Quest for Clean Streams in North Carolina

An Historical Account of STREAM POLLUTION CONTROL in North Carolina

by David H. Howells

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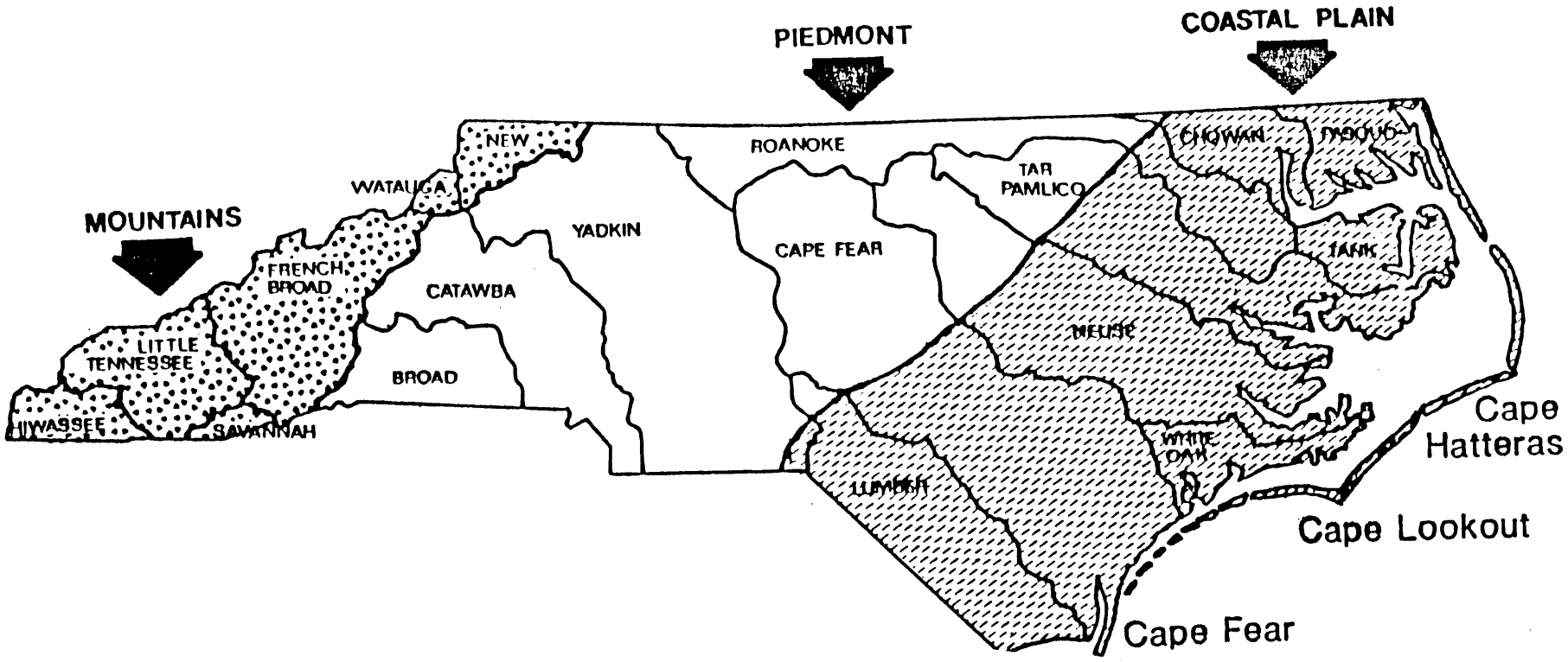


Source: N.C. Division of Environmental Management

I INTRODUCTION: EARLY NORTH CAROLINA

The colonial abundance of North Carolina's natural resources was "a source of both joy and wonder to the first colonists." There were "glowing accounts" of North Carolina's bounty from early settlers to their friends and relatives in Europe. The mild climate and plentiful rainfall, fertile soil, stately forests, abundance of game, great inland sounds and estuaries, and clear and sparkling streams alive with fish were blessings beyond all expectations.[1]

Clearing of the Land

But the land could not be farmed without first clearing the forests and preparing the land for the plow. Fish and game were to be harvested for food. The need for lumber and the milling of grain required water-powered mills with their small dams and ponds. Rivers were the highways for commerce and required dredging and eventually locks to move water craft over the occasional rapids and shoals. Change in the virgin resources of colonial days was inevitable and with that change came a progressive deterioration in water quality.

The pattern of land use changed in a number of ways after the European colonists arrived on the shores of North Carolina. This brought varying degrees of land erosion and sediment pollution of what had once been pristine streams. There was a sharp increase in sediment loads as land was converted from forest to cropland. Row-crop farming was a major source of sediment, particularly in the Piedmont region.[2] By the close of the Civil War, many streams were described as "red" and others as "yellow" with fertile top soil from the land. By 1869, the state geologist is said to have estimated that corn and cotton had reduced three million acres, or half of the cleared area of the

state to a condition described by the term "old fields." Erosion reportedly caused many families to move westward to the frontier in search of fertile new lands.[3]

Bad Wells and Foul Yards

Bad wells, foul yards, privies, and cess pools were the common lot of rural and urban North Carolinians in the late nineteenth century. "Filth and disease go hand in hand," said a health official of the period. "Of the exact nature of the poison generated by filth we know little, but . . . the ravages of epidemics are in direct proportion to the foulness of the locality. Thus," he continued, "in one city, diphtheria followed the line of bad sewers, in another of bad wells." "Bad water" was seen as one of the most efficient agents in spreading disease.[4] "Let no wells," he said, "be placed where kitchen refuse, slops, manure, or any kind of fecal matter can drain into them."[5]

II TURN OF THE CENTURY

Supervision of the Rivers

Philip P. Green, Jr. and colleagues of the Institute of Government, University of North Carolina at Chapel Hill, reported that the first legislative acts concerning streams of the state were acts of the early colonial assembly to encourage navigation. Later in 1787, they said, the county courts of pleas and quarter sessions were made responsible for supervising the rivers of their counties and seeing that all dams provided for the free passage of fish and of logs floated to sawmills.

A state geologist was appointed in 1823. Money received from the sale of Cherokee lands was used to conduct a geological survey which reported the size and location of streams and the abundance of water. The state's water resources were taken for granted during this period and it was not until late in the nineteenth century that the protection of sources of domestic water supply began to emerge as a public health issue.[6]

The principal use of water in the nineteenth century was for drinking, navigation, and water power. The primacy of health as a consideration in the control of pollution led to early action by the General Assembly in 1877 to constitute the State Medical Society as the North Carolina State Board of Health.[7]

North Carolina State Board of Health

The Board of Health was "to make sanitary investigations and inquiries in respect to the people, the causes of disease, especially of epidemics, the sources of mortality, and the effects of localities' employment conditions and circumstances on the public health." The board was also to "advise the government on the sanitary management and location of public institutions, call to the government's attention sanitary matters that affected the industry, prosperity, happiness, health and lives of the state."[8] One hundred dollars was to be paid annually to the board to defray necessary expenses.[9] Membership on the all-medical board was changed by an act of 1879 to include a civil engineer.[10]

The state health officer, with the advice and assistance of the civil engineer member of the board, carried out sanitary measures as a part of the general program. Those measures initially encompassed water supply and associated contamination by human wastes.

By 1883 there were tentative signs that public concern over stream sanitation was soon to expand to include fish life and nuisance conditions as well as human health. It was in that year that the General Assembly adopted An Act to Prevent Poisoning Streams of Water in this State. The act made it "unlawful for any person to put any poisonous substance or matter for the purpose of catching, killing, or driving of any fish in any of the waters of any creek or river within the state."[11]

Sewage Disposal Practices of the Period

A report on "Sewage in Water Supplies" published in the March 1888 *Bulletin of the N. C. Board of Health* emphasized the relationship between proper sewage disposal and waterborne disease. Referring to a paper by Dr. C. S. Smart, U. S. Army, the Bulletin reported that "the continued prevalence of typhoid fever in our communities was referred, among other causes, to the use of water which contained sewage. It was demonstrated that as surely as a water free from sewage is introduced into a city, in place of that from foul streams or wells in contaminated soils, so surely does the typhoid rate fall."[12]

Sewage disposal practices at state institutions in 1885 left much to be desired. William Cain, civil engineer member of the State Board of Health, reported that inspections of the State Penitentiary and Hospital for the Insane disclosed:

State Penitentiary: "Sewage flows out into the opening, just outside of the west portion of the wall . . . whence the water flows down through channels in the earth and over broken stone to an adjoining branch. The solid matter is precipitated here and forms a constantly increasing accumulation of filth."

State Hospital for the Insane: "Sewage [flows] into an open ditch and indirectly into a small stream which flows into Walnut Creek. The open ditch is bad [with a] rank growth of weeds which must arrest and collect much of the solid matter and promote putrefaction and the generation of poisonous gases." He suggested diversion and sewage

treatment "by means of a filter or tight cesspool in which the solids will settle out, and that the fluids be used on garden or grass lots for manure when needed and at other times be conducted into Rocky Branch."[13] Thus, a proposal for land treatment of wastewater was introduced.

At A & M College at Raleigh (NCSU), there were no sanitary fixtures in general use on account of the difficulty of disposing of sewage. "The kitchen slops are thrown out in the rear of the building. Ordinary surface privies are the only convenience of the kind available."[14] At UNC in Chapel Hill, "the sewage is discharged into a small branch and no fear of trouble arising from that method of disposal is apprehended."[15]

Asheville was reported to have a sewerage system "which is apparently complete in all its parts." The board's civil engineer member recommended that "the outfalls into the river should be extended so as to discharge into deep water. As it is, quite an amount of filth is deposited near the outlets . . . quite a nuisance is created below the present point of discharge, and it is not wondered at that complaint has already arisen."[16] Similar problems were reported elsewhere. Cities like Goldsboro, Henderson, Salisbury, Statesville, Tarboro, Washington, Wilmington, and Winston-Salem were unsewered at the time. In commenting on the need for sewers in Tarboro, the engineer said that "the most natural method of sewage disposal would be to discharge it into the Tar River."[17] Of the 20 cities visited, only five had sewer systems.[18]

The situation with respect to sewage disposal in North Carolina towns and cities was comparable to that for state institutions. The town of Wilmington was "built upon a series of sand dunes with intervening brooks. The natural drainage and most of the streams [had] been converted first into partially covered drains and finally made to serve the double purpose of drain and sewers. These discharge[d] their contents into the docks along the riverfront."[19]

In his report[20] "The Sewerage of Cities and Towns," J. L. Ludlow, Cain's successor as civil engineer member of the board, discussed sewage disposal alternatives of the period. He said that the essentials of sanitary sewerage are:

1. immediate, rapid and complete removal of sewage beyond the point of danger;

2. prevention of the accumulation of noxious gases by sufficient ventilation and proper construction;
3. susceptibility to effectual flushing; and
4. imperviousness.

Any sewer deficient in any of these requisites was said to be a "foe to humanity." The emphasis here was removal of sewage from the human environment so as to prevent associated disease. Public health was the primary concern.

Ludlow's analysis of the advantages of separate sewer systems, designed to carry only sewage, over combined sewer systems, to carry both sewage and stormwater, may have influenced North Carolina communities to largely avoid the latter with its inherent problems for the reliable transport, treatment, and disposal of municipal sewage in years to come.

Dead Animals and Sawdust

Raleigh's problems with pollution of Walnut Creek, its source of water supply, came to the attention of the General Assembly in 1887 which enacted legislation[21] prohibiting the wilful deposit in Walnut Creek or its tributaries of "any dead carcass of any animal, or any filthy or poisonous substance, or any other substance or thing by which the water . . . above . . . Raleigh . . . shall be rendered unwholesome, contaminated, or otherwise unfit for domestic purposes."

Use of streams for disposal of dead animals must have been a common practice in the 1880's if measured by legislation, starting in 1887, to prohibit this practice on specified waters of the state. The first such act was drafted to "prevent the throwing of dead stock into the waters of the Neuse River and its tributaries." This was closely followed by like restrictions for the Cashie River, and all waters of Caldwell County.[22] Other streams received similar protection in subsequent years. While the specific motivation for this legislation is unknown, it is reasonable to assume that the prevention of nuisances and control of the spread of animal diseases, as well as watershed protection, all played their parts.

The use of flowing streams to power grist, lumber, and other milling operations was a common practice in the late nineteenth century. The 1880 census shows a total of 440 "lumber and timber products establishments" in 33 of the 50 counties reporting. Moore County, alone, had 26. Pollution by sawdust from these mills quickly became a problem and legislative prohibitions started in 1889. The first of these[23] stated that "no owner . . . of a sawmill . . . shall throw or dump, or cause to be thrown or dumped, any sawdust into any river, creek, or stream of water, whereby the channel may be obstructed or damage done to any oyster bed, or the health of any person may be impaired."

Protection of Water Supplies

Water supply source protection was to remain the preeminent consideration of the State Board of Health with respect to the control of water pollution. In 1889, legislation was enacted to prohibit waste discharges "of such quality or amount as to be deleterious to health" upstream from water supply intakes for cities and towns of Mecklenburg County and the City of Greensboro.[24]

The State Board of Health's role in the control of pollution of sources of public water supply is usually attributed to a 1893 Act Relating to the Board of Health.[25] This gave the board "general oversight and care of all inland waters" and authority to examine such waters as to their fitness for use as sources of domestic water supplies. Little or no protection was yet afforded other uses of surface waters.[26] The 1893 legislation also gave the board authority to "consult" and "advise" heads of institutions, cities and towns, and corporations relative to drainage or sewerage as well as public water supply. Plans for water supply and sewage disposal were now to be submitted to the board for "advice" before contracts for associated facilities were let.[27]

Stream water quality sampling was primitive in this period and very little information is available. Samples from the Little River, source of the Goldsboro water supply, were reported as showing "an alarming amount of albumin and ammonia." Sources of pollution were said to include "ditches and streams draining unsanitary sections of town."[28] Attitudes toward pollution might be characterized by Board of

Health comments pertaining to Reidsville: "In the central and western sections of the state it is only necessary to take it [the sewage] far enough away and turn it loose. There will be no one further down stream to be damaged, for several generations at least."[29]

Dawn of Sewage Treatment

The attitude of engineers and scientists concerning water pollution control was expressed by W. T. Sedgwick of Massachusetts in an article published in the *Bulletin of the N. C. Board of Health.* He cited two reasons for purifying "sewage-polluted water." These were "because such water is a nuisance" and "because it is apt to be dangerous to the public health." Citing experience in London and Berlin and his own state of Massachusetts, Sedgwick recommended land application as a means of sewage treatment and disposal. "Mother earth," he said, "when the place is rightly chosen and the operation is properly managed, will take care of any amount of organic matter which you may wish to put upon it."[30]

Sewage treatment was almost unheard of at that time. Records indicate that in 1885 there were no municipal sewage treatment plants constructed primarily to protect the public health anywhere in the United States. Such plants as did exist involved sewage farming at scattered state institutions or absorption fields located in arid sections of the west where use of sewage for irrigation was the primary motive. The United States lagged well behind England with respect to sewage treatment and the control of stream pollution.[31]

Engineers, chemists, and biologists were given their first opportunity to work together in the development of sewage treatment techniques when the State of Massachusetts established the Lawrence Experiment Station in 1887. Experiments there paved the way for development in later years of the contact bed, trickling filter, and activated sludge processes still in use today. The greatest contribution was the clear demonstration that sewage filtration is a physical, biological, and chemical process involving the gradual transformation of organic matter by living organisms in the presence of oxygen.[32]

Early Stream Sanitation

Pollution from industrial wastes had received very little attention up to this time. In 1898, the President of the N. C. Board of Health asked the board's sanitary engineer member, Col. A. W. Shaffer, to visit Durham to advise the county superintendent of health with respect to the disposal of the sewage of the various cotton mills in that vicinity. In his report, Col. Shaffer focused on "sanitary conditions" at the sites and made no mention of industrial wastes. Of the three mills inspected, Shaffer found only one to criticize. Here, broken sewers and surface pooling of wastes were reported.[33]

As noted earlier, sediment has long been a major pollutant in North Carolina streams. The conversion of land from forest to cropland is reported to have produced a peak of sediment production by the end of the nineteenth century. The Piedmont region was the primary source, and its tributary streams were the most seriously affected. Changing cropping patterns, soil conservation practices, and reconversion of cropland to pasture and woodland have subsequently reduced sediment production from farming, though some of this reduction has been offset by land disturbance associated with urbanization and economic development. Main-stem rivers are still receiving sediment from their larger tributaries that accumulated during the period of accelerated erosion following deforestation and farming of the land. The time required to clear stream beds of this man-induced accumulation is long, and more years would pass before associated sediment loads would stabilize. Changes in sediment loads have been attributed to the construction of reservoirs as well as changes in land use. But the persistence of large loads at points farther downstream has been said to indicate degradation of stream channels.[34]

Sawdust floating in streams continued to be a problem into the 20th century. In 1903, the General Assembly enacted new legislation to prohibit the discharge of sawdust to certain streams of Harnett, McDowell, and Yancey Counties.[35] Similar legislation continued to be passed for other counties through 1921.

