capture the resource. Hence, the individual who defers consumption stands to lose future claim on the resource. Obviously, the resource would rapidly become depleted if no restrictions on use were present. And that is precisely why we have fish and game laws—-to regulate the conditions under which the resource is captured, in an effort to ensure some degree of conservation of the resource.

How does this relate to water pollution? Certain water resources have common property characteristics. The waters of a lake are by law the property of the general public. These waters are used by many uses by people. One "use" is the assimilation of wastes and runoff. If residents around the lake drain their waste into the lake, they are "using" the lake. Since the "use" of the lake is perceived by the individual to be costless, he may not choose to take measures to prevent wastes from reaching the lake. He perceives himself to have no incentive to pollute than to not to pollute.

If the individual, in such an instance, made expenditures to prevent wastes from reaching the lake, the contribution to water quality improvement will be minimal if the other individuals do not take similar preventive measures. If each individual reasons the same way, no preventive measures are taken and the lake may rapidly deteriorate.

Thus, the solution will necessarily involve compelling everyone adjacent to the lake to take preventive measures to avoid polluting. The problem, in this case, has its roots in individual incentives. The solution, if it is to be successful, must among other things, take incentives into account.
From this point, there are two possibilities, both of which have the same net directional effect on the composition of output. The first possibility is that with the increase in the price of the product, sales do not decrease significantly, resulting in more total dollars being expended on the product than before the price increase. With a given amount of consumer income, more dollars spent on this product means less to spend on other products. The physical volume of consumption has decreased. But in its place, there is greater investment in pollution control equipment. Society has traded consumption for investment in capital equipment and a cleaner environment.

The second possibility is that the increase in price of the product has not discouraged consumers from purchasing it that there any less, dollars being spent on the product than prior to the price increase. This leaves more consumer dollars to be used for the purchase of other goods, presumably those causing less pollution. We now have a change in consumption patterns as well as greater investment in pollution control equipment. Society has again made a tradeoff.

In both cases, consumption of the product associated with pollution has decreased and more resources have been allocated to pollution control. The price system more accurately reflects the true costs of production. It is ironic that the imposition of pollution control regulations is sometimes viewed as "artificial" and an "interference with the price system." However, as we have seen, the reason why regulations were imposed in the first place is that the price system failed to bring about a desirable allocation of resources—it failed to register all costs of production. Therefore, the regulations ideally could be viewed as an ameliorating the price system and of making it work better in that, with proper regulations, it now more fully reflects all costs of production.

There are other means of accomplishing this task than imposing water quality standards. A frequently mentioned possibility is that of effluent charges. This is a charge made by a public authority on pollutants emitted. For example, a charge might be made per pound of sulfur dioxide or biological oxygen demand (BOD). In this case, emission of pollutants into the atmosphere or the water is no longer "free" to the firm. There is a cost involved which the firm must take into account—perhaps finding it advantageous to put in additional pollution control equipment rather than to continue polluting.

There are some objections to this system. First, there would be the task of measuring the volume of pollutants for the purpose of assessing the charges. However, this may not be any more difficult than monitoring for the purpose of maintaining administrative standards. Another objection is that some people would interpret this as a "license" to pollute, with the higher profit industries able to pay for the pollution. The degree to which this would occur would depend on the level of the charge. A sufficiently high charge would discourage most pollution, while a relatively low charge would do little to discourage emissions.

The "proper" level of effluent charges would have the effect of forcing the true cost of production to be registered in the price system. The costs of pollution control would be reflected in the price of the products and buyers would face the choice of whether they wanted the goods enough to pay the price of pollution control. The end result means by which this is brought about that is an issue.

A third method of reallocating resources within the private sector—i.e., shifting emphasis from consumer items to pollution control—is to tax the private sector and then subsidize pollution firms to install pollution control measures. Again, the ultimate effect is a shift in the costs of the changed in the price of the final product, it occurs through the mechanism of public finance. In this case, instead of the purchasers of the product paying for the costs of pollution control, the taxpayers in general bear the burden, these two groups not necessarily being synonymous.

In the first two cases, administrative standards and effluent charges, production costs and product prices are increased. In the latter case, however, production costs did not increase, but consumers and producers being, in effect, subsidized by the taxpayers. For this reason, firms which are marginal in the profit making sense will favor the case where the firm may be the major employer in the area and employees forced out of work may have difficulty finding other employment. Although on a nationwide basis, most people favor the private system as a means of reallocating resources within the private sector, there are situations where taxing and subsidization may be a rational means for bringing about the reallocation from consumer goods to investment in pollution control.

2. Reallocation From the Private to the Public Sector

The second form of environmental problem previously discussed was the failure to provide adequate waste disposal facilities. This is the second rational for governmental intervention in the economy for reasons of environmental quality. In this case, the reallocation of resources is from the private sewer systems and waste treatment, publicly sponsored research, public parks and playgrounds, and monitoring and enforcement activity.

1/ Some critics have suggested that the reason why effluent charges have never been tried is that they would work. Freeman, Hesman, and Kress, The Economics of Environmental Policy, John Wiley & Sons., Inc. (New York, 1979), P. 170.

2/ The "ideal" charge, conceptually, would be that which would restrain emission of each pollutant to the point where the damage to society from the last unit of pollutant equals the cost of abating that unit. Ideal would be difficult to attain in practice.
The significant aspect of increased production of public goods is that they are financed by taxes or other forms of public revenue such as charges. An example of the latter is under the Federal Water Pollution Control Act Amendments of 1972, industries discharging to public systems must pay a charge based on quantity and quality of the effluent. This source of revenue, however, is necessarily limited to the proportion of waste treatment costs incurred by industry.

With a given amount of personal income, increased taxes leaves less disposable income to either save or consume. For these and other reasons, increased public goods tend to be resisted. As we have seen, the benefits of public goods are incident upon the public in general, including others of public goods who are incident upon the public in general. Inclusion of expenses of those paying taxes for them. And there is a "remoteness" of expense to which the taxpayer may not readily identify, and hence a tendency to resist higher taxes.

In addition to reluctance to pay taxes, the problem of providing adequate public goods is complicated by other factors. As we have seen, increased public goods tend to be resisted. However, the remorse of tax revenue to proportionately with income. Since tax revenue at the federal level is derived largely from personal income, an increase in income yields more than proportionally increases in tax revenue since effective rates at the federal level are less progressive.

However, this tends not to be true at state and local levels. Therefore, there is a lag in supply or of levels of government. Therefore, the demand for public goods in proportion to income.

Local tax revenue is derived mainly from real property taxes which are relatively unresponsive to changes in income. Therefore, the increased property tax revenue is in support of public demand for public goods. It is not an automatic increase in tax revenue. The response, therefore, is that property tax rates have been increased in order to acquire the local public revenue that is needed. This has caused what has come to be known as the "property tax squeeze." The "property tax squeeze" cannot be attributed primarily to environmental matters since most local revenue is for support of public schools. However, because of this situation, there is resistance to environmental purposes.

At the state level, public revenue tends to be more responsive to income than at the local level because of greater reliance on state income taxes, especially in Minnesota. However, it is less responsive because state income tax rates are considerably lower and less progressive than federal rates. And it is at the state level where many environmental problems need to be addressed.

At the federal level, even though public revenue is responsive to income, there are many competing priorities. The net result is that the reallocation of resources from the private to the public sector, whether local, state or federal, will meet with considerable controversy and is not a panacea to environmental problems.

3. Reallocations Within the Public Sector

There is a final alternative, that of reallocating resources within the public sector. However, this would involve increasing public environmental expenditures at the expense of something else. With a fixed budget, increased pollution control activities can only come about if other expenditures are cut.

The end result of increasing activities by any of these methods is a change in resource allocation, output, prices, and income. This inevitably leads to controversy.

The general criteria on which water pollution control policy must be based is to balance the social costs and benefits of the program, and to attempt to ensure that no particular economic unit bears an inequitable portion of the costs associated with pollution control policies.

Translating Policy Goals into Realities

Up to this point, our discussion has necessarily been somewhat theoretical and rather abstract. Most people agree in principle that water pollution in this country and in Minnesota has been "excessive" relative to what they would consider to be desirable. Furthermore, most people would agree that to resolve the problem necessitates a reallocation of resources which can only be possible by modifying the "rules of the game".

However, the actual translation of general policy goals, such as less water pollution, into reality is difficult to bring about. If this were not so, most of the state and national goals for cleaner water would already have been achieved. However, the hard reality is that pollution control involves expenditures not only on equipment, process change, and facilities, but the establishment and maintenance of governmental machinery to enforce rule changes and to monitor progress. Furthermore, it involves disputes over rights, possible changes in income distribution, and conflicts over meaning and interpretation of rule changes many of which can only be resolved in courts of law.

The remainder of this publication addresses the attempts that have been made to translate these goals into action at federal and state levels with specific focus on Minnesota. We will address the rationale for specific legislation, the means by which it is intended to work, some problems involved in implementing it, and some problems and issues which remain unresolved.
CHAPTER IV

ADJUSTING THE "RULES OF THE GAME"

We have discussed in Chapter II some limitations of the market and
price system in bringing about water pollution control. Individual econ-
omic units, under "rules of the game" which do not have pollution control
mechanisms, view the environment as a "free" resource, which
can be used for waste assimilation. And, as in all cases where resources
are "free" or available at low cost to the decision unit involved, the
environment is used intensively. Hence, there has been heavy use of
the environment as an assimilator of wastes.

To change this, one cannot depend on arguments of a moral nature.
A more pragmatic approach is to change or modify the "rules of the game"
through legislative action or other means so that the cost of utilizing
excessive pollution through legislative actions or other means so that the cost of utilizing
the environment as an assimilator of wastes is apparent to, and incident
up, economic decision units. To this matter we now turn.

Judicial Measures and Their Limitations

In the absence of water quality legislation, there is little the
state can do to improve water quality. Problems relating to pollution
and related damages under such conditions are left to private parties.

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direct injury in kind or in dollar amount. For example, in the Oil Spill of
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direct injury in kind or in dollar amount. For example, in the Oil Spill of
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A second reason for inadequacies of nuisance actions relates to the proportion of total damages suffered by one individual. While the total impact of the nuisance on the community as a whole may be great, the impact on any individual may be too small to support a law suit. The cost of going into interstate action may often exceed the potential recovery. Thus, private nuisance actions to abate water pollution are generally meaningless.

A third reason why nuisance actions sometimes fail is on the theory that the action objected to has been sanctioned or authorized by legislature. For example, zoning ordinances may preclude judicial interference with activities which might otherwise give rise to liability.

A fourth potential hindrance to nuisance statutes as an anti-water pollution tool is the difficulty of proving damages. For example, the destruction of a favorite trout stream by nuclear discharges from a nuclear plant may represent a real loss to the plaintiff. However, if the court cannot place a dollar value on the plaintiff's right, the nuisance action generally fails.

Finally, since the source of much water pollution is industrial waste, the problem of sovereign immunity arises. This defense is mainly based on the premise that "the king can do no wrong," may be Kent, for the practical reason that the government in no sense has an unreasonable burden on taxpayers who must pay for the protection of others. Other than exceptions, the absolute bar to recovery under nuisance actions.

A public nuisance basically consists of an interference with the public rights of the community at large. In this case, an individual cannot collect damages unless he can prove damages over and above those suffered by others. To sue for damages, a fact usually impossible in the case of water pollution.

In general, in any private judicial remedy to water pollution problems, the inherently slow, deliberate, and cumbersome machinery of the courts is a factor. A defendant can, if he has the will to do so, drag out a suit. The initial complaint through the final judgment by means of postponements, delays, motions, court suits, and appeals for months and even years.

Most people who are injured by water pollution, those who use the waterways for recreation and drinking, will never have the opportunity to bring legal action against a polluter. Thus, the most practical solution to the problem of abating water pollution is governmental action involving legislation to change or modify the "rules of the game."

Modifying the Rules: Early Federal Legislative Efforts

The predominant thinking of the public, as reflected through legislative action or inaction, has been that water pollution...
effectuate its end of an agreement could be sued in federal court.\footnote{1}

With these cumbersome and virtually ineffective enforcement procedures, it should not be surprising that the law had virtually no effect. In fact, the Senate Appropriations Committee denied fiscal 1959 funds to the Public Health Service for enforcement on the grounds that the law was "almost unenforceable."

The Act (Section 6(b)) provided for the establishment of a Water Pollution Advisory Board with members from the Surgeon General's Pollution Control Advisory Board; the Department of Agriculture; the Department of Commerce; the Department of Interior; and the Public Health Service to report to the President on the results of research, or other waste treatment plant to the Congress in dealing with the problems of water pollution. It was never funded. In seeking funds, one maximum of $300,000. This was never funded. In fact, the Board could not have been expected to have any useful advice. Again, this type of Board could not have been expected to have any useful advice. Also, there was no financial support to make for issuance of water quality, or to broadly based public concern. In terms of both enforcement provisions and funding, the 1948 Act was totally ineffective.

In 1956 an amendment\footnote{2} was added to the Water Pollution Control Act. It is significant that in this amendment, Congress reiterated its desire to aid in solving the problem, but left the management of enforcement to local government. Pollution was still considered to be a local problem, rather than a national problem. The amendment eliminated provisions regarding technical research to devise and perfect methods of treatment of industrial wastes. In an effort to reduce internal administrative confusion, the Surgeon General was directed to administer the program under the direct supervision of the Secretary of HHS rather than the Federal Security Administration.

Where a pollution problem existed, the new law provided for a conference among interested parties; a public hearing if the conference did not result in action within six months; and then another six-month waiting period, after which the case could be taken to court. However, the major obstacle to Federal enforcement was the necessity for settling state consent before Federal court action could be initiated. This obstacle was removed until 1972, and remained an effective barrier against Federal enforcement procedures.

With respect to funding, the 1956 Act foresaw little better than the 1948 Act. The bill provided for $500 million in Federal waste treatment grants over a ten-year period.\footnote{3}

Interestingly enough, a White House attempt to eliminate waste treatment grants failed in 1958 and 1959. In contrast, the Congress attempted to double the grant money in 1960. However, President Eisenhower vetoed the measure which would have doubled the grants, and there was insufficient support in the House to override the veto.

Thus, enforcement procedures were still for practical purposes, nearly non-existent. The support for Federal grant assistance, though growing, was still rather feeble. It is reasonable to pursue that the Administration and Congress during the decades of the 1960's and 1970's unfortunately reflected the innocence, and lack of concern and comprehension, of the American people of the magnitude and gravity of water pollution as a national problem.

The law was again amended in 1961.\footnote{4} No major changes were made in the enforcement measures. The Amendment placed increased emphasis on research, establishing provision for contract research with private laboratories, and by work on modern equipment, established research grants to universities, established a system of research fellowships to encourage scientists to work in the field of waste treatment, and increased the amount of grants to be given to the state and interstate agencies.

\footnote{1}{15 U.S.C. § 1852 (1977)}

\footnote{2}{PL 84-660, 70 Stat. 498 (1956)}

\footnote{3}{PL 87-69, 76 Stat. 206, (1962)}
The funding for grants was substantially increased. The bill authorized appropriations for grants of $60 million in 1965, $200 million in 1963, and $100 million for each fiscal year between 1964 and 1967.

A major change enacted by the amendment, however, was a great increase in the bodies of water covered by the Act. Previously, Congress had considered itself constitutionally limited to regulate pollution only of navigable waters, even if it was within one state, or not forming a navigable water, even if it was within the boundaries of the state. However, with this amendment Congress declared that interstate waters, however, with this amendment Congress declared that interstate waters, if they were within a state, or not forming a navigable water, even if it was within the boundaries of the state, were within the purview of the state. In practice, this goal had little effect because state consent was still needed before action could be taken through Conference process was still needed before action could be taken through Conference process was still needed before action could be taken through Conference process.

Thus, although much legislation had by this time been enacted, the plan for a federal government had, for all practical purposes, no real enforcement tools.

This plan finally changed in 1965. The Amendment of 1965 doubled the amount of money available for grants. Furthermore, the bill created an agency for the specific purpose of enforcing the provisions of the Federal Water Pollution Control Act as amended, namely, the Federal Water Pollution Control Act, managed by the Department of Health, Education, and Welfare (HEW). This agency would oversee the administration of grants for cleaning projects for federal training assistance, and for water pollution control.

In February, 1970, the Federal government, problems of water pollution would only become more acute. Thus, the 60's saw some limited increase in enforcement tools by the government, and assistance for funding waste treatment works on a much broader scale. It was observed that they were falling to meet the challenge by having separate plans for air pollution, water pollution, and solid waste disposal and that a coordinated plan was needed.

In February, 1971, further hearings were held with the conclusion that water pollution at a health menace was more severe, more pervasive, and growing at a more rapid rate than previous evidence had indicated.

In 1971, Congress recognized that the task of setting water quality standards, assigned to the States by the 1965 legislation was lagging. By 1971, only 27 of 50 jurisdictions had established approved standards. The record shows that the abatement process was also totally inadequate. Since 1948, only one case had reached the federal courts. This was a most telling indication of enforcement proceed up to that time.

The lack of adequate funding of grants to assist state and municipalities in constructing sewage treatment plants was also contributing to the problem.

Thus, the decade of the 60's saw some limited increase in enforcement tools by the government, and increased federal assistance for funding waste treatment, with substantial responsibility remaining with the states. However, the growing magnitude of the problem, the realization that the problem was a long way from being solved, were major considerations in the water pollution legislation of 1972.

Prelude to the Act of 1972

1. Updating the Federal Water Pollution Control Act

The Federal Water Pollution Control Act was again amended in 1966 (The Clean Water Restoration Act). This Act transferred the EPWCA to the Department of the Interior. It also increased the funding for waste treatment grants, establishing a maximum grant of 70-75 percent of a construction project depending on the degree of state matching grants. The five-year authorization for waste treatment grants totaled $2.1 billion. However, only $2.2 billion of this amount was ever appropriated by the Congress.

In 1970, finding that their increased efforts were barely stemming water pollution, Congress again addressed itself to the problem. The 1970 amendments added the basic law new provisions requiring liability for cleaning up oil spills, discharge of hazardous substances, discharge of sewage from ships, and mine drainage, provided for demonstration projects for cleaning up pollution in the Great Lakes, regulation of federal activities affecting water quality, and provided for manpower training for water pollution control.

During April, May, and June of 1970, the Senate Subcommittee on Air and Water Pollution conducted hearings and concluded that there existed a need for environmental planning on a much broader scale. It was observed that they were falling to meet the challenge by having separate plans for air pollution, water pollution, and solid waste disposal and that a coordinated plan was needed.

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The intention of the Refuse Act, as a section of the Rivers and Harbors Act, was to prevent obstructions to navigation. It was broadened by the Supreme Court in the 1960's. The law was "discovered" in 1970 as an enforcement tool for water quality. Focusing on discharges was seen to be complementary to enforcement provisions which focused on the receiving water.

On December 23, 1970, the President directed the establishment of a Federal permit program utilizing the Refuse Act, and requiring close coordination between the Army Corps of Engineers and the Environmental Protection Agency to which Federal pollution control activities had been transferred in December 1970.

Because the Refuse Act authorized the Secretary of the Army to issue permits for discharges, the Army Corps of Engineers had the primary responsibility of administering the Refuse Act Permit Program. The Corps received applications from dischargers for permits, and determined the effect of the discharges on anchorage and navigation and formally issued any permits. EPA reviewed these applications and advised the Corps on the effect of the discharge on water quality. In addition, the respective State was to certify that the discharge would not violate water quality standards under the Federal Water Pollution Control Act.

In December 1971, after only 20 permits had been issued under the Program, a U.S. District Court Judge enjoined the Corps from issuing Refuse Act Permits. This decision was based on the fact that the Corps exceeded its authority if it issued permits for non-navigable tributaries of navigable waters. (The Refuse Act only authorized the issuance of permits for discharge into navigable waters, although the Act prohibited discharges and deposits into navigable waters and non-navigable tributaries.) Recently, the District Court Judge determined that the Corps in issuing permits under the Refuse Act was not exempt from the requirements of the National Environmental Policy Act of 1969 which required all Federal agencies undertaking any major Federal actions significantly affecting the quality of the environment to prepare an environmental impact statement for that action.

The decision was appealed, and pending resolution of issues raised by the Kalar decision on appeal, EPA continued to process the permit applications at hand in preparation for the possible revitalization of the Refuse Act Program or passage of new legislation authorizing the issuance of permits. The basic advantage of the Refuse Act as an enforcement tool was that it permitted swifter and more clear-cut action against polluters than did the Federal Water Pollution Control Act.

In 1974, when the Permit Program came under injunction, the EPA had to decide how to keep alive the momentum created by the Refuse Act Program and other pollution control statutes. The Agency initiated the Abatement Commitment letter program which sought, informally, the voluntary commitment of industrial dischargers to commence abatement plans. This


/ In the case of Kalar v. Resor
It is a national system because it is nationwide and involves Federal and State participation. The policy is to require a permit from any point source, private industry, municipal treatment plant, or any other identifiable source of effluent. The permit is to specify the maximum limit that can be discharged into the water and a rigid timetable for achieving it.

The scope of activities to be covered under the permit authority is enormous. The law covers discharges into all navigable waters, defined as "the waters of the United States including the territorial seas." In practice, this means all surface waters.

Some 30,000 of the nation's 300,000 industrial water users and between 10,000 and 13,000 communities will be affected. Discharges from agricultural sources are, under certain circumstances, subject to the new permit authority. Examples are the animal wastes from concentrated, confined feedlots which reach surface water, and irrigation return flow when discharged from channels, drains, or other conduits. Acid mine drainage from both surface and subsurface coal mines, where such drainage is from discreet conveyances, will be included. Discharging oil rigs, whether onshore or offshore, are also included.

The Amendment, while interjecting more federal control, still attempts to affect a federal-state balance to the system. The final objective is to have each state administer its own permit program. Full implementation of the permit program will take some time. Until then, the program of the states will be allowed to be carried out. The States will administer their own permit programs, and the Federal review and monitoring of the program continues to insure that the purposes of the Act are carried out.

2. Use of "Best Technology"

In order to carry out the objective of this legislation, a two phase program for applying effluent limits was established; the first based on "best practical technology", the second based on "best available technology."

For industrial discharges, not later than July 1, 1977, effluent limitations are to be achieved which represent the application of the "best practicable control technology currently available." By the same time, all publicly owned waste treatment facilities must use "secondary treatment" and, if an industrial discharger sends its wastes through a publicly owned treatment works, certain "pretreatment standards" must be met. An additional requirement is that by the July 1977 date, effluent limitations may be imposed so that any state law or regulation (water quality standards) will be met.