A milestone on the road to protection of sources of public water supplies was reached in 1903 with adoption of "An Act to Protect Water Supplies." In addition to requiring periodic watershed inspections, the act stated that "whosoever defiles, corrupts,

pollutes any well, spring, drain, branch, brook or creek, or other source of public water supply used for drinking purposes, or deposits the body of any dead animal on the watershed . . . shall be guilty of a misdemeanor." The act also stated that no person, corporation, or municipality shall discharge into such waters "unless the same shall have been passed through some well known system of sewage purification approved by the State Board of Health."[36]

In 1905, it became unlawful to discharge any tannery wastes into Richland Creek or any of its tributaries in or above the corporate limits of Waynesville.[37]

The Eno Cotton Mill Incident

The first major action directed toward the control of pollution from industrial wastes appears to have involved the Eno Cotton Mills at Hillsborough. On May 23, 1905, the mill superintendent was ordered to appear before the Board of Health relative to purification of sewage from the mill as required by the Act to Protect Water Supplies. The Durham Water Company had complained that the mill emptied its sewage into the Eno River "in its raw state." The owners proposed a plan of purification by combining steam and water of condensation with the sewage. The board did not approve and settled for a septic tank. The City of Durham then brought suit to enjoin the mill from continuing the flow of raw sewage into the Eno River from which the city obtained, in part, its water supply. An injunction was granted and the case was appealed to the state supreme court. In its findings for the City of Durham, the court found that "the defendant has used no precautions to prevent polluting the waters of the Eno River and does not propose to do so." Under the Act to Protect Water Supplies, the court ruled that "it is not required that the sewage discharged into the stream should injuriously affect the water at the intake (water supply) . . . it is quite sufficient if it pollutes the water at the sewer's outlet." The court's ruling said that "the Legislature has decided that it is desirable to preserve our natural streams in at least their present state of purity, and where they have been polluted to remove the cause as speedily and effectually as possible. It has, therefore, said that no person shall deteriorate the water at all by sending sewage into a natural stream until it has been purified and made wholesome or until all the noxious matter in it has been eliminated. And this means . . .

that the water shall not be poisoned by sewage at the outfall. We must assume that the defilement of the water is an injury which is forbidden by the Legislature."[38]

Mining Wastes

Mining waste was the next industrial waste to gain recognition as a serious pollutant in North Carolina. In 1911, the General Assembly approved legislation to "prevent miners from throwing tailings" into Silver and Muddy creeks of Burke County. It became "unlawful to mine in streams without first building a dam of brick, stone or cement, sufficiently strong and secure, to hold all sand and tailings from such mines."[39]

III SEWERS COME TO NORTH CAROLINA

By 1907, 25 cities and towns were able to report sanitary sewer systems, which were cited as a "great advance in general municipal sanitation in the state during recent years." Cities and towns with sewer systems ranged in size from Wilmington with a population of 20,976 to Pinehurst with a population of 42.[40]

Community Sanitation and Sewerage

The relationship between sewerage and water systems of the time was discussed by Civil Engineer Charles Frances in a 1907 Board of Health Bulletin. A water supply is changed into sewage when used, he said, and "this sewage must be taken away from your premises just as thoroughly and effectively and with just as much pains and care as were used in introducing the water. The question is," said Frances, "What is to be done with this sewage?" It cannot, or should not, be thrown into the street or alley, nor should it be allowed to drain away to low grounds. Again, the most common of all pretenses of disposing of sewage, known as leeching cesspools, should not be thought of for a moment, for they are simply pestiferous abominations, which act well for a short time and then become dangerous nuisances." Frances continued, "The only way by which sewage can be properly removed from premises, dwellings and the like is by a properly constructed sewerage system, with its purifying plant at its outlet."[41]

The same year, Robert Harrison of Reidsville wrote Secretary of Health Richard Lewis complaining of sanitary conditions in that community. Harrison said that sewage was "allowed to run [over the ground] as the natural drainage may carry it." In other correspondence from Reidsville, a D. L. Blackburn asked if it were safe to have a sewer used by a tobacco factory, working 400–450 hands, empty into a dry branch not more than 200 yards from a number of dwellings. A sewer from the town jail emptied "right in town" in the same branch that ran around the dwellings.

Lewis advised the town to install a properly designed sewer system at once. "A public water supply without a sewer system," he said, "is a menace rather than a protection to the public health.[42]

A grading of sewage disposal by five of North Carolina's larger cities in 1911 showed Asheville leading the way toward improved municipal sanitation. The Board of Health findings were as follows:[43]

> Asheville – Ninety per cent of population on public sewer; 10 per cent use privies; privies all sanitary; grade 100.
>
> Charlotte – Thirty-three and one-third per cent of population on public sewer; 66-2/3 per cent population use privies; no ordinance requiring sanitary privies; grade 40.
>
> Greensboro – Thirty-seven and one-half per cent population on public sewer; 62-1/2 per cent use privies required by law to be sanitary, but owners and not city are responsible for their care; privy ordinance is not enforced; grade 55.
>
> Raleigh – Thirty-five per cent of population on public sewer; 65 per cent use privies; law requires privies to be sanitary, but law is not enforced as it should be; grade 65.
>
> Winston – Thirty-three per cent population on public sewer; 66 per cent use open privies, which are not sanitary; grade 40.

Protests From a Sick Town

The importance of a sewerage system to the public health was highlighted in an editorial headed "Protests From a Sick Town That Doesn't Know It is Sick" in the May 1915 *Bulletin of the N.C. Board of Health. Responding to an article in the Mount Airy News*, signed "Citizen," the board took issue with allegations that sewers were not practical in Mount Airy at that time, or that sewers should follow street improvements, and sewers were too costly. The "citizen" concluded that "while sanitation, and cleanliness for other places . . . is all right, it is impractical for Mount Airy, because elsewhere "they have more wealth . . . but Mount Airy can't do it." The writer responding on behalf of the board exclaimed, "Poor old Mount Airy! We would feel

sorry for her if we really thought these charges were true." In its rebuttal, the board's writer discounted the allegations and stressed the countervailing costs in human disease and deaths from unnecessary exposure to fecal matter. "It appears," he said, "that practically all the families in Mount Airy are still using privies, most of which are the old fashioned, open back type where flies, chickens and domestic animals have free access to the filthy fecal matter reeking with disease "ranging from typhoid fever to tuberculosis."[44] In 1923, another resident of Mount Airy wrote the Board of Health requesting "some action in regard to sanitary conditions." He stated that "on Main St., just above our dwelling, is a laundry and all filthy water drains just back of our dwelling and stagnates." He also complained that an adjacent home emptied all kitchen and wastewater on grounds adjacent to their house.[45] In response to a complaint by a citizen of Warsaw of unsanitary conditions near his home as a result of the town emptying raw sewage into a flowing stream, the board advised that since the stream was not used as a source of public water supply, "there is a difference of opinion" of judicial right to empty raw sewage into such a stream and "we should be very careful in making direct recommendations . . . unless requested to do so by the Warsaw Board of Health, otherwise we might be drawn into a needless controversy."[46] No requirements were made "in excess of those essential to adequate water supply protection."[47]

From the Ashes of Despair

At the other end of the state, Morehead City was cited as an example of a town that had arisen from the "ashes of despair" to become a model for North Carolina communities to follow. In an editorial titled "Morehead City Again" in the Board of Health bulletin for May 1915 the writer said that "exactly one year ago this Board called attention to some deplorable public health conditions in Morehead City. . . . Within a year when the public hue was to the effect that 'we are too poor,' 'we can't afford sewers' and 'we can't even afford sanitary privies,' there has been a bond issue [which] raised sufficient not only to build sewers in the business portion of town but they have gone farther . . . than any other town in the state regardless of size or wealth and

provided for sewers to every man's door with the exception of some ten or twelve isolated houses." Sanitary privies were to be installed to serve those.[48]

The Board of Health was encouraging all communities to improve municipal sanitation through the construction of sewer systems. The point here was to remove human wastes from the living environment and get it out of town as rapidly as possible. There was still little concern for stream pollution except for waters used as sources of public water supply.

In 1916, Asheville was cited by the board as a "fine example of the thoroughness and efficiency . . . in her present campaign for the absolute elimination of the surface closet [privy]." Through installation of sewers, the city planned to eliminate all privies by mid-year. "Asheville," said the board, "puts first things first."[49] By 1919, 70 municipalities were said to have undertaken new sewer systems or extensions of existing systems.[50]

A year later, it was reported that "the sewerage development now taking place . . . in North Carolina is truly phenomenal. Towns that have never before considered it possible to have water and sewerage facilities are now undertaking the construction of complete sewerage systems. As much sewerage improvement is being undertaken this year as would ordinarily have occurred in ten years. Compared with former practice, the most remarkable feature of the whole situation is that in many instances small towns of less than 1,500 inhabitants are constructing complete sewerage systems that will make such facilities accessible for practically every home, while the larger towns are extending present incomplete systems to the same extent. The old idea of providing sewerage only for the business sections and more congested areas of the larger towns . . . is now forced to give way before the present tide of sewer construction sweeping over the state, to a realization of the health protection value of adequate sewerage."[51] By 1924, the number of sewerage systems totalled 168. These served a population of 725,000.[52]

IV BROADENING CONCEPTS OF WATER POLLUTION CONTROL

The N. C. Board of Health began to realize as early as 1920, "the need for some detailed information regarding stream pollution as it affected public water supplies." Engineers of the board's Division of Sanitary Engineering "gathered bits of data from time to time" until there were said to be "complete records of the quantity of municipal sewage discharged by each city and town in the state together with data concerning the type of sewage treatment provided in each case." Strictly speaking, the board had control over sewage and other wastes only where receiving waters were used as sources of public water supply. Nevertheless, the board's Division of Sanitary Engineering reported that it had been "successful in enlisting the cooperation of municipal and industrial officials . . . in securing the installation of approved sewage treatment plants . . . in nearly all instances irrespective of the receiving stream."[53] This optimistic appraisal does not appear to have been borne out by subsequent reports.

Fish and Wildlife Protection

A state-wide organization to protect fish and wildlife did not come into existence until 1903 with enactment of a law creating the Audubon Society. The Society was charged with enforcement of game laws but was unpopular and ineffective, and apparently had little influence in broadening stream pollution control objectives to include fish and wildlife habitat needs.[54] [55]

The General Assembly created a Fisheries Commission Board in 1915 to enforce laws relating to commercial fishing. Among other things, the act forbade the discharge into state waters of any deleterious or poisonous substances inimical to fish life.[56] The board was given jurisdiction over game fish in 1917. The antipollution provision was never enforced by the board.

As a result of the "national typhoid scare of 1924," the Division of Engineering and Inspection of the State Board of Health assigned a sanitary engineer to the Fisheries Commission Board for the examination of waters taken from shellfish beds and the inspection of oyster shucking houses and crab meat plants. Where bacteriological examinations showed the water to be contaminated, the Board of Health recommended restriction of the affected shellfish growing areas. In every case, the Fisheries Commission Board and its successor the Conservation Commission, Department of Conservation and Development restricted shellfish areas in accordance with the Board of Health's recommendation. As of May 1950, 27,042 acres of shellfish beds were closed to commercial harvesting because of pollution. This represented 2.7 percent of the state's total shellfish acreage at that time.[57]

Pollution from Industrial Wastes

Albert O. True reported in 1923 that "a very noticeable pollution of streams has resulted from the direct discharge . . . of unpurified wastewaters from industrial plants. At first," he said, "little effort was made to lessen the pollution of streams by these wastes." Complaints from riparian owners against the use of streams for waste disposal and the increasing understanding of the relation of stream pollution to public health eventually encouraged intervention by health authorities. The adoption of waste treatment at some locations, a dawning recognition of the possibility of recovery and utilization of waste materials, and improved methods in the treatment of municipal sewage reportedly brought improvements in stream sanitation at some localities. But these were limited in character and much remained to be done. The recovery and utilization of industrial waste products did not appear to be profitable at that time and the chief aim of waste disposal was to devise an economic means of removal of these products without appreciable nuisance.[58]

The development of municipal sewerage systems enabled many industries to discharge wastes to public sewers rather than directly to streams. This was said to often cause local nuisances where large quantities of wastes were discharged to one or several sewer outfalls rather than being dispersed in smaller quantities at each mill site.

Industrial wastes often interfered with the functioning of municipal sewage treatment plants.

Permissible Stream Pollution

A major question at the time was "what is the permissible pollution of streams used for public water supply?" In addressing this question at a Wilmington Conference in 1926, J. K. Hoskins of the U. S. Public Health Service reiterated the proposition that "the use of water resources as the source of public water supplies is the first and highest use. The extent of utilization of water courses for other purposes, including that for the disposal of sewage and industrial wastes, must then be subordinated in all cases where conflicting interests arise." Hoskins limited his discussion of pollution to bacterial density, since that was viewed as the most important measure of suitability of polluted waters as a source of water supply. The elements which determine the bacterial content of surface waters were said to be sewered population, degree of natural purification in the stream, and the efficiency of artificial treatment processes. The ultimate measure of permissible pollution, he said, was the extent of water borne disease occurring in the communities in which such waters are consumed.[59]

The Public Health Service had for a number of years been engaged in studies of water pollution and more will be said about this later. Headquarters for its stream pollution investigations were in Cincinnati, Ohio. Hoskins reported that extensive studies of pollution of the Ohio and Illinois rivers had been completed and that a study of the Upper Mississippi River was underway. Findings from these investigations provided a means of determining, with some degree of precision, the permissible limits of bacterial pollution of any stream if it was to be used as safe source of water supply. He said that the careful, scientific control of a sewage disposal plant discharging to a water supply stream was "just as essential a part of public health protection as was the proper operation of the downstream water purification plant."[60]

Initial Pollution Control Objectives and Studies

The objectives of the State Board of Health by 1928 with respect to wastewater (sewage and industrial waste) disposal and stream sanitation were said to include

- the promotion of community sewerage systems,
- enforcement of statutes to protect public water supplies and maintain the sanitary quality of streams essential to other lawful uses,
- cooperative supervision of wastewater treatment plants,
- guidance to local governments and others relative to wastewater treatment requirements,
- studies of sewage and industrial wastewater to determine types and extent of treatment required, and
- stream studies to determine the "safe capacity of the streams for assimilation and destruction by natural processes of sewage and other waste materials."

These objectives were expected to lead to "safe public control policies . . . with respect to the sanitary uses of streams both as a source of water supply and as natural and essential channels for the disposal of sewage and all waste materials."[61] The intent was said to be "to fully conserve the interests of the public in public water supply protection, the conservation of fish life and other public interests in the sanitary conditions of streams, and at the same time avoid unfair and unnecessary burden upon municipalities and industries discharging sewage and other wastes into streams."[62]

V FIRST STREAM SANITATION AND CONSERVATION COMMITTEE

The State Board of Health acknowledged a working relationship with the State Conservation Commission "in order to more efficiently serve the state in all of its problems concerned . . . with pollution of streams." This recognized the commission's statutory control for the protection of fish habitat and expanded the scope of pollution control to include that objective as well as the protection of sources of public water supply. Since the Department of Conservation and Development's Water Resources and Engineering Division was responsible for the collection of data on the hydraulic properties of streams, it was propitious in 1928 to form a coordinating body known as the Stream Sanitation and Conservation Committee (SSCC) composed of the executive officers and chief engineers of the two agencies. Through this committee, the Division of Water Resources and Engineering was to make stream flow measurements and collect other hydraulic data incident to stream pollution investigations. The Board of Health's Bureau of Engineering was to make the sanitary studies looking for the solution of stream pollution problems. No appropriation was ever made for the SSCC, though a "great deal of fine work" was said to have been done with funds from the Department of Conservation and Development and the State Board of Health.[63] [64] This informally constituted body represented the first step toward the formation of a state pollution control agency. It was abandoned in 1937 because of the depression.[65]

Cooperative Pollution Studies

Cooperative studies undertaken by the SSCC included the following:

- a study of pulp and paper mill wastes and their effect on the Roanoke River (Water supply protection and the preservation of commercial fishing were involved.)

- a study of the effects of wastewater discharges from a proposed new paperboard mill at Sylva on fish life in Scott's Creek
- an intensive study of the Haw River Basin and the sewage and industrial wastes of Greensboro and local industries

A formal agreement was executed between the paper mills and the two state agencies to undertake a cooperative "study of waste problems with a view to determining practical methods of disposal, which they agreed to adopt when developed."

The Textile Manufacturers' Association appointed a committee to work with the state agencies toward a "practical plan of cooperative study and solution of textile wastes problems."[66]

The Board of Health's Bureau of Engineering made preliminary surveys of river basins in the Piedmont and western sections of the state. These were accompanied by a university study of hosiery mill wastes and associated treatment, in cooperation with the City of Durham.[67]

The state's first step toward interstate cooperation in the control of stream pollution was also taken at this time with the Board of Health's affiliation with other states of the Ohio River Basin for the exchange of information and sharing of experience.[68]

Pollution of Fishing Streams

In 1927, the General Assembly adopted an Act to Prevent Pollution of Fishing Streams and Trespass on State Fish Hatchery Property. This followed on the heels of a 1915 act to protect fish from pollution. Among other things, the 1927 act prohibited the discharge of substances poisonous to fish into any waters designated by the Fisheries Commission Board as fish producing water. Violations were to carry fines of not less than $100 for each offense—a respectable fine in those days. The act was compromised by the inclusion of language excluding "dyestuffs or sewage" discharged from cotton mills.[69] The need for legislation was evidenced by "an increasing number of complaints . . . arising relative to injury to fish from sewage and industrial wastes."[70] The Fisheries Commission Board of the Department of Conservation and Development was responsible for enforcement. According to Green, et al, there were no prosecutions

under either the 1915 or 1927 acts. The constitutionality of the 1915 act was questioned because of its blanket exemptions for firms chartered prior to enactment. The 1927 act was considered to be ineffective because it exempted the textile industry— the state's largest. By this time, there was a lengthy history of enforcing commercial fishing laws by "negotiation and persuasion rather than litigation." The lack of resources for water pollution control, the poor example set by municipalities, and political pressure against pollution abatement were cited as reasons for failure of the acts to have any effect on the abatement of pollution of fishing waters. The first act was declared unconstitutional in 1948 and the second was "abandoned without support" when the Fish and Game Division was separated from the Department of Conservation and Development in 1947.[71]

Stream pollution studies of the period which involved fish life were designed to obtain information on stream flow, time of flow, chemical composition of wastes and polluted water, effect of pollution on different species of fish life, and the effects of pollution on fish food organisms.[72]

The informally constituted Stream Sanitation and Conservation Committee reportedly "worked well" in bringing into accord the interests of the State Board of Health and Department of Conservation and Development. Initially, the Water Resources Division of the latter agency handled all complaints arising from damage to fish life. The Board of Health's Engineering Division handled complaints relating to pollution of sources of public water supply or sewage treatment. In 1930, the Department of Conservation and Development reported an increasing number of complaints relative to injury to fish life from sewage and industrial wastes. These included damage to fish in the Tar River from wastes discharged by the municipal gas plant at Rocky Mount and fish in the Tuckasegee River from industrial wastes at Sylva. Good cooperation from industry was reported. Numerous cases of large fish kills were also reported.[73]

Environmental and Economic Trade-offs

Trade-offs between environmental quality and the economy were a matter of increasing concern at this time, as might be expected in the face of an intensifying state stream sanitation program. The Sylva study, mentioned earlier, is cited as an example. Strenuous complaints had been received of "deleterious effects on fish life in the Tuckasegee River from wastes discharged from industrial plants at Sylva." On the one hand, there was destruction of fish life and impairment of scenic quality in an important game fishing stream passing through a region developing a large tourist and resort business. On the other hand, there were waste products to be disposed of by large industries employing many local people and paying a considerable proportion of the county taxes. The two-year investigation was to determine the extent of damage to fish life and the economic viability of needed treatment works.[74]

The Champion Mill at Canton

Water pollution arising from the wastes of pulp and paper plants in North Carolina has long been an important concern. John D. Rue, Director of Research for the Champion Fibre Co. in Canton, N.C., addressed this subject from the perspective of that plant in 1928. Champion was then withdrawing 30 million gallons per day from the Pigeon River and returning the same volume in wastewater daily. Suspended or dissolved in that discharge were the mill's residual wastes. He reported on steps taken to reduce the mill discharges. These included limited evaporation of water in some cooking liquors, incineration of residues, chemical recovery and reuse, burning and recovery of lime sludge, and recovery of paper stock. No data were provided to reveal the extent of these steps or their overall value in reducing the strength of wastewater discharges. But, Rue acknowledged "that while much is being accomplished in the extended application of known feasible corrective measures, some of the most difficult problems still remain to be solved." Rue was one of the initial appointees to the subsequent first duly constituted pollution control body, the State Stream Sanitation and Conservation Committee.[75]

Sewage Treatment in the 1920's

In 1928, Dr. H. G. Baity, associate professor of sanitary and municipal engineering at the University of North Carolina, wrote extensively on "The Disposal of Domestic Sewage" for the July issue of Board of Health bulletin. Sewage treatment devices at that time, he said, had been in general use for only twenty years or so. He viewed biological methods of sewage treatment as "adaptations of the universal laws of growth and decay. Tanks and filters," he said, "are only incubation beds in which the processes of nature are utilized and often hastened, . . . a biochemical change by which . . . bacteria convert the organic material into more stable substances which are harmless and innocuous. Sewage treatment plants do not complete the transformation; they do part of the work and leave it to natural agencies to complete the job."[76]

The two objectives of sewage treatment, noted Baity, are to "get rid of the foul, putrescible matter with its accompanying smell and appearance," and to "get rid of living, disease producing organisms." This limited view of sewage treatment was characteristic of the times with its primary focus on the health effects of water pollution. Baity classified sewage treatment technology according to function as follows:[77]

1. sedimentation devices, such as cesspools, septic tanks, and Imhoff tanks, which are employed to settle out the heavier suspended materials from sewage and decompose the precipitated sludge through bacterial action

2. oxidation devices, such as subsoil irrigation, sand filters, and trickling filters, which are designed to receive the effluent from sedimentation tanks and effect a further removal of solids and bacteria by physical straining and the oxidizing action of aerobic bacteria

3. disinfection devices, such as chlorination with chlorine gas or chloride of lime in which the effluent from tanks or filters is treated with sufficient amounts of the sterilizing agent to kill the dangerous organisms still remaining in the sewage

New sewer systems were encouraged and promoted by the Board of Health, but little attention was given to sewage treatment where the protection of water supply sources was not involved prior to 1926. At that time, "active field work was begun on stream investigations to determine the source and amounts of pollution" and to

accumulate data needed for sewage treatment policies and requirements. A "general program of sewage treatment improvement was instituted, with the same general objectives of extension of service, construction of new plants, rehabilitation of existing plants and improvements in operation that had been so successfully accomplished in . . . public water supply. No more than the absolute essentials [were] required."[78]

The 1920–1930 decade evidenced considerable progress in the provision of sewer systems to North Carolina cities and towns—the number of towns with sewer systems rising from 132 to 197 and population served from 592,580 to 990,340. Sewage treatment by 1930, however, lagged far behind.[79]

	1930	
	No. Systems	Population Served
No treatment	116	481,690
Septic tanks	50	103,090
Septic tanks & sand filters	6	9,960
Septic tanks & chlorination	4	31,830
Imhoff tanks	24	65,320
Imhoff tanks & sand filters	7	20,240
Imhoff tanks & trickling filters	6	18,090
Activated sludge	3	104,350
Trickling filters with separate sludge digestion	3	76,420
Direct oxidation	1	75,270

Water Pollution Control Theory

Fundamental research by the Public Health Service on stream sanitation was of considerable influence in the development of water pollution control theory and technology in North Carolina, as elsewhere. H. W. Streeter, one of the nation's pioneer investigators, spoke on the natural purification capacities of streams at High Point in 1929. In most problems of stream pollution, he said, the capacity of streams for natural purification is a vital factor. His purpose was to note some of the major factors which influence natural purification, to indicate the nature and extent of changes in characteristics of polluted streams brought about by natural purification, and to point to some applications of present knowledge of these changes in estimating the relative amounts of protection afforded by natural and artificial safeguards. He was referring to

changes in bacterial flora and the biochemical oxidation of putrescible organic matter and maintenance of an adequate reserve supply of dissolved oxygen in the stream water. "Whenever the maintenance of an adequate minimum reserve of dissolved oxygen in various zones of a stream is the primary objective of stream sanitation," said Streeter, "the main problem . . . is that of reducing the oxygen demand of wastes discharged into the river at various points to an amount sufficient to maintain an adequate minimum reserve supply of dissolved oxygen, taking due account of the natural reaeration capacity of the particular stream." He viewed the main function of sewage treatment to be to reinforce the natural purification capacity of the receiving water course.[80]

The ability of natural bodies of water to assimilate organic pollutants was long recognized as due to oxidation processes—largely bio-chemical—which brought about a gradual stabilization of these impurities through their transformation into humus and simple oxidized products of carbon and nitrogen.[81] From classic studies made by Adeney[82] in Great Britain and by Phelps[83] in this country, a basis was established for measuring natural oxidation phenomena by laboratory methods involving the use of tests for dissolved oxygen (DO) and biochemical oxygen demand (BOD). Application of these tests to measurement of oxidation in polluted natural bodies of water had been met by numerous difficulties owing to the great complexity. These difficulties led the Public Health Service to undertake pollution investigations to consider the more fundamental aspects of natural oxidation in polluted streams, having in mind the great practical importance of this phase of the problem to utilization of the natural purification capacity of rivers used as carriers of raw and treated sewage. The first basic study of this kind was undertaken by H. W. Streeter and E. B. Phelps of the Public Health Service in connection with a survey of the Ohio River in 1914–16. In their report of this study, Streeter and Phelps formulated a working theory of stream oxidation based on the progressive change in dissolved oxygen content resulting from concurrent deoxygenation and atmospheric reaeration. That general theory was applied later by a Board of Engineering Review for the Sanitary District of Chicago in connection with a study of the Illinois River.

The Streeter-Phelps report dealt with the basic principles underlying the measurement and interpretation of progressive changes in the bio-chemical oxygen demand of polluted stream waters and considered some of the more important factors which modify these changes. According to the report, these factors were as follows:

1. Under natural conditions the bio-chemical oxidation of organic substances appears to be accomplished very largely as the result of bacterial action.

2. Natural oxidation occurs in two distinct stages. The first stage is oxidation of carbonaceous matter, and the second stage is oxidation of nitrogenous material. As expressed by Theriault,[84] the first stage was represented as:

$$\text{Log}_e \frac{Lt}{L} = - kt$$

where L is the initial BOD, Lt is the remaining BOD after time t, and k is the constant defining the specific rate of oxidation. The true rate of oxidation could not be directly ascertained unless the stream BOD could be corrected for inflow, sedimentation and other disturbing factors, and the effect of reaeration.[85]

VI THE DEPRESSION YEARS

The 1930's were years of sacrifice and postponement in water pollution control, as with other areas of societal advancement. Yet, the need for employment opportunities brought emergency public works construction, including wastewater treatment plants. In January 1932, the Congress created the Reconstruction Finance Corporation as an agency of the Emergency Relief and Construction Act and authorized loans to finance "self-liquidating " construction projects such as water and sewerage systems which were actively promoted by the State Board of Health. This resulted in applications from 50 communities to the Public Works Administration for federal funds to construct needed water and sewerage projects—a marked upsurge in the level of this activity.[86] A total of 21 new sewer systems and 22 new sewage treatment plants were under construction or placed under contract during the two-year period from 1934 to 1936.[87]

A parallel program for the construction of individual sewage disposal facilities was launched by the Public Health Service and the Board of Health in 1933 under a Civil Works Administration (CWA) program. During the first four months a total of 39,256 pit privies were constructed—10 percent of the homes in North Carolina needing privies. The CWA privy program "provided better sanitary facilities for 200,000 . . . citizens, many of whom previously had enjoyed no sewage disposal facilities of any kind." At that time, approximately 325,000 homes in the state depended upon privately constructed means of excreta disposal. The importance of this sanitation work "can best be comprehended when it is considered that during the past ten years North Carolina lost an average of slightly over 1,875 lives each year from such filth . . . diseases as typhoid fever, dysentery, diarrhea, and enteritis [involving children] under two years of age."[88]

"Sanitation on the Bargain Counter" was the theme describing federal aid under depression relief programs in the late 1930's. Water and sewer extensions "at 25 cents on the dollar" would appeal to local and state government right up to the onset of

World War II. The State Board of Health worked diligently to take advantage of the federal programs before they were overtaken by defense needs.[89] During the two-year period 1940 to 1942, 16 new sewer systems and 19 new sewage treatment plants were placed under construction. Special aid was provided under the Lanham Act for such defense-impacted communities as Jacksonville and Fayetteville.[90] Federal aid in the 1930's and early 1940's in response to economic and defense needs was to be followed in later years by more programs aimed at economic recovery and water pollution control.

Despite advance in sewer and sewage treatment plant construction, the Board of Health reported "only negligible amounts of stream pollution work during the past ten years." Prior to 1931, "certain very valuable work was carried on along a few streams, but with the coming of the depression, this work was laid aside." The board cited particular needs along the Tar River from Oxford to Greenville, along the Neuse River from Smithfield to Hillsboro, on Sugar Creek south of Charlotte, along Grant's Creek, Pigeon River, French Broad, Roanoke, "and elsewhere." Although this work is badly needed," said the board, "it is expensive, and must await the time when more funds are available. Textile and pulp mill wastes were cited as particularly difficult problems.[91] What little information the board had been able to compile on stream pollution had "been obtained largely from work previously done by federal agencies."[92] The Department of Conservation and Development "felt that the problem of stream pollution by industrial wastes is one of steadily growing importance and that this problem is not receiving, nor has it received, the attention it merits." Neither the Department's Division of Water Resources and Engineering nor the State Stream Sanitation Committee was said to be "in a position to handle adequately this problem." Funds were needed to conduct a thorough state-wide study of stream pollution by industrial wastes preliminary to the enactment of legislation to control stream pollution. The existing laws in regard to stream pollution were recognized to be ineffective.[93]

Interstate Pollution

Increasing concern over the pollution of interstate waters was reflected in an Act Providing for Administration and Control of Interstate Waters passed by the General Assembly in 1929. The N. C. Department of Conservation and Development and the

State Board of Health, acting jointly, were designated as the state agency to represent North Carolina in any agreement, negotiations, or conferences, in all matters relating to water pollution.[94]

In 1935, a survey of the Dan River watershed in North Carolina and Virginia reported a taste problem in the Danville water supply which was traced to the presence of "aquanol" in the wastes discharged to the Dan River from the Carolina Cotton and Woolen Mills at Spray, North Carolina.[95] While the Danville incident represented an early example of interstate stream pollution involving North Carolina, its importance was minor in comparison to pollution problems involving the Tennessee River system. In 1935, E. L. Bishop, Director of Health, Tennessee Valley Authority (TVA), wrote the North Carolina State Board of Health that "recently, members of our sanitary engineering staff have been giving some thought to stream sanitation problems in the Tennessee Valley . . . In some cases there may be definite stream sanitation problems in which considerable research may be essential in order that the whole question of stream sanitation may receive thought and consideration."[96]

At a conference of state sanitary engineers and TVA staff later the same year, it was concluded that little or no basic data on wastewater discharges to the basin existed. Without such information to be used with stream flow data collected by the U.S. Geological Survey, "no intelligent program or policy planning was possible." Development of a suitable coordinated program and policy for the Tennessee Valley states was deemed desirable. The Public Health Service and other interested federal agencies were to be involved.[97]

The Raleigh-Smithfield Controversy

A test of wills between Raleigh and Smithfield over the capital city's pollution of the Neuse River, source of Smithfield's water supply, came to a head on January 31, 1934, when Smithfield filed suit asking that Raleigh "be permanently restrained from using its sewage outlets to the Neuse River," claiming that "the system is a menace to the health of Smithfield citizens."[98] The state supreme court held with the superior court that Raleigh must build a sewage disposal plant when it was "in a position to comply."[99]

While federal public works funds were available, Raleigh had not applied. Its delay was said to be puzzling to the State Board of Health. When asked if board approval of an application for a WPA loan could be anticipated, its spokesman said, "You darn tootin it would. Time and time again, we've requested them to submit tentative plans . . . just enough to show us they have a proper and adequate plant in mind."[100]

The board insisted upon the "legal and moral obligations" of Raleigh to construct a sewage treatment plant. "Raleigh," it said, "is one of the few prominent cities of the state which has not cleaned up its backyard. The capital city's Chamber of Commerce was reported to be the "leader of the opposition."[101] But, delay followed delay, and Smithfield again filed suit in 1948—some 15 years after the first court decision. Smithfield asked that Raleigh be ordered to discontinue discharging raw sewage to the river and that the court direct Raleigh to construct and maintain "some well-known system of sewage purification approved by the State Board of Health."[102] Raleigh, in turn, asked the court to dismiss the suit on the basis that Raleigh's action presented no serious health menace to the Smithfield population. It claimed that Smithfield, itself, was guilty of polluting the Neuse and didn't come into court "with clean hands."[103]A year later, the court ordered Raleigh to cease dumping raw sewage as soon as a purification plant could be constructed. Raleigh did not open its first sewage treatment plant until nine years after the 1948 decision.[104]

A National Program for Water Pollution Control

The first federal legislation applicable to water pollution control was the 1899 Refuse Act which required a permit from the chief of the Army Corps of Engineers for the discharge of refuse into navigable waters. While its purpose was to prevent obstructions to navigation, it was "rediscovered" in the 1960's as a useful enforcement tool for the control of wastewaters discharged to navigable waters. Congress considered more than one hundred water pollution control bills over the next half century, but disagreement among the various interest groups prevented any specific legislative actions.