For Phase II, not later than July 1, 1983, effluent requirements must be met which represent the "best available technology economically achievable," and, for publicly owned waste treatment facilities, which represent the application of the "best practicable waste treatment technology." Any

The basic means for enforcement of the Act of 1972 is a new permit system called the National Pollutant Discharge Elimination System (NPDES).
other applicable pretreatment standards must also be attained by that date. Special standards for toxic substances must also be observed for both the 1977 and 1983 periods.

The target dates - 1977 and 1983 - are outside limits for compliance. The Act envisions that in meeting effluent limitations there will be stages of compliance including attainment of levels of improvement. There will be imposed on dischargers a schedule of remedial measures which will appear as conditions set out in a NPDES permit.

The Act charges the Administrator of EPA with the task of publishing regulations providing "guidelines" for establishing effluent limitations for point sources.

The Administrator is to identify three items in the regulations:
1. The Administrator is to identify "best practicable" and "best available" technologies.
2. The Administrator is to identify "most practicable" and "most available" technologies.
3. The Administrator is to identify "second most practicable" and "second most available" technologies.

In these guidelines, he is to identify the degree of effluent reduction attainable through the application of best practicable and best available technologies to the pollutants in terms of amounts and composition of effluents. These guidelines can then be applied in setting specific effluent limitations for dischargers, to eliminate the discharge of pollutants.

3. New Source Performance Standards

For new point sources of discharge, the EPA is required to set uniform standards of performance which must reflect the maximum reduction of pollutants possible through use of the best available technologies. The EPA is required to publish a list of categories of sources including 27 industries and to publish a list of categories of sources including 27 industries and to establish Federal standards of performance for those industries. Each state is to submit to EPA a new source's effluent limitations for those categories. The EPA is to establish a procedure for enforcing the standards in those states.

At the same time EPA promulgates new performance standards, it is to provide pretreatment standards for newly constructed point sources discharging into public treatment facilities.

4. Effluent Limitations for Publicly Owned Treatment Works

Not later than July 1, 1977, publicly owned treatment works must meet effluent limitations based on "information" which the Act requires the Administrator to publish regarding the degree of effluent reduction attainable through secondary treatment.

The Administrator is also required to publish information on alternative waste treatment management techniques and systems available as the basis for the 1983 effluent limitations.

5. Grants for Construction of Treatment Works

To assist states and municipalities, the Act established a three year program of Federal grants for construction of sewage treatment plants with Federal matching funds of $10 billion. Federal grants are to be 75 percent of the eligible project cost. The Act also provides for partial Federal reimbursement for sewage treatment plants built without Federal assistance previous to July 1, 1977 (this does not apply to future construction).

The grantees are required to adopt a system of user charges to assure that each class of users will help to pay the costs of operation and maintenance, including replacement, of sewage treatment plants financed with Federal funds. In this context, each industrial user must agree to pay the portion of the Federal share of construction cost allocable to its wastes.

6. Areawide Waste Treatment Management

The Act requires the EPA to develop plans for area-wide treatment for areas with water pollution problems. In addition to industrial and municipal wastewaters, the plans are to include procedures to control non-point sources such as agricultural runoff, surface and groundwater runoff, and disposal of pollutants on land or in excavation.

7. Other Provisions

There are a number of other provisions of the Act. Each state must develop methods of controlling pollution of its fresh water lakes. This restoration of water quality is also to be assisted by Federal aid.

The Act facilitates the enforcement of its provisions against polluters. The EPA is authorized to enforce violations of a state permit or to issue an order of the state. If a state fails to act within 30 days of a report of a violation, the EPA may take the violators to court. Both civil and criminal penalties are provided with a possible fine of $50,000 per day and two years in prison for a second violation.

Under the Act, private citizens have a right of action against polluters. Any citizen who claims to be affected by any pollution source may bring an action in Federal court regardless of the magnitude of damages, provided that he gives 60 days notice to the Administrator of EPA, to the State and to the alleged polluter.
The Act requires the Administrator to establish effluent standards for pollutants being defined as those pollutants or combinations of pollutants which after discharge and upon exposure to any organism either directly or indirectly will cause death, disease, or other abnormalities in the organism or its offspring. Examples are mercury, beryllium, arsenic and cadmium.

Water pollution control legislation in Minnesota dates back to 1885. However, this early legislation was oriented toward public health. It was not until the 1940s that more general pollution problems such as we have today, and abating more general pollution tools were enacted. The Board of Health was given the authority to administer and enforce certain aspects of the Act.

In 1885, the Minnesota legislature passed a bill, primarily as a public health measure, dealing with the discharges of arsenic and other arsenic or cadmium. The Board was established, with the express purpose of meeting and solving the complex problems of air and water pollution.

The basic policy-making element of the Agency consists of 9 members, appointed by the Governor. The members are to possess a wide range of skills and experience necessary to effectuate the policies of the Act.

The Act gives the Agency high priority within the State administrative system and requires all other State agencies to cooperate with and assist the Pollution Control Agency in the "fullest possible degree." Declaring that the State is the trustee of the waters and that financial assistance is necessary to protect the purity of the waters and the health of the public, a separate fund for lending or appropriating money for the acquisition and betterment of public land, buildings, and improvements of a capital nature needed for prevention, control, and abatement of water pollution was established. This fund was $55 million dollars to be expended in the period June 1971 - June 1975.

The funds were used for a State grant program which increased the Federal contribution under the Federal Water Pollution Control Act Amendments of 1966 to an additional 10 percent, provided that the State agrees to pay not less than 30 percent for all projects funded in the State under this Act.

The Agency is imbued with broad powers to effectuate the Act. It is authorized to make any and all investigations necessary of bodies of water and sources of pollution, to establish reasonable water pollution and regulations by enforcing compliance with State statute or regulations which might be in conflict with Federal law.

In 1967, a bill was passed which enabled compliance with Federal regulations by having compliance with State statute or regulations which might be in conflict with Federal law.

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The money was to be disbursed to municipalities in the form of grants or loans. Because of a predicted shortage of funds, a priority system was established, using such criteria as the extent and nature of pollution, the technological feasibility of the plan, assurance that the proposed facilities are adequate and will be maintained, and the financial capability of the community to effect the plan without state aid.

Pollution was explicitly defined to include human and animal excrement, garbage, municipal refuse, decayed wood and sawdust, sewage sludge, incinerator residue, munitions, chemical, biological, and radioactive wastes, heat, wrecked and discarded equipment, or any other substance which would serve to make the water of the State unclean, noxious, or otherwise actually or potentially hazardous to the public health, safety, and welfare, to domestic, agricultural, commercial, industrial, or recreational use, or to livestock, animals, birds, or fish.

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Available remedies for enforcement of the act are listed and criminal penalties prescribed: not less than $300 in the event of negligent violations; not less than $2,500 in the event of a willful violation; and in neither case more than $25,000 per day of violation or by one year's imprisonment or both. The fine shall not exceed $50,000 for a violation after the first conviction. Penalties are also provided for false representation or documentation of information. Civil penalties are set at not more than $10,000 per day of violation or by one year's imprisonment or both. The fine shall not exceed $50,000 for a violation after the first conviction. Penalties are also provided for false representation or documentation of information. Civil penalties are set at not more than $10,000 per day of violation or by one year's imprisonment or both.

Also, in 1973, a bill was passed which charges the Director of the MPCA to establish guidelines determining funding priorities for municipal sewage treatment projects that are not covered under existing Federal law and regulations. The definition of municipality is broadened to include an Indian tribe or an authorized Indian tribal organization. It stipulates that all income from the investment of the Minnesota state water pollution control fund be credited to the local account. Twenty-five million dollars is appropriated for the biennium from the state water pollution control fund to provide $156 toward the eligible cost of projects, with municipalities likely to receive the remaining 70 percent; the Federal government providing 25 percent of the treatment cost. The MPCA is authorized to exceed the 15 percent funding level if a municipality is determined to have a financial hardship under rules promulgated by the agency.

Another bill in 1973 relating to funding appropriated 55 million from the Minnesota state water pollution control fund for the biennium to be disbursed to municipalities for sewage treatment projects. The MPCA may, after consideration of the amount of state funds required to match Federal funds, make a grant of state funds not exceeding 25 percent to a municipality that qualifies for Federal fund granting but needs immediate funding to abate a health hazard.

It is evident that water pollution received relatively little attention in Minnesota until the latter half of the decade of the 1960's when it became recognized as a major problem.

Chapter 423, S.F. 507.

Chapter 771, H.F. 2849.
CHAPTER V

THE MECHANICS OF WATER QUALITY ADMINISTRATION

The Role of the Executive Agency

In section IV, we examined the reasons why legislation is required to achieve water quality objectives. However, this is only the beginning of the process. It is one matter to pass into law water quality legislation designed to achieve results desired by the public. However, it is quite another matter to translate policy goals set by legislation into actual results.

Through legislation, it is possible to specify broad policy objectives. However, it is impossible to get very detailed. It is more efficient to delegate detailed rules and regulations to an executive branch agency. The agency is then charged with implementing the broader policy objectives specified by the legislature.

Thus, although technically, the legislature makes laws and the executive branch carries them out, the executive branch establishes rules and regulations having the force of law. As an example, under the Federal Water Pollution Control Act of 1965, the States were to classify the waters of the state into various use categories. The State legislature responded by delegation to the Minnesota Pollution Control Agency the power (following prescribed procedures) to set up this classification system. The executive branch agencies, therefore, are a crucial link in translating broad policy objectives into concrete results.

We now take a closer look at the Minnesota Agency which has the major responsibility for implementing water quality policy.

The Minnesota Pollution Control Agency

The executive branch agency in Minnesota having major responsibility for translating policy objectives into results is the Pollution Control Agency which was created in 1967. The major policy decisions of the Agency rest with the nine member citizen board appointed by the Governor.

The professional staff of the Agency is responsible for the numerous tasks in carrying out the policies of the Board and the Legislature.

The Agency has authority in three broad areas: air, water, and solid wastes. The concern here is with the Division of Water Quality which is divided into the following sections:

- Planning Section
- Surface and Groundwater Section
- Compliance and Enforcement Section
- Division Services

The major responsibilities of each is described below:

Facilities Section:

Responsibilities of this section include serving municipalities in and maintenance and administering the U.S. EPA and State Minnesota assistance in providing state permits for land disposal systems and permits for the construction and operation of treatment systems.

The major sub-function and a brief description of each are as follows:

a. Administering Construction Grants to Municipalities

The Water Quality Act of 1965 authorized federal grants for local Minnesota's state matching grant and loan program. The 1971 legislation revised this to reflect changes in the federal Water Quality Act.

The Agency regulation, 15.33, specifies the review procedure for local applications which are submitted to the municipal works section, the EPA and to the State for eligibility of construction grants.

The section has developed a priority list for municipalities requesting construction grant aid.

b. Permits/Plans and Specifications

Under existing legislation, plans and specifications for permits to discharge waste (either new systems or extensions of existing systems) must be submitted for review by the Agency as a partial requirement for receiving the permit.

c. Inspections/ Surveillance

This function includes inspection of Minnesota's existing municipal, federal, and private sewage disposal systems to ensure satisfactory operation of sewage treatment facilities receiving EPA construction permits. No inspections are made of municipal sewage treatment systems.

A condition for state receipt of EPA construction grants is the least annually for the first three years, and periodically thereafter to ensure that such treatment works are operated and maintained effectively.
a. Operations/ Evaluations

Operation and maintenance manuals must be prepared for all federal grant projects. A function of the municipal works section consists of review and approval of these manuals. In addition, the section evaluates monthly reports submitted on treatment plant operations for compliance with Agency efficient and water quality standards.

e. Operator Training/ Certification

Minnesota law\(^1\) requires mandatory certification of wastewater treatment facility operators. Training opportunities provided by this section include:

- Annual Institute for Wastewater Treatment Plant Operators
- Regional Training Schools for Treatment Plant Operators
- Activated Sludge Workshops
- Training School for Operation and Maintenance of Stabilization Ponds
- Short Course in Operator Training for Collection Systems

Although the governing body or owner of the treatment facility may certify their operator without examination, that certificate will apply only to that particular facility.

c. Industrial Permits

This section grants state permits for industrial systems. Applications for a permit to discharge is subject to an extensive review process to ensure that it meets criteria consistent with State standards and regulations. The permit serves as the basis for the approved construction of the facility and the routine review of the facility through investigation and monthly reviews of operation reports.

Monthly reports must be submitted on the operation of the system and on the results of monitoring tests made on the effluent or affected state waters.

Routine inspection is made of industrial disposal systems for which permits have been issued or are under review. This includes examination of the disposal systems, making recommendations for more effective operation of the disposal system, collection of effluent samples and gathering of any data which may reflect the effectiveness of the system. The results of these surveillance activities are compared with monthly reports made by the owner of the disposal system.

Cases of noncompliance in the maintenance or operation of permit systems are reviewed. Complaints of alleged industrial pollution problems are investigated when circumstances are unclear, and corrective action taken when necessary.

A permit is required for the establishment of liquid storage sites. Guidance and assistance is rendered to ensure that the applicant meets minimum requirements.

Other activities include inspection and monitoring of all industrial discharges to evaluate other effects on water quality, surveys made on an unscheduled basis including industrial discharges to municipal systems, and other special studies including potential pollution from the culture of wild rice, the disposal of waste lubrication oil and use of salt.

Permits Section

The Permits Section is a newly created Section which has the responsibility of administering the NPDES Program as promulgated in Regulation WPC 36 (See Appendix A). The Environmental Protection Agency has granted the MPCA the authority to draft and issue NPDES permits for all non-federally owned discharges in Minnesota.

Planning Section

The activities of this section can be divided into 3 subfunctions:

Busin Plans

As a condition for receiving federal money for construction of wastewater facilities, there must be, by July 1, 1979, basin-wide plans for the treatment and disposal of wastewater.

Of a total of 11 basin plans, the MPCA has responsibility for 9 of them. These basin plans are to include known water quality violations, complete lists of dischargers effluent limitations for all dischargers, and compliance schedules for meeting these limitations.

Area-wide Plans

Section 208 of the 1972 Act requires the designation of those areas which, as a result of urban-industrial concentration, have substantial water quality control problems. Such plans are necessary for those metropolitan areas because of the urban-industrial concentrations causing water quality problems, where non-point sources, such as urban runoff, are major contributing factors along with point source discharges, and where the control of land may be necessary for the control of water pollution.

Two potential Section 208 districts have been identified, the Twin Cities Metropolitan, and the Western Lake Superior Sanitary District (WSSD). If there is not sufficient money available to designate these as 208 planning areas, they will be designated for Section 201 facility plans.

\(^1\) Section 115.71 et. seq. Minnesota Statutes 1971.
Section 201 Facility Plans

With the Act of 1972, new planning guidelines were established. The planning unit has devoted considerable effort toward meeting the new guidelines. These are done on an area-wide basis to provide control of municipal sources of pollution.

Section 201 planning consists of three basic steps. First, the waste disposal problem is examined in terms of several likely alternatives for solution. One alternative is selected. Second, a grant is made for engineering plans and specifications. The third step is the actual construction.

Other Programs

In addition, the planning unit has basic responsibilities for data management for compliance status, inventories of municipal and industrial sources, basic plan inventories, construction grant information, and certification. Basic plan inventories, construction grant inventories, construction grant information, and certification. A basic objective of the Planning Section is to provide systematic review of all data needs, and avoid disorganized use of data by the operating sections.

Surface and Groundwater Section

The duties of this section include the following subfunctions.

Monitoring and Investigations

This section monitors from 101 permanent monitoring stations on a monthly basis. Section 31 of the 1972 Act requires that each state shall identify and classify as wastewater sources of pollution measures that could be implemented to alleviate recognized criteria violations that are not based on known lakes having existing municipal, industrial or other discharges affecting water quality of such lakes. This requires an accurate inventory of lakes which require restoration.

Preliminary estimates will be based on available information on the nature and extent of lake pollution problems, sources of pollution measures that could be used to alleviate recognized criteria violations that are not based on known lakes having existing municipal, industrial or other discharges affecting water quality of such lakes.

In relation to Section 31 of the 1972 Act, 5 lake surveys were completed in FY 1973. Final reports were released concerning 10 other surveys. In FY 1974, 10 other surveys were undertaken.

Compliance Monitoring Surveys

In FY 1973, minimal compliance monitoring of streams and lakes was necessary to ensure that the permit reporting system was operating.

Permanent In-stream Monitoring Stations

There are two permanent instream monitoring stations. In addition, up to 50 manual stations, mostly in instream waters, will be added.

Complaints

This unit handles and attempts to resolve complaints which are received by the Agency.

Compliance and Enforcement Section

The Compliance unit keeps records on progress by waste dischargers toward meeting water quality and effluent standards, and follow up to resolve problems relating to schedule delinquency.

Compliance records involve management, storage, and retrieval of information on sources with formal compliance schedules, utilizing electronic and manual data systems.

Compliance follow-up involves following the progress of sources with formal compliance schedules and taking appropriate action when a source is in serious delinquency or other delinquent status on a compliance schedule.

The Compliance and Enforcement Section also has responsibility for regulation of hazardous materials.

The accidental spill and management surveillance program involves investigation of an average of 20 incidents per month, with the number expected to increase due to greater public interest and awareness.

Division Services Section

The Division Services Section prepares for and conducts public hearings and other duties such as preparation of mailing lists, physical inventory, and referral of complaints.

Compliance-Enforcement Procedures

Prior to the Act of 1972

Even the most competent, adequately staffed, executive agency cannot deal effectively with water pollution problems if it has no enforcement tools with which to effect changes in the actions of waste dischargers. Perhaps the greatest impediment to the full realization of the goals of the Water Pollution Control Act of 1948 was the ponderous enforcement procedure. With apparent distrust of the judiciary and under strong pressure from industrial lobbyists, Congress wrote into the Act an enforcement mechanism that, for all practical purposes, made voluntary compliance by polluters the only real solution, and rendered the Act a grant of limited financial aid and a bare declaration of intent.

The Act of 1948 provided for no criminal sanctions against an alleged polluter, leaving civil actions the sole available remedy. Since an assessment of monetary damages caused by any given polluter was impractical, an
injunction to halt the effluent was the only available remedy, leaving the polluter free to continue his actions until the conclusion of a longer cumbersome legal process.

The process involved the following. First, after "extensive studies and surveys," the Surgeon General was required to give formal notice to the polluter and the State Pollution Agency. If, after a "reasonable" period, which could be several months or longer, action to abate the nuisance wasn't commenced (action need not have been completed), a second notice was sent to the polluter and the State was recommended to commence legal action. If, after another reasonable period, abatement action had not been commenced and the State had failed to bring suit, the Federal Security Administration was required to call a public hearing and appoint a panel. The panel would hold extensive hearings and issue recommendations concerning the measures. If any, it found to be reasonable and equitable to secure abatement of the pollution. After affording the polluter a "reasonable" opportunity to comply with the recommendations, the Federal Security Administration was authorized, with the consent of the State where the pollution originated, to request that the Attorney General bring suit. At the trial, the record of the hearing was given probative, but not conclusive weight and the judge was empowered to enter any orders which he deemed equitable. Since the Act granted the Surgeon General no special investigatory powers (e.g., subpoena authority) no funds to conduct these investigations, and granted no additional funds to the Attorney General for prosecution, it is not surprising that in the first 10 years of the Act, only one case reached the Federal courts. The government lost!

As the publicity of the enforcement procedures under the 1965 Act became more apparent, and the water pollution problems became more severe and alarming, it became increasingly evident that more effective enforcement tools were needed. Thus, the water quality standards required by the 1965 Federal legislation were a significant part but the states were left to set the standards.

While this gave the authorities a more tangible enforcement weapon, it was difficult to relate these back to specific effluent discharges. Thus, it was nearly inevitable, for an enforcement standpoint, that the shift was made to effluent limitations.

Note that even with this, there is still a strong element of state participation, with the state intended to eventually have major responsibilities for administering the WDEP program.

Under the 1972 Act

The most significant aspects of the 1972 Act is the change to effluent limitations, which makes the issue of proof easier, and the institution of the permit system. The 1972 Act greatly tightened enforcement procedures. Congress concluded that if the time tables established for abatement are to be met, the threat of sanction must be real and enforcement procedures must be swift, direct, and effective.
CHAPTER VI

PROBLEMS OF IMPLEMENTING GOALS AND POLICIES

Progress Under the Act of 1972

With a far-reaching effort such as the WPC Act Amendments of 1972, it is to be expected that there are some problems to overcome in implementing the Act. Therefore, in some cases, progress was slower than hoping for by the framers of the Act. Yet, much progress has occurred.

With the heavy emphasis of State participation under the Act, many changes in state law were required. This, of course, took time. As April 1973, no states had qualified for approval under the WPC Act Amendments of 1972. However, by July 1, 1974, fifteen state programs had qualified, but Minnesota being the 15th State (June 30, 1974). In addition, there have been new statutory provisions in 30 states and new provisions pending in another 10 states.

Another difficult task was the establishment of the 1972 effluent guidelines covering "best practicable control technology currently available" and the 1972 standards to cover the "best available technology economically achievable." In addition, there were to be new source permits and pretreatment standards for numerous industrial categories, for a total of over 100 sets of standards.

Effluent guidelines for 28 industrial categories were promulgated by June 30, 1972. Effluent guidelines for 20 classifications of industry have been promulgated.

It must be recognized that the 1972 Act profoundly changed and expanded nearly every aspect of the nation's water pollution control effort. As the time frame was provided to make these changes. In addition, extremely long time frame was provided to make these changes. In addition, extensive revision of public participation were added. Extensive and time consuming revision of public participation were added. The creation problems both for the EPA and for many states which were noted.

The "Funding Gap"

As we have seen, the funds made available at the Federal level for municipal waste treatment have been low, the philosophy being that waste treatment was a local responsibility. Whether or not the philosophy was rational on economic or other grounds is not at issue here. The fact remains that for a number of reasons, municipalities were not able and/or willing to finance treatment facilities at sufficient levels to maintain water quality consistent with public objectives.

As we have seen, the Water Quality Act of 1948 began very modestly, with low interest loans up to $200,000 for municipal treatment works. The 1956 Act provided for $50 million in Federal waste treatment grants over the objections of the President. The grant money was again increased in 1961, 1965, and 1966. And, of course, the 1972 Act increased the authorized money still further.

While the concept of Federal responsibility to aid construction of local waste treatment facilities has gained prominence, there has been a sizeable funding gap between authorized money and actual appropriations. While sums of money may be authorized by legislation to be spent for a specific purpose, these amounts may be appropriated only in part or not at all.