An important step toward a national water pollution control program was taken in 1935 when the American Association for the Advancement of Science adopted a

resolution[105] setting forth proposed elements of a national water pollution control program:

> Whereas the degree of control of pollution of coastal and inland waters by domestic and industrial wastes, which is essential for public health and national welfare, has not yet been achieved and cannot be without further development and coordination of federal, state, and local authority. Therefore, be it resolved that the American Association for the Advancement of Science . . . urgently recommends the adoption of legislation adequate to control pollution of public waters.

Several outstanding causes for "this growing demand for the sanitary protection of our water resources" cited in 1935 by J. K. Hoskins of the Public Health Service were[106]

1. the necessity for conserving the quality of our sources of public water supply,
2. increasing nuisance and damage suffered by riparian owners,
3. deterioration in recreational and aesthetic value of streams, lakes and coastal waters affecting a large percentage of our population, and
4. economic losses imposed upon the industrial and commercial uses of surface waters including those of fish and shellfish production.

The emergence of interest in federal action in the control of water pollution can probably be traced to mounting concern over water pollution in the Ohio River Valley in the mid-depression years. Federal public works programs to provide employment had demonstrated the potential for a continuing federal role in sewage treatment plant construction. In 1934, the Cincinnati Chamber of Commerce proposed that sewage disposal facilities be made a part of any flood control or conservation projects proposed for streams in the region. A year later, the chamber's Committee on Health urged other river cities of the Ohio River Valley to join in a request to the federal government for aid in abating pollution. The chamber took definite steps in 1935 to promote interest in possible national legislation. A Committee on Stream Pollution met with the state sanitary engineers of Kentucky, Ohio, and Indiana to review efforts health authorities were taking toward pollution abatement in the Ohio Valley. The committee concluded that Ohio Valley streams were not intended to serve as sewers and that they should be restored to their proper uses. The committee drafted proposed legislation to establish a

"water treaty" for the Ohio Valley for the control of pollution and the appointment of a director of stream purification in the Public Health Service. Preliminary drafts provided for an Ohio Valley Water Treaty and federal assistance proposals. The latter took two forms—one for a Division of Stream Pollution Control in the Public Health Service and the other to place a similar responsibility in the U.S. Army Corps of Engineers. The committee voiced the opinion that federal legislation should provide for cooperation between the states and the federal government in regional planning but that the actual construction of projects would be done by cities and by other political subdivisions.[107]

The Barkley-Hollister bills introduced in the 74th Congress in 1936 were based on recommendations of the Ohio River Valley Committee. The Committee on Stream Pollution of the Conference of State and Provincial Health Officers recommended the creation of a Division of Stream Pollution Control in the Public Health Service. The division would cooperate with state water pollution control agencies and encourage the enactment of uniform water pollution control laws. There was provision for grants-in-aid and/or loans to civil subdivisions and loans to private corporations for the construction of necessary remedial treatment works.[108] A subsequent Barkley-Vinson bill might have been enacted had opposition not developed on the part of those who favored direct federal regulation of stream pollution.[109]

A conference on stream purification problems was held in the office of the Secretary of War late in 1934. It reportedly did much to center congressional interest in federal legislation in the field of stream pollution control. However, a legislative drafting committee failed to agree and majority and minority reports were filed. The majority report favored unified federal leadership but opposed the minority position calling for federal jurisdiction with respect to interstate waters and all tributaries thereto. The relative federal and state roles in water pollution control were a matter of contention in many subsequent bills introduced into the Congress. A bill providing the type of legislation favored by the Conference of State and Territorial Health Officers was later passed by both houses of Congress in 1938 only to be vetoed by President Roosevelt. In his message to the Congress on water pollution control the following year, the President said that though he fully subscribed to the general purposes of the act, he withheld

approval because of "the method which it provides for the authorization of loans and grants-in-aid. It would," he said, "prevent executive branch consideration of appropriations as a part of the annual budget." Roosevelt then sent Congress the National Resources Committee report to facilitate study of the problem. He favored federal participation in the form of establishing a "central technical agency to promote and coordinate education, research, and enforcement. It should," he said, "be supplemented by a system of federal grants-in-aid and loans." His message concluded with the observation that "the time is overdue for the federal government to take vigorous leadership along these lines." Later bills introduced in 1943 and 1944 eliminated the language objected to by the President, but failed passage by the Congress.[110]

National Resources Committee River Basin Studies

It was in 1937 that the National Resources Committee undertook its drainage basin studies in the Southeast. The committee report[111] for the Roanoke-Chowan-Tar-Neuse-Cape Fear-Yadkin-Pee Dee basins found that

> the same factors that have caused problems of water supply have produced serious pollution conditions in all parts of the basins of this area. Rapid growth of urban centers, a very great increase in industries, the variations in stream flow, have all contributed to make this a most important problem.
>
> In the Roanoke-Chowan basin, in addition to the wastes from textile mills and rayon manufacturing in the Piedmont and pulp and paper plants on the lower part of the basin, the sewage from eighty-five per cent of the population now served by sewers is emptied into streams without being treated. Only slightly over three per cent is given complete treatment, while only two-thirds of the population served with water now has sewerage facilities. In the Tar-Neuse basin, thirty-six per cent of the population is served by sewers, half of which provide no sewage treatment and only one-fourth of which have complete treatment. The Cape Fear basin leads other basins, both in the percentage of population served and in the percentage of population supplied with complete sewage treatment. In the upper part of this basin, however, the discharge of industrial wastes, chiefly from textile dyeing and finishing processes, causes serious pollution conditions. In the Yadkin-Pee Dee basin, only thirty per cent of the population has sewerage. Forty-one per cent dispose of sewage by dilution and only nine per cent . . . have complete treatment. For the entire group

> of basins, one-third of the total population is provided with sewerage, and of these, one-half has no treatment and only one-fifth has complete treatment of sewage.
>
> It is evident, therefore, that there exists great need for additional sewer systems, for extensions to existing systems, and for much additional treatment of sewage and industrial wastes in order to abate stream pollution. Adequate information is now lacking on the location and character of sources of pollution, the quantity of polluting substances and the resultant effect on other water uses. Cooperative effort by public and private agencies to discover and apply feasible methods of waste treatment must be supplemented by adequate legislative control.

Emerging Interest in State Water Pollution Control Legislation

Director of the Department of Conservation and Development R. Bruce Ethridge stated in 1937 that

> because of its tremendous importance to the future welfare of this State, and at the risk of monotonous repetition, I desire to call to your attention again the great need for controlling pollution in North Carolina streams. This matter has within recent months become a matter of great national attention, and the National Congress is at this time considering several bills which relate directly to the controlling of this condition. One cannot overemphasize the dire need that exists for clearing up many of the streams of North Carolina by the removal of industrial and municipal wastes, the prevention of soil erosion and restoration of streams to their former regimen.

In 1937, Ethridge said, "A bill providing for control of stream pollution was prepared and introduced in the General Assembly. Although very strongly resisted by industrial interests, the bill received a favorable report from the Senate committee, but was promptly put to death when it reached the floor of the Senate." A conference of "various interests" was suggested "so that at least a beginning can be made in the control and abatement of this pollution."[112]

Nothing further was done until 1945 when an inter-agency study group known as the State Stream Sanitation and Conservation Committee was formally created by the General Assembly to assess the need for further water pollution control legislation.[113]

State Planning Board Report

The State Planning Board Report on Water Resources of 1937 had the following to say about waste disposal and pollution abatement:[114]

> The use of the streams of the state for purposes of disposal of domestic and industrial wastes has long been practiced in North Carolina, as elsewhere in the Nation. In earlier days, the volume and distribution of these wastes was such as to cause no loss or nuisance. However, with the rapid development of urban centers . . . and an even greater development of industries which discharge polluting process waste into the streams, the matter of waste disposal has become a most serious matter. Combined with the disastrous effects of soil erosion, the streams of the state have become in many instances utterly unfit for other uses and often sources of actual danger to health.
>
> Laws have been passed which protect streams which are used as sources of public water supplies, but there are now no regulations which are effective to prevent pollution of the streams not so used. The control of such matters is one fraught with great difficulty. Often the economic advantages derived from the operation of industries are greater than the corresponding economic value of the fishing or recreational uses of the streams. No general rule can be laid down which would prohibit any discharge of wastes, for such regulation or prohibition might work serious hardship on particular industries or classes of industries, and through them to the people as a whole. It is necessary to set up standards of what constitutes pollution for various water uses, and place the determination of such conditions in the charge of agencies capable to make such findings and empowered to require proper methods of treatment to prevent or reduce the pollution to suitable limits.
>
> The development of technological investigations and research on the treatment of municipal sewages and wastes from industrial processes has been rapid. The progress made gives rise to the hope that severe pollution may be eliminated at low cost and often with the recovery of valuable by-products.
>
> It is greatly to be desired that the problem of pollution abatement be approached in a spirit of cooperation, enlisting the interest and support of industrial leaders and developing an increased public interest in the problem. It will then become, not a problem of law enforcement upon unwilling and resentful offenders, but a joint enterprise inspired by motives of real patriotism, to conserve the public welfare and preserve the water resources for future generations.

The Planning Board's individual river basin reports carried additional commentary on water pollution. Its assessment of conditions in the Roanoke-Chowan River Basins was typical.[115]

> Practically no data are available on the extent and effect of pollution of the streams in this basin. However, it is known that a number of textile processing mills in the upper part of the basin empty untreated or partially treated wastes into the streams, as do some paper mills on the lower reaches of the river. There are a number of municipalities emptying untreated sewage into the main stream and its tributaries. This pollution undoubtedly brings about harmful effects to fish life, both sport and commercial, recreational values, and increased cost in treatment of surface waters for industrial and domestic purposes.
>
> Silt and erosion cause a great deal of pollution in the streams, but are more detrimental to the public welfare by reason of the tremendous loss of soil resources caused by lack of proper control of run-off waters from cultivated lands. This problem is being attacked in a vigorous manner by the Soil Conservation Service in the Deep River Valley of the Cape Fear Basin. It is earnestly recommended that the work of this agency be extended to include this and other basins in the state, and that every assistance, local, state and federal, be extended to cooperate with the valuable work proposed under their program.
>
> Existing regulating legislation relating to control of pollution of the streams is woefully inadequate, and in order that the exact effects of pollution may be determined and correctional legislative measures proposed, a survey should be conducted in this basin to determine the location, degree, and effect of pollution in the streams of the basin.

Pulp & Paper and Textiles

Wastes from pulp and paper mills had created new problems in the Roanoke and Chowan rivers, affecting the shellfish industry and damaging, or destroying, a valuable fishing industry at Plymouth. Large pulp mills on the Chowan River at Franklin, Virginia, and the Pigeon River at Canton, North Carolina, were prime examples of pollution of interstate waters. Textile wastes were also recognized as a major source of stream pollution. Dr. H. G. Baity, professor of sanitary engineering at the University of North Carolina, studied the problem for the Textile Foundation for a number of years.[116] In a report to the Public Health Service, Baity said that about five percent of textile wastes was being treated prior to discharge. "Very few treatment works," he said, "have been built specifically for handling these liquors, and such as have been provided are

usually not properly designed or operated." He noted that Greensboro, Durham, High Point, Spindale, Gastonia, Charlotte, and "several other towns" were responsible for most of the treatment of textile wastes in North Carolina.[117]

Wastewater Treatment Plant Operator Training

The importance of operator training to the satisfactory operation of municipal and industrial wastewater treatment plants was increasingly recognized. But, such training was not always possible. To this end, annual training courses were initiated at the School of Public Health at the University of North Carolina under the direction of Dr. H. G. Baity in 1937. "It [was] felt that only through the 'invaluable assistance' of such short courses would the Board of Health be able to cope with the tremendous responsibility of maintaining . . . reasonably efficient sewage treatment."[118]

Department of Conservation and Development Speaks Out on Pollution

The Department of Conservation and Development spoke out again in 1938 for more rapid progress in pollution abatement saying:[119]

> The rapid increase in the number and size of cities and industries throughout the State has brought about greatly increased pollution of the surface waters. There is at present not only no law which can adequately control such pollution (except in the case of streams which may be desired as a source of public water supply), but no agency of the State government now has any authority or funds with which they may investigate the present extent and character of the pollution problem. An effort was made at the last session of the General Assembly to secure the passage of laws covering stream pollution, but the effort was unsuccessful. It is again most urgently recommended that some adequate legislation be enacted to correct present conditions and to preserve the quality of water courses for future generations to use and enjoy.
>
> The location of new plants for the manufacture of pulp and paper in the Coastal Plain has already occasioned complaints of pollution and deleterious effects upon fish life. This points to the great necessity for adequate, thorough study of conditions obtaining in the areas, and the development of proper and reasonable methods for controlling and treating the wastes from these mills. No facilities are now available to this Division for carrying on the necessary investigations. If the water analysis laboratory recommended in the foregoing section should be established, additional personnel should be employed, utilizing the same laboratory and equipment, to enable these studies if industrial waste pollution to be

> prosecuted in a suitable manner. Only upon such a basis of fact can just and satisfactory regulation of these industries be made. To do otherwise would unnecessarily penalize these new industries or would permit pollution to go unchecked.

Legal Doctrines for Stream Pollution Control

Legal doctrines regarding stream pollution prior to the enactment of state and federal water pollution control legislation in the 1940's involved the power and duty of the state to protect the health of its citizens and to prevent nuisance conditions. Under the riparian reasonable use doctrine, riparian owners were entitled to have the stream come to them with its quantity undiminished and its quality unimpaired. This was subject, however, to the reasonable use of water by upstream riparian owners. Common law remedies were chiefly applicable in dealing with stream pollution after the fact. Initiative for corrective action was left to the injured parties and costly, protracted litigation offered little hope for the average injured party. Legislation was required to prevent pollution in the first place and to offer prompt relief after it occurred. The control of pollution was viewed as primarily a state responsibility, and this theme was emphasized in federal legislation yet to come.[120]

Status Report–1939

By 1939, there were 176 municipal sewage treatment plants–an increase of 42 percent over the preceding decade. Federal aid under economic recovery programs of the depression was an important incentive. Yet, decisions by the Board of Health as to the type of municipal and industrial waste treatment were on a "catch-as-catch-can" basis. The board had neither the funds nor personnel to make the necessary studies leading to sound decision-making. "The State of North Carolina," it was said, "would very advisedly plan ahead to the time when more serious work on stream pollution abatement will actually be done."[121]

VII FACING THE ISSUES

Stream sanitation was viewed by the State Board of Health in 1944 as "becoming more critical each year." Conferences were held with industrial polluters and plans for a cooperative approach to the problem were developed. Industry, it was said, was beginning to realize that it had a responsibility in this matter.[122] The Department of Conservation and Development warned that, "Something will have to be done about this (pollution) before we reach the point where all our streams will be so badly polluted that no more industries can come into our state." A number of law suits had been filed against industries and the state was urged "to help clear up this situation by helping industries find a solution to their problems." The department reported "no adequate laws to control this problem."[123]

A number of requests were received by the Board of Health from industries outside the state for information relative to possible site locations, and it was anticipated that a number of the industries would move to North Carolina after the war. The board reported that "a number of our municipal sewage treatment plants are now overloaded." Serious difficulties were experienced in some locations with the treatment of industrial wastes through municipal sewage treatment plants which had not been designed for the extra loads. These and other pollution problems were said to point to the need "to begin work on stream sanitation in this State."[124]

Recognition of the Problem

By 1945, stream pollution was recognized as the state's single most important problem. Responsibilities for management were divided among the State Board of Health, Department of Conservation and Development, and the Wildlife Resources Commission. Funding was negligible and authority was limited to an assumed injunction to "exhort" and to "inspire cooperation." The physical measure of stream pollution

seems to have been largely qualitative at this time. The following partial quotations emphasize the fact that conditions were believed to be very bad:

> Stream sanitation has been largely neglected in North Carolina. Ninety-six municipalities empty untreated sewage into the rivers. Three of the largest cities are among these offenders. Numerous civil actions for damages against North Carolina towns have been successful. The unrestricted pollution of North Carolina's streams is without doubt the greatest single threat to her industrial development. Ten of the State's most valuable shellfish beds . . . have been . . . closed. Hundreds of thousands of fresh water fish have died in recent years. Two beaches have been declared unfit for bathing. Stream pollution research and regulation . . . have been negligible because of lack of funds, political pressure against pollution abatement, and the exemption of the principal pollution industries.[125]

The Tennessee Valley Authority (TVA) Intervenes

Early TVA regulations to control stream pollution never proved to be adequate and in 1935, the health officers of the seven valley states requested the agency to collaborate in a study of the condition of streams to determine sources and characteristics of pollutants. Work began in the spring of 1935 and consisted of studies of the Tennessee River and its main tributaries along with a comprehensive survey of all the industries which discharged liquid wastes. The work was carried out in cooperation with the state and the Public Health Service. By 1943, it was realized that legislation alone would not be sufficient. Regulations controlling pollution would be necessary.[126]

The TVA called a meeting of state agencies in 1944 to discuss stream pollution within the Tennessee River Basin. It equipped a mobile laboratory for industrial waste studies and took the lead in a "cleanup of the rivers in that section."[127] The pulp and paper manufacturers set up an organization to carry on research and expressed their interest in cooperating with state officials.[128] One pulp and paper mill (Champion at Canton) was to remain a center of controversy between the states of North Carolina and Tennessee until the 1990's.