As a rule, appropriations are considerably below authorized levels of spending. To fund all programs at fully authorized levels would be impossible without greatly increasing the magnitude of the public sector. However, lack of full funding has caused difficulty for Minnesota communities in that only a small portion of the grant applications could be funded. Those communities not receiving grant applications, for the most part have deferred construction.

The Water Pollution Control Act Amendments of 1972 departed from convention by stating in the law that specified amounts be spent. These amounts, nationally, were $5 billion, $6 billion, and $7 billion in fiscal years 1973, 1974, and 1975 respectively. However, only $3 billion, $3 billion, and $4 billion have been released. This has led to court action, with the State of New York attempting to secure its portion of the monies which have not been released. The case is pending before the Supreme Court.

The failure to release the funds has meant a shortfall to Minnesota communities of close to $61 million in both FY 73 and 74, and $50 million in FY 75. Again, this means that construction is held up and that goals and objectives of the 1972 Act cannot be met. In view of the estimated $1.3 billion in expenditures in Minnesota required to meet the goals of the 1972 Act, it appears that the chance of achieving these goals is quite remote.

The current high rate of inflation, especially in the construction industries portends dismal prospects for achieving water quality goals, 1

1 This is the basis of the oft-statedquip that the "shrewd" politician votes for legislation containing authorizations for spending, but against the appropriations and especially the taxes out of which they are financed.
even if the pending court case is favorable to the release of funds. Higher construction costs reduce the impact of fixed dollar allocations.

The "Zero Discharge" Controversy

A national goal stated in the 1972 Act is the elimination of the discharge of pollutants into navigable waters by 1985. An interim goal stated in the 1972 Act is the elimination of pollutants or "zero discharge" by 1985.

What can be concluded concerning the reality of this goal? First, it is an ideal only - an ideal toward which the nation can strive. The 1983 goal is an objective which carries with it certain enforcement mechanisms which, if proven to be effective, would improve water quality but which are not completely eliminate pollutants. The 1985 goal of "zero discharge" is an ideal, and it would appear extremely unlikely, for several reasons, that the goal will be achieved.

First, it must be recalled that pollutants are a by-product of production and consumption. To change these pollutants into a form which is not harmful takes resources which cannot be represented in dollar terms. As a greater degree of sewage "treatment" is achieved, the cost per unit of separating more of the pollutants (BOD, nutrients, etc.) increases at an increasing rate. And in view of the numerous alternative investments at nearly the same cost, it may be difficult to justify and competing uses for public funds. It is difficult to justify and competing uses for public funds. It may be difficult to justify and competing uses for public funds. It may be difficult to justify and competing uses for public funds.

Also, one must consider that to discharge zero wastes into water may result merely in the substitution of one pollution problem for another. Disposal of wastes by incineration can cause air pollution problems.

An alternative receiving much attention is the disposal of wastewater on land using the percolation through land as a "living filter." This has much intuitive appeal, particularly because of the "recycling" aspect. But there are numerous technical conditions that must be present and problems which must be solved.

In addition to the foregoing problems, the U.S. economy has been experiencing increasing inflation, which deters construction. Limited purchasing power in real terms tends to create an atmosphere of "belt-tightening" and fosters a reluctance to spend for what some consider to be "luxuries." Such as pollution control. As was discussed earlier, environmental concern seems to be a phenomenon associated with affluence. It can be argued that in periods of recession and unemployment, public works expenditures for waste treatment plants would be expansionary, and helpful in increasing the level of employment. The problem is, however, that there is a tradeoff between inflation and the level of employment. Expenditures which increase the employment level tend to contribute to a rise in the price level. Policy makers and politicians are constantly attempting to strive for an "acceptable" balance between the levels of employment and prices.

Furthermore, there is the matter of competition for public funds. Even if public expenditures are to be increased as a means of fighting recession and unemployment, it is not at all certain that policy makers will consider the goals as expressed in the 1972 Act to be of paramount importance.

Thus, while "zero discharge" may be an ideal toward which to strive, or a criterion by which to judge progress, it does not appear that it is realistic to expect attainment by 1985 or any other time, for that matter. The goal, which is difficult enough to achieve by an all out effort, is impossible without the necessary resources with which to achieve that objective.

Other Factors

There are several other factors, previously alluded to, but deserving of more specific mention, which work against the translation of water quality goals into realities.

First, there is the difficult matter of non-point sources of pollution. The runoff from urban and rural land inevitably carries with it numerous substances, some of which have a harmful effect on water. These are difficult sources to control, and in view of the fact that runoff occurs even in the absence of man, the practicality of attempting to control this source of pollution may be extremely limited.

Another problem is the sheer magnitude of man-hours needed for monitoring and inspection, which must be done for all the point sources of pollution.

In Minnesota, there will be an anticipated 1350 permits issued under the NPDES system. The permits are required to submit monthly reports. Nevertheless, periodic inspections must be made. A current goal of the MPCA under the NPDES system is to inspect "major" dischargers annually with the remainder being inspected at least once every 5 years.

While this may sound like a relatively modest inspection program, it must be recalled that to inspect more frequently takes more manpower. It remains to be seen to what extent the public will support the necessary resources the effort to overcome this obstacle to translating goals and objectives into tangible results.
CHAPTER VII

SUMMARY AND CONCLUSIONS

Water pollution is basically a problem in the allocation of scarce resources. There are many uses to which surface water can be put — many of which are conflicting. In particular, use of surface water for transport and dilution of wastes conflicts with use for recreation, aesthetic values, municipal and industrial uses, and other purposes.

There are many reasons why solutions to water pollution problems are controversial and difficult to achieve. Some pollutants are subtle — being difficult to measure with any degree of precision. People disagree on the importance of pollution, the degree to which it should be abated, and, in particular, the extent to which they are willing to pay for abatement. Regarding the latter, there is further disagreement over who should pay the costs, and the method by which such payment should be made (taxes, higher prices, etc.). Arguments over who should pay may, at first, seem academic since the end result will be some combination of higher taxes and higher consumer prices. Yet, the initial incidence may vary, hitting various producer groups and taxpayers initially harder than others.

Surface water pollution results not from evil intentions of individuals, municipalities, or industries, but because of the structure of the incentive system. The market system does not put a price on the use of water and air to absorb wastes. Hence, these are used extensively as receptacles of wastes and the costs realized in the form of polluted water and air.

The price system, without the aid of rules, regulations, taxes, and subsidies, does not provide sufficient incentive for abatement activities to occur. This is, first, because of the capacity of producers and consumers to push the costs of pollution on to the public in general, and second, because many pollution control related amenities are not produced in sufficient amounts except through public action.

The failure of the price system to meet the objective of pollution abatement has led to efforts to change the rules of the game through political processes - both in terms of provision of public goods and in terms of modifying the rules and incentive system under which business, governmental units, and individuals operate.

The goals and objectives of the public relating to water pollution control have been expressed in a series of legislation at the Federal level dating from 1948 to the present. Laws have also been passed at the state level, but Federal legislation has been the impetus to state action.

Although pollution control measures add to price increases, it should be emphasized that environmental protection measures account for only a minute portion of today's inflation. Thus, it would not be rational to cease pollution control measures on the grounds of "fighting inflation."

However, even when legislation is enacted, there is a considerable and seemingly persistent gap between goals and realities. This is for several reasons. First, water pollution control efforts require funds. Federal legislation, there has consistently been a "funding gap" or a difference between authorized expenditures and actual expenditures. A second major problem has been translating goals into tangible enforcement mechanisms such that dischargers could be identified and forced to the effluent standards of the 1972 Act that these mechanisms were used, cumbersome and administratively difficult at best. Yet, there seems to be no more effective system. If public goals are to be attained, the which may be subject to change, represents the most ambitious statement of water pollution control goals yet made. While the zero discharge goal may not be attainable, the other provisions, nevertheless, represent ambitious goals which will require considerable effort.

It should not be surprising, for such action requires resources in terms of money and manpower, and requires private and public agencies to take administrative procedures is not possible because of the increasing fact is that existing procedures, even with all their complications, are more desirable to more of the public than would be the state of affairs without these laws and procedures. And these procedures will necessarily have some limitations in moving toward expressed goals. It is hoped that
APPENDIX A

Brief Description of Federal Water Quality Legislation

Water Pollution Control Act of 1948 PL 80-845, 62 Stat. 1155.

This was the first significant legislation at the federal level which addressed water pollution. The Act provided federal funds to aid in research for controlling pollution. The Act strongly emphasized that local and state governments were primarily responsible for controlling water pollution and that the programs established and money allocated was primarily to aid state and local government in their programs rather than being a federal substitute for them. Since the Act was limited only to interstate waters, it strongly encouraged interstate cooperation and authorized the creation of inter-state compacts.

Water Pollution Control Act of 1956 PL 84-658, 70 Stat. 148

This Act was designed to strengthen the 1948 Act. It reemphasized the Congressional policy of recognizing and preserving the primary role of the States in controlling water pollution. This Act improved the 1948 Act in 4 major ways:

1) It intensified the federal research effort in water pollution.
2) It provided a broader base for support to state pollution control agencies.
3) It provided a more reasonable and equitable means for federal-state cooperation in resolving serious interstate water problems.
4) It greatly increased the federal funds available for the program, thereby making implementation of the goals more possible.

Water Pollution Control Act of 1961 PL 87-58, 75 Stat. 201.

These Amendments were passed in recognition that water pollution problems were becoming more serious. The Act placed authority for its enforcement in the Secretary of HEW, and increased his powers in this area. It greatly increased the funds available for grants for construction of treatment facilities and for research. The major change, however, was to bring within the purview of the Federal government all navigable waters, including for the first time such major waterways as the Hudson River, the Great Lakes, and the nation's entire coastal waters.


This Act doubled the amounts of money available for grants under the 1961 Act. It also created the Federal Water Pollution Control Administration within the Department of HEW and received the authority of the Administration to conduct investigations into possible sources of pollution. The Act required that states were to develop water quality criteria applicable to interstate waters within the state and develop plans for implementation and enforcement.


This Act provided grants to states for developing water quality programs for financial assistance for research and grants for construction of control and abatement plans for drainage basins, and increased authorization of sewage treatment works.

The National Environmental Policy Act PL 91-204.

This Act declared national policy for the enhancement of environmental quality. Included in this Act are provisions for Environmental Impact Statements (EIS's) for Federal agencies taking action which would significantly affect the quality of the environment. This Act also established the Council on Environmental Quality in the Executive Office of the President.

Water Pollution Control Act of 1972 PL 92-500, 86 Stat. 816.

This Act constitutes the most direct Federal intervention into the problem of water pollution. The major change from previous legislation was a change from water quality standards to effluent limitations as the mechanism for controlling water pollution. The major effect is to improve the ability to enforce statutory standards. A permit system is established, requiring the use of the best practicable technology to abate pollution, and...
APPENDIX B

WPC Regulations: Origin and Significance

WPC 1

Classification and Standards for the Mississippi River and Tributaries from the Rum River to the Upper Lock and Dam at St. Anthony Falls.

Adopted March 28, 1963

Uses of this length of the River are (1) as water supply for the people and industry of the Twin Cities Metropolitan area, (2) for boating and fishing, (3) for production of electricity, (4) for some commercial navigation. Sources of pollution are the sewers of Minneapolis and St. Paul and industrial pollution. These waters are not suitable for drinking water or swimming.

Water quality and pollution conditions:

These classifications and standards are necessary for the purposes of Minnesota Statutes (1961) Sections 115.01 - 115.09. Sections 115.01 to 115.09 are cited as the state's water pollution control act. These sections outline the powers and duties of the Minnesota Pollution Control Agency. These also specify certain duties of citizens and dischargers in the state of Minnesota.

WPC 2

Classification and Standards for Mississippi River and Tributaries from Upper Lock and Dam at St. Anthony Falls to the Outfall of the Minneapolis-St. Paul Sanitary District Sewage Treatment Plant.

Adopted March 28, 1963

Uses of this zone of the river include:

(1) commercial navigation
(2) pleasure boating
(3) industrial uses
(4) disposal of treated sewage and waste effluents
(5) esthetic enjoyment of scenery

Water quality and pollution conditions:

These classifications and standards are necessary for the purposes of Minnesota Statutes (1961) 115.01 - 115.09.

WPC 3

Classification and Standards for Mississippi River and Tributaries from the Outfall of the Minneapolis and St. Paul Sanitary District Sewage Treatment Plant to Lock and Dam #2 near Hastings.

Adopted March 28, 1963

Uses of this zone of the river include:

Water quality and pollution conditions:

Effluents from Minneapolis and St. Paul sewage treatment plant, South St. Paul Sewage treatment plant, other public sewage treatment plants and industrial waste are discharged into this zone. No other feasible means of disposal of such effluents exists. The water in this zone is not suitable for drinking water, swimming or high quality industrial uses.

These classifications and standards are necessary for the purposes of Minnesota Statutes (1961) 115.01 - 115.09.

WPC 4

Regulation Relating to Storage of Keeping of Oil and Other Liquid Substances Capable of Polluting Waters of the State.

Adopted June 26, 1964

The Water Pollution Control Act of 1965 created the Water Pollution Control Commission (WPC) and defined pollutional materials as being essentially waste materials. In 1963 two accidental oil spills resulted in deaths of about 10,000 ducks, damage to boats, harbors and beaches over a stretch of Mississippi river, and endangered water supplies for many miles downstream. These episodes served to emphasize that the WPC did not have authority to (1) deal effectively with storage of such non-waste materials, (2) require these responsible for spills to take necessary clean-up or salvage action unless a public health emergency was created. Therefore in 1963 the Minnesota legislature amended the WPC Act. These amendments authorized the WPC to adopt regulations and to prohibit the storage of liquids in any manner which does not provide reasonable protection against water pollution in case of spills. Ground waters were also included as needing such protection. These amendments provided a legal basis for WPC-4.
WPC 5
Classification and Standards for the Minnesota River and Tributary Waters from Carver Creek to the Outlet of Reilly Creek and Grass Lake Below Shakopee, Zone 56-22.
Adopted November 2, 1965

WPC 6
Classification and standards for the Minnesota River and Tributary Waters from the outlet of Reilly (Perroll) Creek and Grass Lake to the Mississip. River at Fort Snelling, Zone 56-22.
Adopted November 2, 1965

WPC 7
Classification and Standards for Reilly (Perroll) Creek, Bluff Creek, The Other Creek, Spring Creek, Carver Creek and Head Creek and Tributary Waters.
Adopted November 2, 1965

WPC 8
Classification and Standards for Eagle Creek and Purgatory Creek and Tributary Waters.
Adopted November 2, 1965

WPC 9
Classification and Standards for Nine Mile Creek and the Credit River and Tributary Waters.
Adopted November 2, 1965

WPC 10
Classification and Establishment of Standards of Water Quality and Purity for the Red River of the North, the Otter Tail River from Fergus Falls to the mouth and the Red Lake River from Crookston to the mouth.
Adopted July 30, 1966

Adoption of standards for all interstate waters was required by the Federal Water Quality Act of 1965. The Red River of the north is, of course, an interstate body of water. At the time of this regulation only a few of the communities on the Red River of the north had permits for the operation of disposal systems and these were old permits. It was determined that both industrial and municipal sources of pollution made the water detrimental to public health, unfit for recreation and for drinking water, injurious to water life, and detrimental to economic growth of the area. So by authority in Minnesota Statutes 115, the regulation was adopted.

WPC 11
Classification and Standards of Water Quality and Purity for the Rainy River from the outlet of Rainy Lake at Fosston to the Minnesota and Ontario Paper Company sawy in International Falls.
Adopted November 9, 1965

Findings of Fact:
One of the main reasons for lack of development (in section or zone 2 of the river) in the gross pollution of the river by industrial waste and sewage.

Considerable recreational development exists along zone 1 and 3 of the river.

Primary uses of the water are domestic consumption, fisheries and recreation, and industrial consumption.

Recreational uses greatly discouraged by discharge of partially treated sewage and industrial wastes. Major sources of industrial pollution were found to be the pulp and paper mills in International Falls.

Industrial wastes and municipal sewage added to the waters result in severe oxygen depletion of the water which has seriously affected fish propagation.

The floating sludge and offensive gases decrease the esthetic value of the Rainy River.

Adoption of standards for all interstate waters in Minnesota is now required by the Federal Water Quality Act of 1965 as well as by Minnesota Statute, Chapter 115.
WPC 12
Classification and Standards of Water Quality and Purity for the Rainy River from the Minnesota and Ontario Paper Company Dam in International Falls to the Canadian National Railway Bridge in Baudette.

Adoption of standards for all interstate waters of Minnesota is now required by the Federal Water Quality Act of 1965 as well as by Minnesota Statute, Chapter 115.

WPC 13
Classification and Standards of Water Quality and Purity for the Rainy River from the Canadian National Railway Bridge in Baudette to Lake of the Woods.

Adopted November 9, 1966

Adoption of standards for all interstate waters of Minnesota is now required by the Federal Water Quality Act of 1965, as well as by Minnesota Statute, Chapter 115.

WPC 14
Criteria for the classification of the interstate waters of the state and the establishment of standards of quality and purity.

Filed August 15, 1967 Amended October 4, 1973

Minnesota Statutes, Chapter 115 and Federal Pollution Control Act, as amended, require criteria for the adoption of classifications and establishment of standards and procedures for their implementation and enforcement for all waters of the state.

The five general categories listed in Appendix A apply to all the waters of the state.

Classification and establishment of standards serves to protect the existing high quality waters and also to upgrade the presently polluted and degraded waters of the state.

Amendments to WPC 14 were made as result of the Federal Water Pollution Control Act Amendments of 1972, communications with the U.S. EPA, and also Minnesota Statutes, Chapter 116.

Chapter 116 of the Minnesota Statutes created the WPCA and it details the powers and duties of that agency.

Other previously-approved regulations specify water quality standards for waters also included in WPC 14 (and WPC-24). Where this occurs, the more stringent standard shall apply.

WPC 15
Criteria for the classification of the Interstate waters of the State and the Establishment of Standards of Quality and Purity.

June 14, 1967 last amended October 4, 1973

Classifications and standards were set pursuant to Minnesota Statutes, 1965, Chapter 115, and the Federal Water Quality Act of 1965, as amended. The standards were set to reasonably accomplish the abatement and prevention of water pollution.

Amendments to WPC 15 were made as a result of the requirements of the Federal Water Pollution Control Act Amendments of 1972 and communication with the U.S. EPA.

Where two regulations apply to the same body of water, the more stringent standard shall be considered to be applicable.

WPC 16
Classification and Establishment of Standards of Water Quality and Purity for Anderson Creek, Big Silver Creek, the Blackfoot River, Cuntrip Creek (and Mary Brook), Clear Creek, Deer Creek, the Little Net River, the Net River, North Fork Creek, Skunk Creek, Stateline Creek and Stony Brook, Carlton and Pine Counties.

Adopted June 5, 1967

WPC 17
Classification and Establishment of Standards of Water Quality and Purity for the Nemadji River System, Carlton and Pine Counties (except Waters Included in WPC 16).

Adopted June 5, 1956

These classifications and standards are necessary for the purposes of Minnesota Statutes, Chapter 115 to safeguard the specified waters of the state from pollution by preventing any new pollution and abating existing pollution.

WPC 18
Effluent standards for disposal systems discharging to the Mississippi River from the outfall of the Minneapolis-St. Paul Sanitary District Sewage Treatment Plant to Lock and Dam #2 near Hastings.

Effluent standards for disposal systems discharging to the Mississippi River from the junction of the Rain River to the outfall of the Minneapolis-St. Paul Sanitary District Sewage Treatment Plant, and from Lock and Dam #2 near Hastings, to the junction with the Chippewa River, and to the St. Croix River from Taylors Falls to the junction with the Mississippi River.

Filed with Secretary of State September 26, 1968
Effluent standards for disposal systems discharging to the Minnesota River from above Chaska to the Junction with the Mississippi River at Fort Snelling.

Filed with Secretary of State September 26, 1968

WPC 20

Effluent standards for disposal systems discharging to the Minnesota River from Mankato to Chaska.

Filed with Secretary of State September 26, 1968

WPC 21

WPCA may set effluent standards for the reaches of the rivers as proposed by WPC 18, 19, 20, 21 by, among others, Minnesota Statutes 1965, Sections 115.01, 115.141 and Laws 1967, Chapter 203.

Law 1967, Chapter 203 amended Section 115.141 of the Minnesota Statutes. The WPCA could find that in order to comply with Federal legislation all or part(s) of Section 115.141 must be violated. Chapter 203 allows this section, or the appropriate part(s) to be waived if a situation should arise.

WPC 22

Classification of Underground Waters of the State and Standards for Waste Disposal.

Filed August 14, 1973

The intent of the regulation is to insure that land disposal of effluents is not utilized at the expense of ground water quality. This regulation satisfies section 402 b (1) (6) of the 1972 amendments to the Federal Water Pollution Control Act and regulations promulgated by the EPA in response to this section. This regulation is intended to control land disposal as a means of assuring protection of ground water quality. It is not intended to eliminate irrigation as a means of waste disposal.

WPC 23

Standards of Quality and Purity for Effluents Discharged to Intra-State Waters.

Filed with Secretary of State April 15, 1969

This regulation applies to the effluents themselves, not the receiving waters.

The standards are altered depending on the classification of the receiving waters.

Section 115.141 Subdivision 4 of Minnesota Statutes gives express authority for this regulation.

WPC 24

Classifications of Intrastate Waters of Minnesota

Filed September 7, 1973

WPC 24 is a companion regulation to WPC 14. WPC 14 supersedes the classification of intrastate waters given in WPC 1, 2, 5, 6, 7, 8, 9, 10, 17.

WPC 25 and 27 are used in conjunction with WPC 24. Adoption of WPC 24 is in response to the Federal Water Pollution Control Act Amendments of 1972 and guidelines developed by United States Environmental Protection Agency, U.S. EPA.

The classification of intrastate waters as to their use enables the agency to apply specific water quality standards to protect and preserve the particular use of the designated sections of these waters.

WPC 25

Classification of Interstate Waters of Minnesota.

Filed with Secretary of State February 4, 1971 Amended September 7, 1973

This is a companion regulation to WPC 15. It supersedes classification of interstate waters adopted in WPC 1, 2, 3, 5, 6, 10, 11, 12, 13, 16, 17.

WPC's 5, 18, 19, 20, 21, 26, 27, 28, 30, 31, 32 contain effluent standards which will be used in conjunction with WPC 25. Amendments to WPC 25 are a result of requirements of Federal Water Pollution Control Act Amendments of 1972 and communication with U.S. EPA.