State Stream Sanitation and Conservation Committee Formalized

The General Assembly adopted legislation in 1945 which established the State Stream Sanitation and Conservation Committee (SSSCC) to coordinate the pollution control activities of the State Board of Health and Department of Conservation and Development.[129] This formalized what had previously been an informal, coordinating committee created by the State Board of Health and Department of Conservation and Development in 1928. Duties of the newly constituted committee, acting through the facilities of the two member agencies, were

- to locate and study instances of stream pollution tending to impair the best usage of streams;
- to determine the nature and circumstances of pollution;
- to determine, in general detail, the technical and economic feasibility of remedying or improving the situation;
- to appraise the streams with respect to present and probable future dominant use; and
- to make recommendations as to the future course to be followed with regard to stream pollution.

The SSSCC was to be composed of six ex-officio members and ten members representing the public and industry to be appointed by the governor. The former included the director of the Department of Conservation and Development, state health officer, chief engineers of the Department of Conservation and Development and the Board of Health, a representative of the State Planning Board, and a member of the engineering staff of the School of Public Health, University of North Carolina. The appointed members of the SSSCC included three members representing municipalities and one member each from the following industries: pulp and paper, textiles, agriculture, tanning, clay, fertilizer and industry at large. The purpose was "to study and report on pollution of all streams." Although no appropriation was made for carrying

out this work, nor personnel assigned, it did facilitate a survey which was to lead to a report to the General Assembly in 1947.[130]

An act to provide some of the needed strengthening measures was passed in 1947. This amended the 1945 act to give the SSSCC authority to employ staff and establish necessary standards, regulations, and procedures to manage its affairs. The committee was authorized and empowered to act as an agency of the state for the purpose of "setting up and administering any state-wide plan relating to stream conservation, sanitation and stream pollution which is . . . required in order to comply with any federal law and in order to receive and administer any funds which may be provided by an act of Congress for such a purpose." The Committee was to have the "right in order to comply with federal regulations only to promulgate . . . statewide plans . . . and regulations to meet requirements and receive the benefits of any federal legislation." This was accompanied by authority to receive and administer federal funds made available for stream sanitation, control of stream pollution, stream conservation or any other objectives related thereto.[131] Clearly, the new state legislation was prompted, at least in part, by agitation at the national level for legislation to authorize a cooperative federal-state water pollution control program.

The first meeting of the newly created State Stream Sanitation and Conservation Committee was held on July 25, 1945. At that time, legislation had been introduced in the Congress for a federal water pollution control program. This proposed a federal coordinating agency to work with state and local bodies on stream pollution investigations and abatement programs, to facilitate interstate action, to conduct research, and to provide for loans and grants to municipalities for planning and construction of sewage treatment works.[132]

Mr. James M. Jarrett, Chief Engineer, N. C. Board of Health, was elected chairman of the SSSCC. The first agenda item was a discussion of organization and operations by Dr. H. G. Baity of the University of North Carolina. This was followed by consideration of a report, "Stream Pollution in Tennessee," prepared by the Tennessee Stream Pollution Study Board. Chairman Jarrett then discussed ongoing work and what might be accomplished by the present staff and equipment. The State Board of Health

was at that time equipping a mobile laboratory for use in the field. Pending federal legislation "that might make it possible to get funds to help carry on these studies" was also mentioned. The member representing the paper industry reported on "what the paper companies are doing in the way of clearing up their pollution."[133]

At the second meeting of the SSSCC it was acknowledged that casual examination of existing policy relative to water use revealed that North Carolina possessed neither the scientific information nor legal provisions for administration of a pollution control program. The obvious first duty of the SSSCC, it was said, was to assemble data on the present use of surface water before attempting to formulate a state policy or recommending further legislation upon which regulations could depend. The first objectives were "to locate and study instances of stream pollution tending to impair the best use of surface waters, to determine the nature and circumstances of pollution and the technical and economic feasibility of "remedying or improving the situation," to appraise the streams with respect to present and probable future dominant use, and to make recommendations as to the future course to be followed. These objectives were to be sought "through facilities of the member agencies." Important water uses were deemed to include public and industrial water supply, waste disposal, hydropower, habitat for fish and other aquatic life, recreation, agriculture, and aesthetics. The meeting closed with a talk by Admiral J. H. Hoskins of the U.S. Public Health Service.[134]

Control of Pollution from Industrial Wastes

The responsibility of industry for the control of water pollution from industrial sources has been the subject of debate from the onset of stream sanitation programs. In addressing the 25th annual meeting of the North Carolina Water and Sewage Works Associations in 1946, L. L. Hedgepeth, of the Pennsylvania Salt Manufacturing Company, noted that "the continued movement of industry southward and the increased sewered population are adding to the waste load of our streams. This increase has created a demand for effective control of pollution in order to avoid further rape and degradation of southern streams." One of the common allegations by an industry

confronted with the need to invest in pollution control, he said, was that, "pollution control will drive away payrolls." Perhaps it was because he was shortly to assume responsibility for the enforcement of water pollution control law in Virginia that Hedgepeth took a more enlightened view than might have been expected. "If it is clearly understood during design," he noted, "that stream abuse will not be permitted, but that reasonable use will be encouraged, we believe that industrial technology is sufficiently resourceful to find an economical answer. If there is no answer for disposal of wastes from a specific plant, and stream pollution is going to be an inescapable price of another industrial payroll for the community," then the question to the watershed community is "Are you willing to have this river become an offensive water course as a part of the price of industrial development in this basin?"

Hedgepeth did not agree with the premise that stream pollution control would drive away industrial payrolls. Yet, he said that he did not think that industry should be asked to be altruistic. "It is silly wishful thinking to expect it. A corporation is merely a paper creature—it has no conscience . . . and of necessity is operated on hard headed business principles. . . . If the public wants its streams to be clean, then appropriate legislation, enforced impartially, will be required." He continued, "Industrial waste disposal reaches its fullest development through the combined efforts of the chemical engineer's attention to processes and the sanitary engineer's work on the effluent, . . . the most profitable place to start correction is in the process . . . when the plant man has done all that he can economically accomplish on waste reduction in the process, the sanitary engineer must then devise a suitable treatment . . . to avoid stream abuse."[135]

VIII PREPARATIONS FOR A STATE WATER POLLUTION CONTROL PROGRAM

A preliminary study of stream pollution in North Carolina was completed in 1946. The report was submitted to Governor Cherry early the next year for referral to the General Assembly. It was said to contain sufficient information to complete the first two tasks assigned to the SSSCC which were "to locate and study instances of stream pollution tending to impair best usage" and "to determine the nature and circumstances of pollution." The chief purpose was to provide "justification for the appropriation of funds for continuing the work."[136]

Assessment of Pollution

Prior to the 1946 report, there was no information on the nature and circumstances of industrial waste pollution in North Carolina. The study and report were cooperative projects with the State College (NCSU) Department of Engineering Research, the State Board of Health, and the State Department of Conservation and Development. Surveys of industrial establishments were made by Associate Professor of Sanitary Engineering Robert E. Stiemke. The report also appeared as a publication by Stiemke under the aegis of State College.[137]

Stiemke worked from the North Carolina Directory of Manufacturing Firms for 1944 and attempted to identify unlisted industries while making field visits. The chief waste-producing industries, he found, were pulp and paper, textile dyeing and finishing, milk processing, meat packing, laundries, tanneries, food processing, and chemical manufacturing. The four river basins within the jurisdiction of TVA were not included because of the earlier "more extensive work" under the TVA-state cooperative stream

sanitation program reported in a TVA report, "Studies of Pollution of the Tennessee River System."

Few Data–Many Assumptions

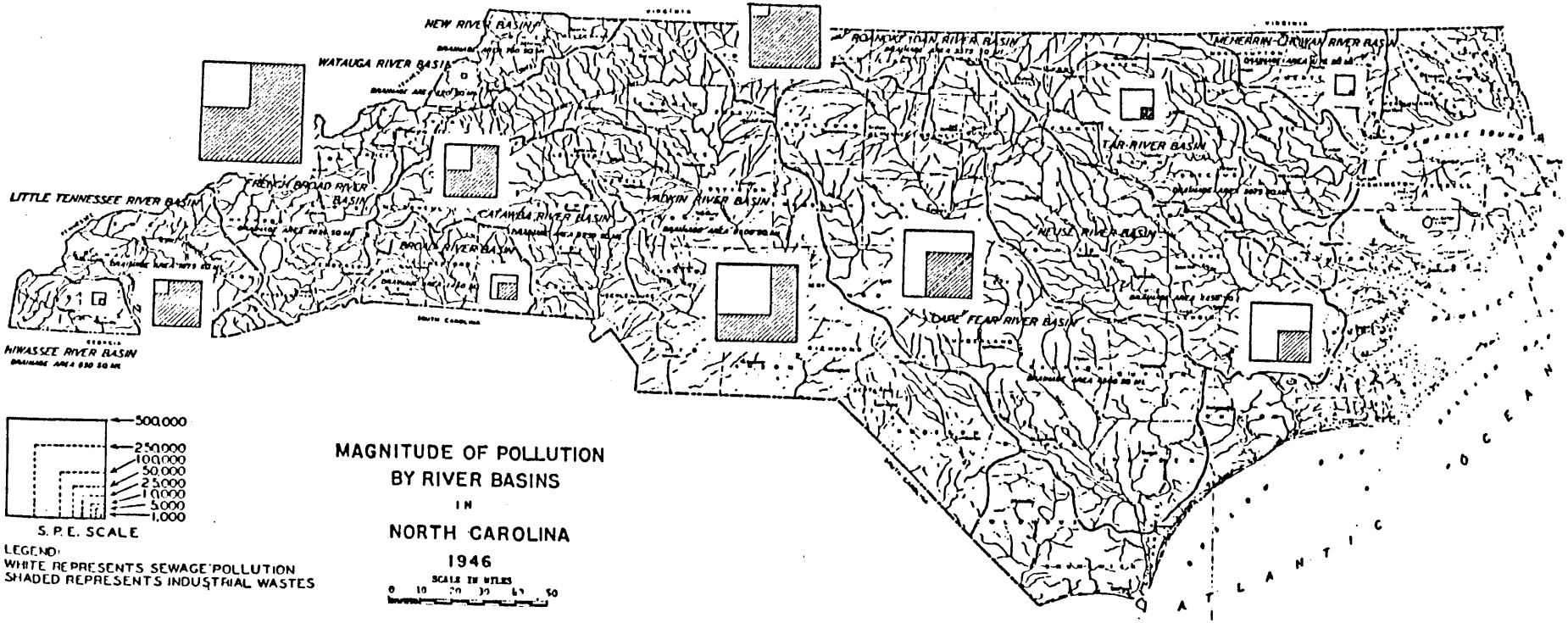
Since there were little reliable data on municipal and industrial wastewaters, it was necessary to make a number of assumptions that tended to underreport the extent of the problem. Municipal sewage treatment plants were assumed to operate at design efficiencies, which called for good operation and maintenance, no overload, and compatible industrial wastes. This, of course, was rarely the case, but there were no data to define the actual operating conditions.[138]

The composition of industrial wastes was poorly understood and the practice was to assume that the principle component was degradable organic matter which exerted an oxygen demand on receiving streams. Thus, biochemical oxygen demand (BOD) was often applied to industrial wastes when the detrimental effects of such wastes were something quite different. But a common parameter was necessary and it rapidly became the practice to use BOD in terms of its human "population equivalent" which provided a number even though "the true significance" of industrial waste discharges was considerably more serious than indicated by the single parameter. Little quantitative data on erosion and sedimentation were available and neither technology nor resources permitted the additional work necessary to more fully define the problem.

Because stream pollution is most logically studied on the basis of natural drainage basins, the state was divided into thirteen river basins as a geographical and hydrologic framework for the study. See Figure 1.[139] The magnitude of pollution in 1946 is shown by river basin in Figure 2.

The 1940 population of North Carolina was 3.6 million, of which less than one-third was classified as urban. But, North Carolina was a state of small communities and relatively few large cities. Many of the small communities had populations of less than 2,500–the cutoff point for census classification as urban. Many of these were at least partially served by sewer systems and could not be considered to be rural in terms of water pollution. At the same time, most cities and towns were not fully sewered.[140]

Figure 2. Magnitude of Pollution in 1946



Source: Stlemke 1947. See footnote 137.

More than 250 communities in North Carolina, with a combined population of more than one million, were at least partially sewered. One-third of these provided no municipal sewage treatment. Less than one-half had primary treatment, and about one-fifth had secondary (so-called "complete") treatment. Primary treatment consisted of simply settling out the larger suspended matter which was then "digested." Secondary treatment involved further treatment of the liquid portion of the sewage after settling by biological oxidation. Many plants were found to be overloaded with consequent adverse effects on treatment efficiency.[141] See Table 1.

About two-thirds of the industries discharged their wastes to municipal sewer systems, one-third of which provided no treatment and another third which provided only primary treatment. The remainder went to municipal systems providing secondary treatment, though "the plants in most cases were designed primarily for municipal sewage." There were no "complete" industrial waste treatment plants in the state. Only a few industries provided partial treatment, usually consisting of ponding for short periods before discharge. The major industrial discharges came from the pulp and paper and textile industries. State-wide summaries of municipal and industrial wastewater data are presented in Tables 2 and 3.[142]

The total amount of all industrial waste pollution was estimated to be about twice the municipal sewage pollution. Industrial waste pollution varied from a minimum of four percent of total pollution in the Meherrin-Chowan River Basin to a maximum of 94 percent of the total in the Little Tennessee and Roanoke River Basins, with an overall average of 55 percent for the state as a whole. Four river basins, the Cape Fear, French Broad, Roanoke, and Yadkin were responsible for over 70 percent of the total pollution in the state. Because of pulp and paper wastes, the portion of the state lying within the Tennessee Valley discharged industrial wastes about equal to industrial waste discharges from the remainder of the state.[143]

Table 1: Statewide Summary of Municipal Sewerage System Data by River Basin in North Carolina - 1946

River Basin	Number of Communities	Population		Type of Sewage Treatment					
				None		Primary		Secondary	
		of Communities	Connected to Sewers	No. of Comm.	Population Sewered	No. of Comm.	Population Sewered	No. of Comm.	Population Sewered
Broad	11	36,513	29,564	3	1,914	7	25,150	1	2,500
Cape Fear	49	316,764	228,296	16	76,398	23	38,244	10	113,654
Catawba	28	191,940	175,153	3	2,629	13	29,542	12	142,982
French Broad	18	79,233	78,280	16	77,030	1	600	1	650
Meherrin-Chowan	10	24,930	18,859	5	14,957	5	3,902	0	0
Neuse	34	146,436	159,885	12	96,327	13	10,433	9	53,125
New	4	3,973	5,116	0	0	4	5,116	0	0
Roanoke	14	24,040	17,656	7	11,625	5	4,121	2	1,910
Tar	20	84,289	65,615	6	19,750	12	22,315	2	23,550
Yadkin	64	256,373	235,461	16	35,258	35	140,466	13	59,737
Totals	252	1,164,491	1,013,885	84	335,888	118	279,889	50	398,108

Source: Stiemke 1947. See footnote 137.