WPC 26

Effluent Standards for disposal systems discharging to Lake Superior, Lake of the Woods and Rain lake.

Filed with Secretary of State February 4, 1971

WPC 27

Effluent standards for disposal systems discharging to the Intrastate Waters of the Lake Superior Basin, and to the Interstate Waters of Lake St. Croix.

Filed with Secretary of State February 4, 1971
WPC 28
Effluent standards for disposal systems discharging to the St. Louis River from its source to and including St. Louis Bay and Superior Bay; the Mississippi River from its source to the Blandin Dam in Grand Rapids including Lakes Andrusia, Besidji, Cass, Itasca, Pokegama, and Winnibigoshish; and the Little Minnesota River and Big Stone Lake, and Albert Lea lake.
Filed with Secretary of State February 4, 1971

WPC 29
Effluent standards for disposal systems discharging to that portion of the Mississippi River from the Blandin Dam in the City of Grand Rapids to the mouth of the Rum River and from the mouth of the Chippewa River to the Iowa Border, the Red Cedar River from Austin to the Minnesota-Iowa border, the Minnesota River from the mouth of the Pomme de Terre River, and including Marsh Lake to Mankato, and the Blue Earth River from the mouth of Elm Creek to the junction with the Minnesota River in Mankato.
Filed with Secretary of State February 11, 1971

WPC 30
Effluent standards for disposal systems discharging to the St. Croix River from the Wisconsin Border crossing to Taylors Falls.
Filed with Secretary of State February 4, 1971

WPC 31
Effluent standards for disposal systems discharging to the Roseau River from its source to the Canadian Border, the North Fork of the Yellow Medicine River, the West Fork of the Lac Qui Parle River, the Blue Earth River from the Iowa border to the mouth of Elm Creek, the Little Rock River, the West Fork of the Little Sioux River, the Rock River, the West Fork of the Des Moines River from its source to the Minnesota-Iowa border, the Red Cedar River from its source to Austin, Bear Creek, the Upper Iowa River, Pine Creek, and the Root River.
Filed with Secretary of State February 4, 1971

WPC 32
Effluent standards for disposal systems discharging to Crooked Creek from its source to its mouth.
Filed with Secretary of State February 4, 1971

Regulations 26-32 are effluent standards for disposal systems discharging to designated waters of the state. All of these regulations are similar in that they specify the effluent quality for discharge to designated waters. The differences between them relate to their use, the capability of receiving waters to assimilate waste and the necessity for removal of nutrients so as to minimize aquatic weed and algae growths.

WPC 33
Reserved for future use.

WPC 34
Rules for the administration of the municipal facilities assistance program and the Minnesota State Water Pollution Control Fund.
Filed with Secretary of State April 25, 1972

The legislature in 1971 created the Minnesota State Water Pollution Control Fund, Minnesota Statutes, Sections 116.16 et. seq. (1971), the primary purpose of which is to provide state matching grants for Federal construction of municipal disposal systems under the conditions prescribed in section 116.16 et seq. WPC 34 was promulgated and adopted for the administration of this program.

The amendment to WPC 34 provides necessary flexibility needed by the MPCA in order to comply with any requirements which may be reevaluated by EPA for the adoption of a new basis for determining priorities for Federal funds.

WPC 35
Reserved for future use.

WPC 36
For administration of the National Pollutant Discharge Elimination System (NPDES) and State Disposal System Permit Programs.
Filed with Secretary of State on April 10, 1974

The NPDES was established under the Federal Water Pollution Control Act Amendments of 1972. WPC 36 is necessary to meet, in part, the requirements imposed by the EPA for approval of Minnesota's administration of the NPDES permit program.

A need exists to establish a standard procedure for the administrative processing of NPDES permits and State disposal system permits.

A need exists for MPCA to properly carry out the requirements of Minnesota Statutes Chapters 115 and 116, as amended. The promulgation of WPC 36 supplements and is pursuant to such statutory authority.
APPENDIX C

Water Quality Classification

Interstate waters are defined as all lakes, rivers, and other waters that flow across or form part of state boundaries. All remaining waters in the state which do not fit the definition of interstate waters are intrastate waters.

Note that the classification scheme is not intended to be listed in order of priority. The classifications for both interstate and intrastate waters are:

1. Domestic Consumption—waters used for drinking, cooking, or other domestic purposes.

2. Fisheries and Recreation—waters used for fishing, fish culture, bathing or other recreational purposes.

The background level may be used instead of the standard if (a) the background level is higher than standard, (b) the background level is lower than standard and reasonable justification exists for preserving the natural state.

(b) is closely related to the non-degradation part of the regulations which states that water of high quality should be maintained unless a change is justifiable as a result of economic or social development and will not interfere with present and future uses of the water.

If the FCA finds that adhering to the standards would be unreasonable or impractical it may grant a variance to the person(s) involved and allow the person(s) to continue normal operation.

3. Industrial consumption: waters which are used for industrial processes, cooling water, or any other industrial or commercial purposes.

4. Agriculture and wildlife: waters used for any agricultural purposes (including stock watering and irrigation) or used by wildlife.

5. Navigation and waste disposal—waters used for any form of water transportation, for disposal of waste effluents (municipal, industrial, etc.), or fire prevention.

6. Other uses.

Note that these classifications are not mutually exclusive. A particular body of intrastate water can belong to more than one classification.

The major classifications are further divided as follows:

1) Domestic Consumption

Class A—Without treatment of any kind these waters will satisfy the mandatory and recommended requirements of the Public Health Service. Usually this standard will be restricted to underground waters with a high degree of natural protection.

Class B—The waters in this class will meet the requirements of the Public Health Service when disinfected (with chlorine, etc.). Usually this standard will be restricted to surface and underground waters with moderately high degree of natural protection.

Class C—If this water is treated by coagulation, sedimentation, filtration, storage and chlorination or other equivalent processes, the water will meet the requirements of the Public Health Service. This standard will usually be restricted to surface waters, and ground waters not afforded adequate protection against contamination.

Class D—If this water is treated by coagulation, sedimentation, filtration, storage and chlorination and additional pre, post, or intermediate stages of treatment, the water will meet the requirements of the Public Health Service. This standard will usually be restricted to surface waters, and ground water not afforded adequate protection against contamination.

2) Fisheries and Recreation

Class A—These waters will permit maintenance of warm and cold water fishes and be suitable for recreation of all kinds.

Class B—These waters will permit maintenance of warm or cool water fish and be suitable for recreation of all kinds.

Class C—Water in this class will permit maintenance of rough fish and be suitable for boating.

3) Industrial Consumption

Class A—These waters can be used without chemical treatment (except softening) for most industrial purposes (except food processing).

Class B—With moderate treatment these waters can be used for general industrial purposes (except food processing).

Class C—Without high degree of treatment these waters can be used for industrial cooling and materials transport.

4) Agriculture and Wildlife

Class A—These waters can be used for irrigation purposes with no significant harmful effects on the crops.

Class B—Livestock and/or wildlife can use these waters with no harmful effects.
5) Navigation and Waste Disposal

These waters should be suitable for enjoyment of scenery and should not interfere with navigation or damage property.

6) Other Uses

APPENDIX D

TERM INOLOGY

Terminology Common to Water Quality Legislation and Administration

Interstate Compact - a contract entered into between 2 or more different states. The U.S. Constitution requires that such a compact be approved by Congress in order for it to be binding on the parties.

A suit in Law - is one in which the plaintiff is seeking monetary damages and is tried before a jury if either party requests one. A suit in equity is one in which some relief other than monetary damages is sought, such as an injunction to prohibit a polluter from dumping sewage. An equity suit is heard only by a judge.

Sovereign Immunity - A legal principal providing that governmental agencies cannot be sued. Several State and Federal Statutes permit suits in specific circumstances. Most states and federal water pollution statutes provide that governmental agencies can be sued.

Injunction - A court order prohibiting or requiring an act. For example, an order requiring a discharger to stop polluting, or an order requiring a discharger to install certain treatment facilities.

Temporary Restraining Order - An order issued by a court of equity upon the filing of an application for an injunction which has the same effect as the injunction which is sought. It may be granted without notice to the other party, and only when the petitioner can demonstrate a likelihood of serious harm resulting if it is not granted. It expires upon termination of the injunctive action.

Jurisdictional Amount - One requirement of a suit at law in federal courts is that the damages be at least $10,000. Thus, most damage actions involving $0 pollution are brought in state courts and federal cases are for injunctions.

Mandamus - order issued by a court to a government official instructing him to perform his statutory duties.

Point Source of Pollution (As defined in the 1972 Water Pollution Control
Act Amendments - Any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are discharged. It is to be differentiated from such broad area pollution sources as soil erosion.

Pollutant - dredged soil, solid waste, incinerator residue, sewage, garbage, sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, discarded equipment, rock, sand, municipal and agricultural waste discharged into water.
Toxic Pollutant - Those pollutants, including pathogenic organisms which after discharge and upon exposure or ingestion will cause disease, death, behavioral abnormalities, cancer, genetic mutation, or physiological malfunction in any organism. Literally, this would include anti-bacterial and anti-viral agents, but such an interpretation was probably not intended.

Intrastate Waters - Those streams and lakes contained entirely within the boundaries of a single state.

Interstate Waters - Rivers and lakes which flow through, are within, or form the boundaries of two or more states. The distinction is no longer usable, as all navigable waters, whether intrastate or interstate, are within the purview of the Federal Program.

NPDES (National Pollutant Discharge Elimination System) - This is the major provision of the Act of 1972. It is a permit system operating under joint State-Federal control. All point sources of pollution must obtain a permit from either the Federal or State government for the discharge of pollutants. Permits require compliance with applicable effluent guidelines and/or water quality standards and regulations. A compliance schedule is built into the permit where the discharger is not now in compliance. The permits are for a maximum duration of five years and must be renewed or reissued. It is illegal to discharge without a permit. Heavy fines are provided for violations of permits.

Promulgate - In law, to follow the prescribed requisite procedure for instituting a rule or regulation, usually by publication in the Federal Register or some other official journal.

Navigable Waters - The waters of the United States including the territorial seas. In practice, this means all surface waters.

Effluent Limitation - Any restriction established by a State or the EPA on quantities, rates, and concentrations of pollutants discharged into navigable waters.

Schedule of Compliance - A schedule of remedial remedies, including an enforceable sequence of actions or operations leading to compliance with effluent limitations.

Civil Action - A legal action brought either by a government agency or a private party, usually in pollution cases. It is for an injunction or damages.

Criminal Action - A legal action brought against a person or a corporation by the government upon the conviction of which, the defendant can be fined and imprisoned.

Plaintiff - The party who initiates a suit in law or equity, the one who is seeking redress, prevention, or cessation of a wrong.
Terms that appear in the MPCA effluent standards

Biochemical Oxygen Demand (BOD) - the BOD of a given volume of water refers to the amount of oxygen needed by bacteria when they act on decomposable organic materials present in the water under specified conditions. In Minnesota regulations, five days is the time specified for the test. The BOD test is one of the most important tests in pollution work. Knowledge of the BOD of the effluents being discharged, the BOD of the receiving waters, and the rate at which oxygen is dissolved by the receiving waters permits an estimation of the level of pollution which exists in the receiving waters.

Coliform Group Organisms - See the section on items appearing in the water quality standards.

Gill - See the section on items appearing in the water quality standards.