Table 2: Statewide Summary of Industrial Plants Discharging Wastes by River Basins (exclusive of area within Tennessee Valley) - 1946

River Basin	No. of Plants	No. of Employees	Quantity of Waste Gallons Per Day	Method of Disposal				
				Municipal Sewers			Private Outfall to Stream	
				No Treatment	Primary Treatment	Secondary Treatment	No Treatment	Partial Treatment
Broad	25	5,292	1,601,830	2	9	3	9	2
Cape Fear	131	27,727	8,003,790	32	29	34	33	3
Catawba	127	14,901	6,067,505	10	21	48	40	8
Meherrin-Chowan	8	640	37,964	4	0	0	4	0
Neuse	55	9,442	2,846,480	32	1	14	7	1
New	6	83	50,400	1	3	0	1	0
Roanoke	21	11,237	23,305,360	9	0	0	10	2
Tar	34	2,060	733,130	10	6	8	10	0
Yadkin	124	25,504	10,332,632	15	45	27	32	5
Totals	531	96,886	52,979,091	115	114	134	146	21

Source: Stiemke 1947. See footnote 137

Table 3: Statewide Summary of Industrial Plants Discharging Wastes by Types of Industry (exclusive of area within Tennessee Valley) - 1946

Type of Industry	No. of Plants	No. of Employees	Quantity of Waste Gallons Per Day	Method of Disposal				
				Municipal Sewers			Private Outfall to Stream	
				No Treatment	Primary Treatment	Secondary Treatment	No Treatment	Partial Treatment
Chemical	30	1,902	454,315	3	1	9	16	1
Food and Misc.	21	1,186	206,700	3	1	1	16	0
Laundry	142	7,865	3,519,654	45	45	38	14	0
Meat Packing	16	1,336	750,415	4	3	4	3	2
Milk	90	3,698	3,435,202	19	21	23	26	1
Paper and Pulp	5	1,639	20,469,950	0	0	0	3	2
Tannery	2	210	345,000	0	0	0	1	1
Textile	225	79,050	23,797,855	41	43	59	67	14
Totals	531	96,886	52,979,091	115	114	134	146	21

Source: Stiemke 1947. See footnote 137.

Tentative Legislative Response

The North Carolina Stream Pollution Survey helped to produce a small appropriation from the General Assembly in 1947. Immediate steps were taken to recruit a small, initial professional staff. An engineer-director, George F. Catlet, was employed on August 15, 1947. His staff consisted of two engineers and a secretary.[144] The appropriation also enabled the SSSCC to undertake its first field study—a survey of the Neuse River from above Durham to Smithfield to determine the effects of sewage discharges on the public water supply at Smithfield.[145]

With its limited powers, there was very little the SSSCC could do to abate pollution. In 1947, for example, it concluded that "no definite action could be taken under present laws" in response to a citizen's complaint to the governor of pollution in Hominy Creek in the French Broad River Basin.[146]

The embryo SSSCC continued to be assisted by the N. C. Board of Health which reported in mid 1947 that, "one of the most important (engineering) activities . . . was in connection with stream sanitation works." Board engineers participated in the Neuse River survey and in the preparation of the Stiemke Report. They were reported to be "quite active" in the program for advance planning of public works through the Federal Works Administration.[147]

TVA Again Prompts North Carolina

On October 10, 1947, Frank W. Kittrell of TVA wrote, "I have not heard from anyone over your way recently regarding progress on your stream studies. You said at one time that you might call on us for assistance on the portion of the Tennessee Valley that lies in North Carolina and I wish to assure you that we stand ready to assist in any way we can."[148] The following December, TVA agreed to continue its study of the French Broad River and to "work up a complete plan for the use of the River around Asheville."

It was at about this time that the pulp and paper industry's National Council for Stream Improvement was beginning its work and the staff observed that "this organization is making good progress in (its) study of how to reduce pollution from paper and pulp mills."[149]

River Basin Surveys

By the end of March 1948, field work on the Neuse River survey had been completed. Personnel and the mobile laboratory were moved to Concord to undertake a study of Rocky River, a tributary of the Yadkin River. The large textile mills at Concord were surveyed as to the nature and quantity of their wastes. From Concord, the laboratory and staff moved on to Salisbury, Winston-Salem, and Albemarle, where studies were made of sewage treatment plants. While at Winston-Salem, tributaries of the upper Haw River receiving wastewater discharges from Greensboro were investigated. The overall program called for "complete surveys of entire watersheds" starting with the French Broad and followed by the Yadkin River. The Yadkin River Basin was selected for detailed study "as no information was available and since many different interests were involved."[150]

The state-wide program[151] called for a survey of all watersheds to include

- location of all wastewater outfalls on maps and identification as to municipal sewage and industrial wastes;
- a visit to each industrial discharger to determine the quantity and character of each waste component and effect on streams;
- establishment of sampling points with analyses for color, turbidity, BOD, solids, pH, alkalinity, total bacteria, and coli-aerogenes bacteria (Sampling points were to be located at the mouths of tributaries, and above and below "concentrations of pollution.");
- visual observations of biological indicators of pollution; and
- stream flow.

Data were to be procured "at special points on State streams where problems require immediate solution." There was to be a systematic program to enlist the interest of management of industrial plants in technical studies of individual waste problems. The main objective was "to get industry to solve its own problems." Municipal sewage treatment plants were said to "present no difficulty." The treatment methods were known, and if Charlotte, Greensboro, Durham, High Point, Gastonia, and Winston-Salem could build treatment plants, "there should not be so great a hardship in

expecting Asheville, Raleigh, and Wilmington, among the larger cities, to do likewise."[152] At that time, Raleigh still discharged its raw sewage to the Neuse River which the downstream City of Smithfield used as its source of water supply.

The Yadkin River survey disclosed some problems in the municipal arena. Treatment plants designed to treat textile wastes along with domestic sewage were found to have "a very low efficiency." The reasons were said to be "fairly obvious and can be corrected." The chief difficulty with municipal sewage treatment plants was reportedly that of getting efficient maintenance and operation."[153] Upon completion of the Yadkin River study, the mobile laboratory was moved to Raleigh where studies of the Cape Fear River were scheduled but later abandoned due to flood conditions. From Raleigh the laboratory was taken to Wilmington for a survey of shellfish growing areas in New Hanover County.[154]

Survey of Interstate Pollution

The Public Health Service made a comprehensive survey of interstate streams in North Carolina and Virginia in 1946. It reported that discharges to the Smith River in Virginia needed treatment to safeguard the water intake at Spray, North Carolina, that pollution from North Carolina menaced the Leaksville, Virginia, water intake, and that pollution of the Dan River in North Carolina rendered the stream unsatisfactory at Danville, Virginia. The pending federal water pollution control legislation was expected to place the Public Health Service in a position to furnish technical assistance and some financial aid to the two states.[155]

IX FEDERAL WATER POLLUTION CONTROL LEGISLATION

As noted under the section on A National Program for Water Pollution Control, many bills were introduced over the years to establish a federal water pollution control program. On three occasions, legislation was almost enacted, but it was not until 1948 that Congress finally acted. Two years prior to that, the Council of State Governments had invited representatives of interested organizations to a conference in Washington to address divergent viewpoints relative to federal legislation. Little progress was reported. At a subsequent meeting, the Conference of State Sanitary Engineers directed its Committee on National Water Policy to draft water pollution control legislation for consideration of the 80th Congress. It included a "reinforced enforcement clause" that it acknowledged "might be objectionable in some quarters."[156]

An amended version of the Barkley-Taft Bill (S. 418) was passed by the Senate in 1947. It was said "by those experienced in the conduct of pollution control programs to deserve the active support of all who believe that federal pollution control authority should supplement and not be superimposed upon state authorities." It would have authorized the use of federal enforcement procedures only with the consent of the state or interstate pollution control agencies involved. Some conservationists were acknowledged to consider the bill to "lack teeth" and were said to be "marshalling forces to resolve controversial clauses." The bill would have authorized $100 million per year for loans at two percent interest to finance up to one-third the cost of sewage or industrial waste treatment works.[157]

First Federal Water Pollution Control Act

On June 30, 1948, the President signed Public Law 845, the first Federal Water Pollution Control Act. Administration of the law was divided between the Public Health

Service and the General Services Administration. The latter agency was to be responsible for administering those provisions pertaining to grants and loans for planning and construction of sewage treatment works. Sensitivity to the rights of the states under the Tenth Amendment to the Constitution was evidenced in the act and subsequent amendments by the statement that it was "to be the policy of Congress to recognize, preserve, and protect the primary responsibilities and rights of the states in controlling water pollution."

The act was to support technical research to devise and perfect methods of treatment of industrial wastes, to provide federal technical services to state and interstate agencies, and industries, and to provide financial aid to state and interstate agencies and municipalities in the formulation and execution of their stream pollution abatement programs. The emphasis in this initial federal legislation was on surveys, investigations, and research. Uniform state laws and interstate compacts were to be encouraged. There was a provision for the regulation of pollution of interstate waters with state consent. A Water Pollution Control Advisory Board was authorized. There was an authorization of $22.5 million per year for loans for the construction of pollution abatement works, but no appropriations were made.[158]

The new federal act authorized the Public Health Service to prepare or adopt comprehensive programs for eliminating or reducing the pollution of interstate waters and associated tributaries. In preparing these programs, water uses to be considered included public water supplies, propagation of fish and aquatic life, recreation, agricultural, industrial, and other legitimate uses. The programs were to consist of a background presentation covering such items as water uses, sources of pollution, water quality, and stream flow. From this information, the program contemplated reasonable and equitable projects for the abatement of pollution. The initial programs were, by necessity, based upon very sketchy data available from the states and were, in reality, anything but "comprehensive" in scope or content.

The desirability of approaching pollution abatement on a river basin basis was recognized and the federal administrative framework consisted of ten river basin offices within a Division of Water Pollution Control in the Public Health Service.[159]

The act authorized $1 million per year for allotments to state and interstate agencies for investigations, research, surveys, and studies relative to the prevention and control of water pollution caused by industrial wastes. It also authorized $1 million per year for grants to states, municipalities, and interstate agencies for the preparation of engineering studies and plans preliminary to the construction of remedial works. Only a fraction of this amount was ever appropriated.[160]

The regulatory features of the federal act were limited to interstate waters and dependent upon state concurrence. As one observer of the period wrote, "Analysis of the enforcement clause indicates that several years might pass before effective federal action could be taken." The legislative history of the act made it clear that failure to accomplish adequate progress in pollution abatement through federal-state cooperative efforts would undoubtedly call for much stronger and more direct federal enforcement measures.[161]

Initial policy under the 1948 Federal Water Pollution Control Act reflected the apprehension and opposing views leading to this compromise legislation. The word "objective" tended to be used in lieu of "standard" to denote a desirable end to be reached. Tolerance would be granted when necessary. In individual pollution situations involving industrial wastes, it might be necessary to accept less than a wholly satisfactory abatement program pending solution of technical and financial problems. "As long as an ultimate goal beckons and abatement efforts continue, experience has shown," it was said, "that ingenuity . . . will before long find a solution." The relative merits of stream standards and effluent limitations were discussed, but the latter were not to materialize for more than twenty years.[162]

The roots of federal authority in water pollution control stem from the commerce clause of the Constitution, wherein the Congress exercises jurisdiction over waters capable of use as highways for interstate commerce. Despite this constitutional basis, the federal role was to be debated for many years to come.

X NORTH CAROLINA MOVES ON

The new Federal Water Pollution Control Act was expected to increase the responsibility and workload of the SSSCC and other participating agencies. Funds became available from the Public Health Service for industrial waste studies in the fall of 1949. A sewage and industrial waste laboratory was then established for the analysis of wastewaters.[163]

Report to the Governor and General Assembly

With the completion of surveys of the French Broad and Yadkin River Basins, attention was focused on the Catawba Basin where "there [seemed] to be no question as to this basin being next in importance from a general pollution . . . standpoint."[164]

A report to the governor and General Assembly for the two-year period of 1949–1950 cited a number of studies and findings.[165] Included were the following:

- a special study of pollution of shellfish growing areas in New Hanover County, which were "found to be heavily polluted from domestic sewage, making the areas unsuitable for the growing and marketing of shellfish"
- a supplemental study of the Neuse River near Goldsboro as a source of water supply, which disclosed that "the river . . . [was] not acceptable as a source of public water supply because of heavy bacterial pollution originating at Smithfield, Raleigh, Durham, and other points above Goldsboro"
- investigation of pollution of North Buffalo Creek at Greensboro as to the effects from wastes discharged by Cone Mills and the city sewage treatment plant
- study of the effects of pollution of the Dan River near Leaksville-Spray on the area's public water supplies

- examination of the efficiency of Greensboro's South Buffalo Creek sewage treatment plant into which Burlington Mill wastes were discharged
- investigation of pollution of the Neuse River near Raleigh from wastes discharged by the Burlington Mill Finishing Plant
- survey of the Haw River and Cape Fear River relative to domestic and industrial waste discharged in the Greensboro and Burlington areas
- detailed reports on pollution in various river basins as requested by the Public Health Service under the Federal Water Pollution Control Act
- cooperative studies of industrial wastes by the Board of Health and SSSCC
- initiation of a detailed study of the Catawba River from Old Fort to the South Carolina line

Investigations disclosed some of the more important pollution areas to be

- the French Broad River to the Tennessee line from industrial and domestic wastes attributable to the Asheville and Hendersonville areas;
- small tributaries of the Lower Catawba River near the South Carolina line from domestic and industrial wastes originating at Gastonia, Bessemer City, Mt. Holly, Charlotte, and Belmont (Cited as "probably the worst polluted areas in the State");
- small tributaries of the Upper Catawba River, which were heavily polluted;
- the Yadkin River, which was said to be "in need of attention" (The towns above Winston-Salem required sewage treatment plants. Winston-Salem needed improved treatment to protect the Albemarle and Salisbury sources of public water supply);
- the Neuse River, which was found to be heavily polluted from Durham to below Goldsboro;
- the Catawba River where heavy siltation from soil erosion was said to be damaging the fish life; and
- the Dan River near Leaksville-Spray, where there was a serious pollution problem involving both towns and industries.

Steps were reportedly being taken by a number of industries to curb pollution. These included the Ecusta Paper Company at Pisgah Forest, Champion Paper Company at Canton, Enka Corporation at Asheville, Burlington Mills on the Neuse River, Cannon Mills at Concord and Kannapolis, Clear Water Finishing Company at Old Fort, Camp Manufacturing Company at Franklin, Virginia, and Riegel Paper Company at Acme.

In 1949, the General Assembly passed legislation to provide for the issuance of bonds by municipalities to finance sewer systems and sewage treatment plants and to collect sewer service charges.[166]

The report to the governor and General Assembly proposed more new legislation in the form of an act to rewrite Article 21 of Chapter 143 of the General Statutes relating to stream sanitation. This would have created a State Stream Sanitation Commission composed of the chief engineer of the Board of Health and the chief engineer of the Water Resources and Engineering Division, N. C. Department of Conservation and Development as ex officio members and five members to be appointed by the governor. The latter would have represented agriculture, wildlife, municipal waste disposal and industry. The proposed commission was to have powers to

- locate instances of water pollution and conduct studies;
- collect and analyze data on wastewater treatment;
- conduct surveys and investigations regarding best usage of streams;
- adopt, amend, and cancel rules and regulations;
- establish water quality standards for best water uses;
- conduct scientific experiments, research, and investigations on corrective measures;
- issue orders with respect to wastewater discharges;
- issue, amend, and revoke discharge permits;
- make investigations and inspections;
- consult with adjoining states; and
- act as the official state agency relative to federal water pollution control legislation.

Pollution Declared to be a Serious Menace

In 1950, the Board of Health was told by the head of its Sanitary Engineering Division and chairman of the SSSCC, J. M. Jarrett, that "water supplies are being seriously menaced in North Carolina . . . in that our streams are becoming polluted, more and more, with human and industrial waste material. In some cases," he said, "it is impossible for a city to tap an adequate water supply because of this condition."[167]

Jarrett also advised that funds under the Federal Water Pollution Control Act had been allocated to the State Board of Health by the Public Health Service for special studies and investigations of industrial wastes on interstate streams. These were conducted in Winston-Salem, Thomasville, Statesville, Marion, Mount Airy, and Elkin. Laboratory facilities were provided in the State Laboratory of Hygiene for the examination of sewage and industrial wastes.