Pathogenic Organisms - Organisms that produce disease are called pathogenic. Here, the main concern is with waterborne pathogens, e.g., typhoid. Usually the presence of pathogenic organisms is only inferred from the detection of fecal coliform bacteria.

pH - See the section on items appearing in the water quality standards.

Phosphorus - See the section on items appearing in the water quality standards.

Suspended Solids - See the term Total Suspended Solids in the section on items appearing in the water quality standards.

Turbidity - See the section on items appearing in the water quality standards.

Unspecified Toxic or Corrosive Substances - The enormous number of chemicals in existence and the continual synthesis and discovery of new ones precludes the specific listing of all but the most common toxic or corrosive substances. Therefore, some category must be included in the regulations which will apply to all unspecified dangerous substances.

Alkalinity - A pH of greater than 7 (see pH). Highly alkaline waters are unpalatable. Thus the necessity for a limited amount which can be present in public water supplies.

Ammonia - Nitrogen may be present in water in the form of ammonia, organic nitrogen, nitrites, and nitrates. In freshly polluted water, the nitrogen is mainly in the form of organic nitrogen and ammonia. If the water is aerobic, these forms will be converted to nitrites and nitrates (a process called nitrification). Analysis of effluent for the various forms in which nitrogen is present can indicate the degree of nitrification occurring in the treatment processes as well as the oxygen demand placed on the receiving waters for the completion of the nitrification process. In receiving waters, tests for the various forms of nitrogen are an indication of the length of time which has elapsed since the water has been polluted.

Arsenic and Barium - These are both poisonous heavy metals.

Bicarbonate - This is a naturally occurring ion in the waters of Minnesota. If calcium and/or magnesium is also present, the water is said to be temporarily hard.

Boron - Boron is essential for plant growth but is harmful in excessive amounts. Large amounts of boron affect the central nervous system in humans.

Calcium - Calcium is a metal that is highly toxic when one of its soluble salts is taken orally. Affected persons have been known to suffer intense pain in their bones; their bones can also fracture at the slightest strain.

Carbon Chloroform Extract - This test gives an approximation to the total amount of organic material present in the water. Synthetic detergents are not measured by this test, however.

Chlorides - Chloride ions are present in almost all natural waters. The limit on chloride ions is for reasons of taste rather than for health requirements. Fresh water fish may be hurt by high levels of chloride ions.

Chlorine - A gas used to disinfect drinking water and effluent discharges. Excess chlorine can have harmful effects on aquatic life present in the receiving waters.

Chromium - This metal can be present in two forms in the water - hexavalent and trivalent. There is evidence that large doses of hexavalent chromium lead to corrosive effects in the intestines. Trivalent chromium is not considered to be physiologically harmful.

Coliform Group Organisms - Coliform is a type of bacteria. Some types of coliform inhabit the intestines of warm blooded animals (including man) and are called fecal coliform. When fecal coliform is found in water,
the water has been contaminated with fecal material. While the coliform bacteria are not usually harmful themselves, their presence in water indicates the possibility that pathogenic organisms transmitted by feces may be present.

Color Value - This is a measure of the color of water from which turbidity-causing substances have been removed. It is determined by comparison of the test water with a visual standard.

Copper - Copper is known to be essential for humans and is believed essential for all plants and animals. In excessive quantities, copper is toxic to many forms of aquatic life.

Dissolved Oxygen - Oxygen that is dissolved in the water is the source of oxygen for fish, bacteria, etc. When the dissolved oxygen level falls below certain critical values, various species of fish cannot survive. Also, anaerobic decomposition of waste materials (which produces noxious fumes, etc.) rather than aerobic decomposition will occur if the dissolved oxygen levels fall low enough. Hence, the amount of dissolved oxygen provides a very useful measure of water quality.

Fluoride - Fluoridation of public waters is the most common artificial source of fluoride. Fluoride is not typically found in industrial wastes.

Hardness - Hard water formed by a high concentration of mineral salts forms a scum when soap is introduced into the water. Hard water will also produce scale in hot water pipes, boilers, etc. Hard water has no known adverse effects on aquatic life.

Hydrogen Sulfide - Hydrogen sulfide is a noxious, foul-smelling gas (the odor of rotten eggs is caused by hydrogen sulfide) which can be produced during anaerobic decomposition of wastes.

Iron - In high enough concentrations, iron salts may reduce the pH of the water to a harmful level. Iron salts also form precipitates which may hinder the breathing and reproduction of fish.

Lead - Lead is harmful to aquatic life and is toxic to humans. Lead is also accumulated by the body, and hence low levels of lead could, in the long run, build up to harmful levels.

Manganese - The limits on manganese arise from practical considerations rather than for reasons of toxicity. Manganese imports unsightly and persistent stains to laundry and plumbing.

Methylene Blue Active Substances (MBAS) - Those substances which react with methylene blue reagent are detected by this test. Among these substances are detergents. Hence, the MBAS test gives an estimate of the amount of detergents present in the water.

Nitrates - Nitrates are important in the growth of aquatic plants. Excess amounts of nitrates can contribute to algae blooms and the eutrophication of lakes. If large doses or nitrate are present in the drinking water of infants, methemoglobinemia (blue babies) and death can result. (See also under Ammonia for a discussion of nitrates).

Oil - This category includes petroleum products and also fats and waxes. Oil floats on the surface of water and can inhibit the respiration of it, thus reducing the dissolved oxygen levels. Oil can also interfere with the normal functioning of aquatic plants and animals. Patches of floating oil can be aesthetically unsleeping as well.

pH - A measure of the acidity or alkalinity of water. A pH of seven means that the water is neutral; a pH greater than seven means the water is alkaline; a pH less than seven means the water is acidic. The pH of effluent is an indicator of the success of treatment processes. Highly acidic or alkaline effluents will cause the receiving waters to likewise become acidic or alkaline. If the pH of water becomes very much different from seven, the normal functioning of aquatic life is disrupted.

Phenolic Materials - Typically, the phenolic material itself is not harmful at the concentrations in the standards. But phenols often form unpleasant tasting and smelling compounds with chlorine. Since municipal water supplies are chlorinated, the low limits allowed for phenolic materials prevent the formation of these chlorinated phenols in significant amounts.

Radioactive Materials - The harmful effects of radioactive materials on all forms of life are well known. Hence the necessity for including limits on these materials.

Selenium - Selenium in water supplies has been linked with long term health effects such as bad teeth, skin discoloration, and intestinal disturbances.

Silica - Silica is the form that the element silicon takes in sand and quartz. Silicon can be found as suspended material in natural waters.

Silver - Typical of heavy metals, silver is harmful to life. However if silver is present in significant amounts in industrial wastes, the silver will usually be recovered and sold.

Sodium - Sodium is one of the most common ions found in waste water. It is not harmful to aquatic life except in high concentrations. Sodium in drinking water can be harmful to people suffering from cardiac, renal, or circulatory diseases.

Specific Conductance - The specific conductance of a sample of water varies with both the number and the type of ions present. Used with the pH value, specific conductance can give a rough estimate of the total dissolved solids in the water.

Sulfates - Although sulfate occurs naturally in water, high concentrations give the water a bad taste and have a laxative effect. Water with levels of sulfate higher than those permitted by standards have been consumed with no large scale adverse effects.

Temperature - Changes in temperature affects the palatability of water, the ability of the water to be used by industry, the efficiency of treatment processes, and the desirability of a body of water as a habitat for aquatic life.
As the temperature of water increases, less and less oxygen is able to dissolve in it. Decomposition is usually speeded up by temperature increases. The increased rate of oxygen use coupled with the decreased availability of oxygen can lead to anaerobic conditions prevailing in regions of the water. Temperature can therefore be an indicator of the rate at which a body of water can assimilate waste materials and yet maintain aerobic conditions.

Threshold Odor Number - This parameter is a measure of how "smelly" the water is. Although the usual implication is that the water smells bad, this quantity just means the water gives off an odor. The threshold odor number is determined by noting by what factor the "smelly" water must be diluted with odor-free water until the resulting mixture has a barely detectable odor. This dilution factor is the threshold odor number.

Total Dissolved Solids - This is the quantity of solids which is dissolved in a specified volume of water.

Total Phosphorus - Phosphorus has noticeable effects on the rate of eutrophication of lakes. Presently efforts are being made to control phosphorus levels by removing it at the waste treatment plants. Phosphorus can be present in a number of forms in the water. Total phosphorus is simply the sum of all the amounts of the various forms present in a specified volume of water.

Total Salinity - This is a measure of all the salts present in a given volume of water. This parameter is closely related to Total Dissolved Solids since often most of the dissolved solids will be of mineral origin and hence be detected by the Total Salinity Test.

Total Suspended Solids - As the name implies, this quantity is a measure of the total amount of solid material which is suspended, and hence can be filtered off, in a given volume of water.

Turbidity Value - Turbidity refers to the cloudiness of a sample of water. Such cloudiness can be caused by suspended or colloidal material and hence is related to the Total Suspended Solids parameter. A high turbidity value can indicate that a treatment plant is not functioning properly. High turbidity also means that light cannot penetrate very far into the water. A change in turbidity can thus cause a change in the aquatic biota because the penetration of the sunlight will be limited.

Zinc - Zinc is essential for growth. In relatively large amounts it can give an astringent effect to the water and can be harmful to aquatic life.

Other Terms Relating to Water Pollution

Aerobic Decomposition - Organic waste materials undergo aerobic decomposition when the bacteria involved use oxygen in the processes of decomposition, and anaerobic processes. Products of anaerobic decomposition often have offensive odors and can be harmful.

Colloid - Sometimes very fine particles of a solid get dispersed in water. Although these particles are so fine that they do not settle out, they do not dissolve to form a true solution either. This resulting mixture is called a colloid and the solid material is said to be in colloidal suspension.

Effluent - Waste-containing water which is discharged to streams or lakes is called effluent.

Equivalent Weight - A weight of a substance that is in some chemical sense "equivalent" to a specified quantity of some standard substance. For example, 61 grams of bicarbonate ions (HCO₃⁻) are chemically equivalent to the specified quantity of a standard acid. Thus, the equivalent weight of bicarbonate is 61 grams. More commonly one will find the equivalent weight.

Most probable number per one hundred milliliters (MPN/100mL) - This is a unit, based on test results, expressing the most statistically likely number of bacterial organisms present in one hundred milliliters of water.

Parts per million (PPM) - This is a concentration unit which is used in water pollution measurements. In water pollution work PPM is usually replaced by the equivalent unit milligrams per liter (mg/l). For some substances concentrations are reported in parts per billion (ppb). This unit is one thousand times smaller than ppm.

Primary Treatment of Sewage - Sewage treated to the extent that the heavier solid particles and flotable materials are allowed to settle out is said to have undergone primary treatment.

Secondary Treatment of Sewage - If, after primary treatment, the sewage is allowed to be partially decomposed by bacteria, the sewage has undergone secondary treatment. The effluent that remains after secondary treatment will not have such a high BOD and will not put such a strain on the receiving waters as would the sewage after only primary treatment.

Synergism - Sometimes it is found that two or more substances, neither of which is present in toxic amounts, work together to produce adverse effects. Such cooperative action is synergism. In reality all the other environmental factors normally found with it because of possible synergistic effects.
Tertiary Treatment - If, after secondary treatment, the sewage is further processed to remove high percentages of nutrients (such as phosphorus) or to further reduce the sewage's BOD, the sewage is said to have undergone tertiary treatment.