A special research project on rendering plant wastes was conducted in cooperation with Professor Marvin Granstrom at the School of Public Health of the University of North Carolina. Conferences were held with out-of-state industries that were considering sites for location of plants in North Carolina. Technical problems relating to waste disposal were said to be of primary importance and "further emphasized the need for more adequate laws relating to stream sanitation."[168]

While there were some signs of progress, it came in small steps. In 1951, the town of Brevard completed the first sewage treatment plant to be constructed in the French Broad River Basin. Town officials and citizens were "commended for their progressive move toward the reduction of the pollution of the streams in this area."[169]

News Media Report on Water Pollution

It was at this time that Chester S. Davis of the *Winston-Salem Journal and Sentinel* began a series of articles[170] on water pollution. "Everyone agrees," he wrote, "that North Carolina has a stream pollution problem. And everyone says that something must be done to meet this problem. Yet, the word among the politically wise in Raleigh is that antipollution legislation now before the General Assembly will be defeated, just as similar legislation was defeated in 1937 and 1948."

"In view of the present condition of our streams," said Davis, "this is a frightening prospect. . . . There are towns in North Carolina today which face the threat of an epidemic of waterborne sickness should human failure or a mechanical breakdown occur in their purification plants." He called attention to the Town of Smithfield, "located 33 miles below the point where the City of Raleigh dumps its raw sewage" as an example. "Today," he noted, "cities like Raleigh, Wilmington, Asheville, Goldsboro, Fayetteville, Kinston, and Greenville discharge their sewage without any treatment whatsoever. A far greater number of our small towns," he said, "lack sewage disposal plants." In reference to a "one-industry-to-a-stream policy," he cited the Ecusta Paper Company as having the Davidson River, Champion Paper Company the Pigeon River, and the Enka Rayon Corporation Hominy Creek. These industries, he said, were "merely examples taken from a long list" which "have so polluted the water of their 'private' streams that industrial sites located below them are valueless."

"Of all state water pollution control laws," said Davis, "only one has proved valuable as a control measure. That law," he said, "gives the State Board of Health the power to enjoin any person, firm, corporation, or municipality from discharging sewage into streams serving as a source of public water [supply]. . . . Time and again the Supreme Court has upheld the constitutionality of this law. Early in the 1930's, the State Board of Health ordered Raleigh to install a sewage disposal plant. Raleigh did not obey the order. Smithfield brought a suit against Raleigh. In 1935, the Supreme Court ruled that Raleigh should not delay unreasonably in complying with the order. Raleigh did delay unreasonably and in 1948 Smithfield went to court again. This time the Superior Court ruled that Raleigh must comply by January 1, 1956. As a result, Raleigh approved bonds for a sewage disposal plant early this month" (February 1951).

Farmers Oppose Stream Pollution

North Carolina farmers were becoming increasingly concerned over pollution of the state's streams by municipal sewage and industrial wastes and went on record in 1950 in favor of legislative action to correct the situation. Both the North Carolina Farm

Bureau and the State Grange adopted resolutions on the subject. At its annual meeting in Raleigh in February of 1950, the Farm Bureau declared:

> Whereas the North Carolina Farm Bureau recognizes that the streams and waters of the state have reached a condition of pollution so as to affect seriously the health of the citizens, the development of livestock and farming, recreational uses, the existence of aquatic life, and industrial development; therefore, be it resolved that the North Carolina Farm Bureau promote and actively support legislation by the 1951 General Assembly to curb and control pollution of the waters of North Carolina.

The Grange, meeting in Hendersonville in the fall, voted to strongly recommend that proper laws be enacted to protect the health and welfare of our citizens and livestock from the effects of stream pollution, and that public health officials maintain rigid inspection of said streams for the purpose of enforcing such laws.[171]

XI LANDMARK STATE STREAM SANITATION ACT OF 1951

Earlier efforts to enact water pollution control legislation, wrote Chester Davis of the *Winston-Salem Journal*, met with failure. He predicted that amending legislation introduced in the General Assembly would also be defeated. But, fortunately, he proved to be wrong. After several years' experience under the 1945 and 1947 legislation, the General Assembly moved to enact the landmark State Stream Sanitation Act of 1951. This markedly advanced the state program and set the stage for the future.

The State Stream Sanitation and Conservation Committee was replaced by a new State Stream Sanitation Committee (SSSC) somewhat along the lines proposed in the SSSCC report to the governor and General Assembly for the period 1949–1950.[172] The act to rewrite the earlier legislation declared the policy of the state to be "that the water resources of the State shall be prudently utilized in the best interest of the people. To achieve this purpose, the government of the State shall assume responsibility for the quality of said water resources." This required "the creation of an agency charged with this duty, and authorized to establish methods designed to protect the water requirement for health, recreation, fishing, agriculture, industry, and animal life." The new SSSC was placed within the framework of the State Board of Health. Its membership included the chief engineers of the Board of Health and the Water Resources and Engineering Division of the Department of Conservation and Development, *ex officio*, and six members appointed by the governor.

Legislative Struggle

Enactment of new water pollution control legislation in 1951 followed a long legislative struggle that lasted three sessions of the General Assembly. As reported by Professor Milton S. Heath, Jr., Asst. Director, Institute of Government,[173] the words of

Senator J. Vivian Whitfield, long-time chairman of North Carolina's pollution control bodies, give interesting insight into the legislative struggle:

> Water has become our most precious commodity. I have said that many times, but I know of no better way to express it. When a nation gets without water it can use, a civilization then is ended. North Carolina, back in 1945, saw that the situation was becoming very serious in the State and the Legislature created a study commission on stream pollution. There were 16 of us and by the time the 1947 General Assembly came around why we were ready with a bill. It was just about as popular as a yellow jacket. And then we tried to introduce it in the 1947 General Assembly and some of my best friends said I ought to be sent to Dix Hill for doing it. Of course, we couldn't get it out of Committee. It took three terms to finally pass it in 1951 at which time the present Stream Sanitation Committee was created.

Adoption of the 1951 act did not occur in a vacuum. The 1948 Federal Water Pollution Control Act and associated debate influenced the course of future events in North Carolina, as in other states. The enunciation in federal legislation of primary rights and responsibilities of the states to control pollution challenged the states to move forward in the development of state programs or possible experience an erosion of those rights as the federal program picked up the slack between national aspirations and state performance.

North Carolina was well represented in the interest groups influential in the enactment of the 1948 federal legislation, the drafting of a model state law, and development of subsequent federal policy. It was not in the vanguard of state moving to implement national stream pollution control. There was a good deal of sharing of state experiences and development of policy proposals through such groups as the Conference of State Sanitary Engineers and the Council of State Governments. North Carolina, for example, reportedly profited from the New York experience in the development of its water classification system.

Legislative Objectives

The primary objectives of the new legislation were to provide

- adequate sources of public and industrial water supply,

- waters suitable for recreation,
- waters capable of maintaining fish and wildlife,
- water suitable for agricultural purposes,
- waters adaptable to "such other uses as may be legitimate," and
- waters free from unsightly and malodorous nuisances due to floating solids, sludge deposits, and other undesirable substances.

These program objectives were to be attained through a multiphase effort. Phase I involved the development of a stream classification and water quality standards system, and Phase II included the actual classification of the more important streams throughout the state. These steps were to be followed by Phase III which provided for the promotion of pollution abatement through voluntary action. Phase IV addressed the actual abatement and control of pollution. This final implementation phase was to include education, cooperative efforts with cities and industry, the promotion of voluntary pollution abatement projects, research on municipal and industrial waste treatment, and compliance with orders in cases where voluntary action was not forthcoming.[174]

The 1951 act required that a state-wide survey be done to serve as the basis for adoption of "best usage" classifications for surface waters and associated water quality standards. It is interesting to note that these actions came some 14 years before they were required by federal law. National standards were first seriously discussed at the 1960 National Conference on Water Pollution. Recommendation 21 of the conference stated:

> Provision should be made within the Public Health Service for developing the water quality criteria which are suited to application on a national basis. However, many water quality criteria are not uniformly applicable because of the effects of area usage differences, stream characteristics and other factors. State and local determinations of some criteria also will have to be made. It is recognized that periodic revision of these criteria not only will be in order, but should be sought as new data are made available.

The conference recommendation was soon followed by a study sponsored by the California State Water Quality Control Board with financial assistance from the Public

Health Service. This study provided considerable guidance during the years to come. The North Carolina system of classification and standards adopted November 19, 1953, was cited in the report.[175]

The new state law also required permits for the discharge of wastes into surface waters, authorized special orders to cope with infractions of law, and provided for penalties for violations. Permits were required for new sources of pollution and for any changes in the quantity and quality of wastewater discharges to waters of the state. Permits were to prevent "as far as possible, any pollution or any increase in the pollution of the waters of the State from additional or enlarged sources." special orders were to be issued to sources of existing pollution except, where "it was not feasible . . . to correct or eliminate the activities causing or contributing to any pollution." The SSSC was "to seek to obtain the cooperative effort" of dischargers, and enforcement powers were to be exercised only when the objectives could not be otherwise attained.

XII THE NEW STATE STREAM SANITATION COMMITTEE

The new SSSC was hailed as the first regulatory body ever to be created in North Carolina for the specific purpose of carrying out a comprehensive program for the protection of State waters." James M. Jarrett was the first chairman and E. C. Hubbard the first executive secretary to administer the program.[176]

The General Assembly appropriated $49,880 for the SSSC in fiscal year 1951–52 and $46,580 for the subsequent year. Prior appropriations to the Dept. of Conservation and Development for its Water Resources Division in the amount of $25,354 per year were also made available to the committee.[177]

The SSSC was charged with the development and adoption of water classifications and water quality standards, survey of all state waters and identification of those sufficiently important to be classified, and assignment of classifications. In establishing the standards applicable to each classification, the committee was to determine "the extent to which any physical, chemical, or biological properties shall be prescribed as essential to the contemplated best usage." Permits were to be required for all new sources of pollution and for any changes in the quantity and quality of wastewater discharges to waters of the state. The administration of permits was to prevent, "as far as reasonably possible, any pollution or any increase in the pollution of the waters of the state from any additional or enlarged sources."

The new agency was authorized to issue special orders to sources of existing pollution except where "it was not feasible . . . to correct or eliminate the activities causing or contributing to any pollution." The committee was "to seek to obtain the cooperative effort of dischargers, and enforcement powers were to be exercised only

when the objectives could not be otherwise attained. Civil penalties were authorized for violations.

First Meeting

The first meeting of the SSSC was held on January 15, 1952. As might be expected, principle attention was given to rules of procedure, development of an organization chart, and such questions as a program seal, letterhead, and the need for job descriptions for the staff. The industrial waste staff of the Board of Health's Division of Sanitary Engineering was turned over to the SSSC and discussions of cooperative projects with the state laboratory and U. S. Geological Survey were authorized. Visits to nearby states to observe procedures, stream classifications, and water quality standards were discussed. The Yadkin River Basin was selected for the first basin-wide water pollution control investigation.[178]

Comparison with the Tennessee Program

A report of a visit to the Tennessee Stream Pollution Control Board, presented to the SSSC at its April meeting, led to the conclusion that the Tennessee water pollution control program "was fully five years ahead of the work in North Carolina." This discouraging news was somewhat balanced by action authorizing the executive secretary, E. C. Hubbard, to enter into "a suitable contract" with the U. S. Geological Survey for a cooperative stream gaging and flow analysis program on a 50/50 matching basis. A proposed research program with the Engineering Research Department at State College was rejected "because of high personnel costs." Senator Whitfield was authorized to appeal to the governor for assistance in resolving staff recruitment problems.[179]

Expanded Training and Education

Waste treatment plant operator qualification received additional attention and training courses were provided. There were certificates awarded following completion of course work and passing examinations. The training was conducted in cooperation with the University of North Carolina, North Carolina State College, and Duke University.

The first Industrial Waste Conference in the South was held at North Carolina State College. The conference reportedly attracted "top level administrative and technical men from industry and municipalities."[180]

The Catawba River Report

One of the new committee's first reports was a study of pollution in the Catawba River Basin,[181] published in 1951. This, however, reflected work conducted by the earlier Stream Sanitation and Conservation Committee and was completed just prior to the creation of the new State Stream Sanitation Committee. The Catawba River report followed a prior study of the Yadkin-Pee Dee Basin. Like similar "comprehensive" studies conducted at this time, the Catawba report reflected the lack of reliable data on sources of pollution and contained little information on the actual quality of the river or its tributaries. But, it was a starting point for more detailed future work.

Laboratory Services

In 1952, the SSSC was told of a cooperative program with the State Laboratory of Hygiene to be paid for by the Public Health Service. The Service also provided a mobile laboratory for use on stream pollution studies. This was the second mobile laboratory to be placed in operation.[182] Two years later, the date was notified that no further federal equipment could be loaned to North Carolina under the then-existing federal law.[183]

Proposed Interstate Compact

A proposed Tennessee River Basin Stream Pollution Control Compact was submitted to Governor Scott by Governor Browning of Tennessee in 1952. The SSSC concluded that since the North Carolina program was just getting underway it would be premature to enter into an interstate compact.[184] Only three states (Kentucky, Mississippi, and Tennessee) eventually ratified the compact. In 1958, the SSSC was advised that "there would be no advantage to the State of North Carolina in becoming a member of the compact." This apparently brought the matter to an end.[185]

Alleged Need for Financial Assistance to Communities

Concern over pollution in Reedy Fork Creek below Greensboro was expressed by Senator Whitfield who reported that several members of the General Assembly had raised questions concerning the problem. The City of Greensboro was said to have employed an engineer to study the problem and was planning to go forward with necessary improvements to its sewage treatment plant. Whitfield expressed the opinion that, "the weakest point in our program was the inability of some of our cities that were bankrupt, or nearly so to finance needed improvements." He asked the staff to inquire of the States of Virginia and New York as to how they handled such problems.[186]

Yadkin River Survey

Pollution Survey Report No. 1 on the Yadkin River Basin was published by the SSSC in 1953. The data were reportedly based on laboratory studies of existing stream conditions, engineering surveys of municipal and industrial water supplies and waste treatment facilities, and from other available information. Data on streamflows, watershed areas, and stream mileages were provided by the U. S. Geological Survey under its cooperative program with North Carolina.[187] The Yadkin River Basin Report presented information on current stream conditions, water use, sources of pollution, existing pollution prevention measures, and proposed classifications for basin waters. It noted the rather extensive interbasin transfer of water where water supply was taken from one basin and wastewater discharged to another.

A total of sixty-six points of "significant pollution" were reported, consisting of an estimated 45 million gallons per day of wastewater, about evenly divided between domestic sewage and industrial waste. Eighteen percent of the domestic sources and more than 80 percent of the industrial sources provided no treatment prior to discharge. Even where provided, however, treatment was often inadequate and better operation and maintenance were needed. Despite these deficiencies, the report concluded that "the surface waters of the Basin are not extensively damaged by pollution.[188]

Cooperative Studies

By mid-1953, a bulletin *Tar Heel Waters*—partially funded by the Public Health Service—was ready for the printer. Cooperative studies of the Smith and Dan Rivers with Virginia and the Roanoke River with the Public Health Service, Fish and Wildlife Service, and the State Wildlife Resources Commission were announced. Action on a proposal from "Friends of the Land" to study the Haw and Cape Fear Rivers was postponed until ongoing studies were completed.[189]

Adoption of Stream Classifications and Standards

The SSSC approved the state's system of stream classifications and water quality standards on November 19, 1953. This system represented a major departure from the earliest example of stream classification by the Sanitary Water Board of Pennsylvania in the 1920's which divided the waters of that state into three classes: (A) relatively clean and pure streams, (B) more or less polluted streams, and (C) heavily polluted streams to be maintained just above the nuisance state.[190] The North Carolina system provided for the classification of surface waters on the basis of "best usage" associated with water quality standards for each classification. The six classifications for fresh water included:

A-I Protected water supply sources requiring only disinfection

A-II Water supply sources requiring full treatment

B Body contact recreation

C Fish life propagation

D Agriculture, fish survival, and industrial cooling and processes

E Navigation, sewage and industrial waste disposal short of nuisance conditions

A similar system for saline waters included:

SA Shellfish growing

SB Body contact recreation

SC Fish propagation

SD Navigation short of nuisance conditions

These classifications were developed at a time when many waters were severely polluted and there was a tendency to write off some of these through use of the D and E classifications.[191] Such waters often breached the "no nuisance" qualification and the E

classification was frequently characterized as "open sewers." Both of these were later discarded.

In cases where sewage or other wastes were to be discharged into waters assigned a classification different from downstream waters, the quality of waters receiving the waste discharges was to be such that there would be no impairment of the best usage of the downstream waters.

XIII MOVING FORWARD

The SSSC awarded its first "Certificate of Approval" of pollution control facilities to the City of Salisbury on July 23, 1953. Soon thereafter, the Cape Fear River Basin was selected for the next pollution survey.[192] This was followed by the adoption of a voluntary plan for the certification of sewage works operators.[193]

Neuse River Watershed Authority

Local government boundaries often conflicted with hydrologic boundaries and have frequently been viewed as impediments to rational water resource management. In 1953, the General Assembly adopted "An Act to Establish a Neuse River Watershed Authority," which authorized a river basin management mechanism that included provision for the collection and disposal of sewage and other wastes produced within the district. While this management concept never materialized, it offered a framework for water resource and quality management long extolled by professionals in the field. This was the only watershed authority authorization approved by the General Assembly.[194]

From the Yadkin to the Cape Fear

In 1954, the SSSC reported that following completion of studies and classification of waters in the Yadkin River Basin, it had moved on to the White Oak, Chowan, Roanoke, French Broad-Pigeon, Neuse, and Cape Fear River Basins. Nearly 14 percent of the state's waters had been classified. Forty-two municipal and industrial "remedial projects" had been completed or were underway and 24 more dischargers had taken "active steps" toward planning needed improvements.[195] After completion and adoption of the Yadkin River Basin Pollution Control Report, the SSSC unanimously adopted a motion by Senator Whitfield expressing a "sincere note of approbation to the staff . . . for a job well done."[196]

As the committee moved forward in its program, the need for continuing legal assistance became apparent and a request was made to the Attorney General toward that end.[197]

Toxicity studies were included in the inter-agency investigation of the Roanoke River to determine the effects of paper mill wastes discharged at Roanoke Rapids on the spawning and hatching of striped bass.[198] Funds were short and a request was made to Governor Umstead for an additional $14,000 for personnel to proceed with an investigation of the French Broad River in cooperation with TVA and the Public Health Service.[199]

Proposed cooperative studies of salt intrusion in the Neuse and Tar-Pamlico River Basins to determine effects on irrigation and water supplies were approved.

Requests were coming in protesting some stream classifications as "too high," but these were often met with vigorous opposition from other watershed interests. Letters from 72 persons, petitions by 29, and telegrams from 12 protested any reduction in the proposed classification of High Rock Lake, for example. There were, on the other hand, successful requests for downgrading such as the one from Cannon Mills, Inc., and the City of Concord. They sought and were granted a reduction in the proposed classification of segments of Irish Buffalo Creek and Rocky River downstream from Kannapolis "where large quantities of untreated industrial waste and some treated sewage were discharged." The wastes reportedly "resulted in offensive conditions down Rocky River."[200]

Priorities for Control of Industrial Pollution

The SSSC approach to the control of pollution from industrial discharges was said to be threefold. The first and preferred approach was to "change the industrial process in order to make better use of . . . materials and . . . reduce the amount discharged as wastes." In some cases, by-products were allegedly being developed to use the materials being discharged. Reuse of wastes in the original process was also cited. Following the in-plant changes to reduce wastes, the second approach was to treat industrial wastes with municipal wastes if compatible with municipal treatment processes.

The third and final approach was to provide treatment explicitly for the industrial wastes. This is essentially the same hierarchy of choice in use today.[201]

As an incentive for the control of pollution from industrial wastes, the General Assembly adopted legislation in 1955 to provide for a five-year amortization allowance for income tax purposes in lieu of depreciation for industrial waste treatment and pollution abatement facilities. The act also exempted such facilities from ad valorem property taxation. In retrospect this would have seemed to encourage waste treatment rather than reduction and recovery.[202]

Special Legislation for Haw and Northeast Cape Fear Rivers

In 1955, the General Assembly adopted acts to prohibit the discharge of raw sewage, industrial waste, and "other noxious and deleterious substances" into the waters of the Haw and Northeast Cape Fear Rivers or tributaries "which shall render said waters harmful to the public health and fish life."[203] Such pollution was defined as that which would render the waters unsatisfactory for "best usage" classification or contravention of applicable water quality standards. The effective dates were January 1, 1960, for the Haw River and January 1, 1962, for the Northeast Cape Fear River.

Status of River Basin Surveys in 1955

The Department of Conservation and Development reported in 1955 that the SSSC had completed all its work on the Yadkin River Basin Report and was nearing completion of reports on the White Oak and Chowan River Basins. A preliminary report on stream flows required to sustain striped bass spawning in the Roanoke River below Kerr Reservoir was completed by the Public Health Service and recommendations as to reservoir releases were sent to the Army Corps of Engineers. Further work remained for this and the French Broad, Cape Fear, and Neuse River Basins. The Department reported that the SSSC had completed all work necessary to the assignment of classifications for 14 percent of the area of the state. Detailed river basin studies were completed and preparation of comprehensive reports underway in another 20 percent, while detailed studies were half completed in an additional 33 percent of the state.[204]

Whitfield and Hubbard at the Helm

The February meeting of the SSSC in 1956 was noteworthy in several respects. Senator J. Vivian Whitfield was elected chairman to replace James M. Jarrett, Director of the Board of Health's Division of Sanitary Engineering. Senator Whitfield and Executive Secretary E. C. Hubbard were to lead the State Stream Sanitation Committee through the next two decades of program development and expansion. They were also to be influential in the enactment of federal water pollution control law and program development. Both were appointed to attend congressional hearings on PL 845 in 1956 to expand and strengthen the Federal Water Pollution Control Act.[205]

Governor Luther Hodges on Industrial Pollution

Governor Luther Hodges met with the SSSC at the February 1956 meeting relative to pollution from industrial wastes. He said that, "the state must have more business and industry in order to obtain the funds with which to provide the services expected of the State which are growing by leaps and bounds." Hodges noted that, "he had talked to literally dozens of industries during the past year and that they all say 'South Carolina will give us so much or will do this or that' and unfortunately some of them are telling the truth even though they may be stretching it a little." He advised such industries that "we don't give away anything and when South Carolina gives you something you will have to pay sooner or later. Nevertheless, about half of them succumb to the temptation to take what they are offered." Governor Hodges reported that, "he would not change our basic philosophy but felt that everyone should cooperate in trying to encourage industries to locate in the state." Senator Whitfield responded by saying that "members of the South Carolina Water Pollution Control Board had told him that they had studied our law and would give anything if their legislators had the courage of the North Carolina legislature."[206]

Pleas for Lower Regulatory Requirements in Coastal Waters

Briefs had been received from the fishing industry on the proposed classification of the White Oak River Estuary. The petitioners stated that Bogue Sound waters did not justify classification as SA waters for shellfish growing and recommended reduction

to SC for fishing. Commendably, the committee adopted the higher SA classification. Analogous actions were taken with respect to the waters of Core Sound.[207]

In a similar action relative to waters of the Chowan River Basin, the committee adopted a C (fishing) classification for waters of Edenton Bay, Queen Ann Creek, and Pembroke Creek in the face of a request from the Town of Edenton for a downgrading to a D or E classification. Studies showed that Edenton Bay and its tributaries received raw sewage from Edenton and "some wastes from a fish packing plant and veneer mill." The SSSC found that, "the public interest will be best served if these waters are assigned the C classification as originally proposed in the Chowan River Basin Report."[208]

The Comprehensive Pollution Abatement Plan for the Chowan River differed from the Yadkin River plan in that it provided for "the issuance of a temporary permit covering the continued discharge of sewage and wastes by polluters who submit an acceptable voluntary plan for complying with their pollution abatement requirements."[209]

Effects of Toxic Pollutants Investigated

Emerging concern over toxic chemical pollution was evidenced by a $2000 state grant in support of the initial stages of a research project by Dr. Charles M. Weiss at the University of North Carolina at Chapel Hill on cholinesterase activity in fish brain tissue. The purpose was "to develop a suitable method for determining the effects of certain agricultural poisons upon fish brain tissue which could be used in our investigation of fish kills." Despite opposition by one committee member "that $2000 was a lot of money and that he could not vote in favor," the action was approved following a statement by J. M. Jarrett "that when the State Stream Sanitation Program was initiated . . . certain types of research would be necessary."[210]

Overlap and Duplication of Effort

Overlapping responsibilities between the Board of Health's Division of Sanitary Engineering and the SSSC were beginning to create some administrative problems. Documents of approval for the enlargement of municipal sewage treatment plants were required from both agencies, for example.[211]

The State Commission on Reorganization of State Government concluded in 1957 that the water pollution control statutes "result in duplication of efforts" between the SSSC and other units of the State Board of Health. This produced draft legislation to revise laws relating to stream sanitation. Later that year, the General Assembly adopted An Act to Eliminate Duplication of Effort in the Water Pollution Control Programs of the State. The act made the Board of Health the administrative agent of the SSSC through a Division of Water Pollution Control which was to be established "to do stream sanitation work." Duties relating to the control of municipal, institutional, and industrial sewage and waste collection systems were to be assigned by the Board of Health "as soon as practicable, in order to eliminate duplication of effort." The Division director was to be "a well-qualified sanitary engineer, fully trained and experienced in the field of waste disposal." He was to serve as administrative officer and secretary of the committee.[212]

The purpose of the act in the view of the Board of Health was to more closely coordinate and integrate water pollution control "into the total public health program of the State." E. C. Hubbard was appointed director of the division in addition to serving as Secretary to the SSSC.[213] His interpretation of the act was that the SSSC would continue as the policy-making agency while actual work would be performed by the Division of Water Pollution Control in the State Board of Health. Despite this legislation, an "acceptable division of responsibilities" between the Board of Health's Divisions of Water Pollution Control and Sanitary Engineering continued to be a problem.[214]

Federal Water Pollution Control Act Amendments of 1956

The role of the federal government in the control of water pollution was extended in 1956 with enactment of PL 660 amending the earlier 1948 legislation to authorize federal grants for the construction of publicly owned wastewater treatment plants, program grants to the states, increased technical assistance, broadened research, and limited enforcement authority. The initial construction grants were limited to 30 percent of project cost up to a maximum of $250,000. This favored the smaller communities, as was intended by those who drafted the legislation.

The 1956 act also authorized increased federal enforcement action with respect to wastewater discharges to interstate waters. It was to be used only when states or interstate agencies had been unable to cope successfully with problems at hand and sought such assistance. Federal enforcement authority was viewed by the Public Health Service as "a last resort."[215]

Public Health Service policy in administering the Federal Water Pollution Control Program was intended to limit the federal role to those activities needed to complement the work of the state and interstate agencies, communities, and industries in order to attain a well-balanced national pollution control program. This was influenced by the Federal Water Pollution Control Act policy statement "to recognize, preserve, and protect the primary responsibilities and rights of the states" and the further statement that "nothing in this act shall be construed as impairing or in any manner affecting any right or jurisdiction of the states with respect to the waters . . . of such states." According to Public Health Services Chief Engineer Mark D. Hollis, "In its long history of working with the states, the Public Health Service has found that the best way of getting a job done is to support and assist the states." [216]

The 1956 amendments to the Federal Water Pollution Control Act, P.L. 660, increased the federal influence in the North Carolina program. Chairman Whitfield was nominated to serve on a newly authorized Federal Water Pollution Control Advisory Board. North Carolina was also notified that it would receive $48,248 to strengthen its pollution control program and $1,270,675 in grants for the construction of municipal sewage treatment plants. Inability to secure needed technical personnel due to low salaries had become an issue, and chairman Whitfield was granted "full and complete authority to have a 'heart-to-heart' talk with . . . director of the state personnel department."[217]

The question of which local governments were to receive federal construction grant funds was resolved by adoption of a priority system. A total of 24 grant applications for $2.6 million had been received against a state allocation of about $1.3 million.[218] In response to continuing attacks on the federal construction grants program, the SSSC advised the North Carolina congressional delegation that it supported the

program and asked the members to vote to continue the grants.[219] The committee reported a three-year need for waste treatment works construction totaling more than $31 million and federal grants of nearly $8 million, as compared to scheduled federal allotments of $3.8 million.[220]

Chairman J. Vivian Whitfield appeared before the House Public Works Committee, U. S. Congress, in 1959 to present a resolution[221] from the SSSC stating, in part:

> The grants for sewage treatment works construction under P.L.660 (84th Congress) . . . have greatly stimulated progress in the water pollution control program as evidenced by the high role of municipal sewage treatment works construction. But the rate . . . of construction still falls far short of being adequate. The progress already noted . . . would be seriously retarded if the appropriation of adequate funds to continue and enlarge the . . . program is not provided.

XIV SUBSTANTIAL PROGRESS REPORTED

By the end of 1956, the SSSC had reported "substantial progress" in stream study and classification activities. The waters of three major river basins comprising about 20 percent of the entire state were either classified or public hearings were held preparatory to classification. Comprehensive pollution surveys were completed in the French Broad-Pigeon, Cape Fear, and Neuse River Basins comprising an additional 33 percent of the state. See Figure 3.[222]

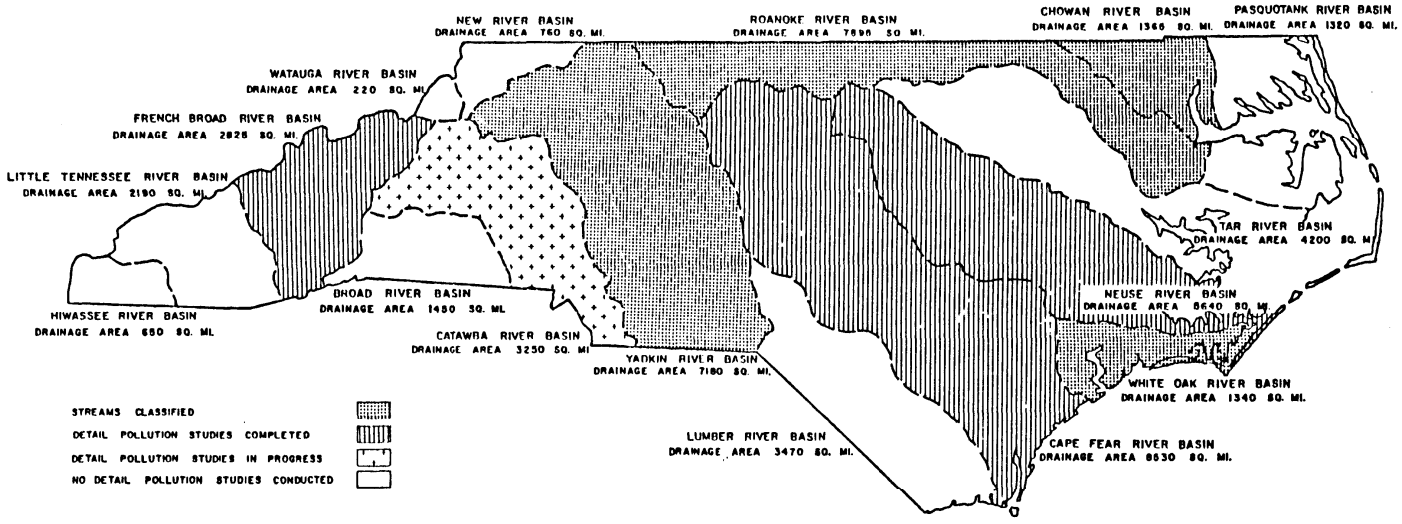
Waste Treatment Works Construction

During 1955 and 1956, 32 municipal and industrial pollution abatement projects costing more than $12 million were completed, and another 20 projects costing more than $10 million were placed under construction. The cooperation of municipalities and industries was reported to be "most gratifying." The federal construction grants program was said to be "stimulating pollution abatement activities and, if continued, should prove quite beneficial to our municipalities."[223]

A 1958 letter from the State Board of Water Commissioners offered to recommend financial assistance to supplement federal construction grants. But, Chairman Whitfield observed that state financial aid had been considered. However, in his opinion "the state should not provide grants, but should lend assistance to municipalities through long-term loans at a low interest rate." A motion to this effect was adopted by the SSSC.[224]

Proposed state financial aid for the construction of local wastewater treatment facilities continued to be of interest to the committee. Early in 1959, Chairman Whitfield discussed a legislative proposal for a revolving fund for this purpose. He said that "legislation establishing a revolving fund is essential." A motion was adopted that a bill be prepared for submission to the 1959 session of the General Assembly to provide such a fund. The proposed funding was $2.5 million per year of the biennium for long-term loans to municipalities. Recipients would be required to show that their

Figure 3. Status of Stream Pollution Studies, 1957



Source: State Stream Sanitation Committee, Third Progress Report. See footnote 222.

financial condition was such that they could not proceed in the matter of stream pollution abatement without the availability of such help from the state. The staff was instructed to prepare draft legislation toward that end.[225]

Mining Wastes

Following a discussion of pollution of the Nolichucky River in Tennessee from mining operations in North Carolina, Chairman Whitfield said that he believed the State Stream Sanitation Law should be changed to include mining operations. He concluded that the matter would be discussed with the governor.[226]Somewhat later, mining interests requested reclassification of the North and South Forks of the Toe River from D to E. This was denied.[227]

Pulp & Paper and Textile Waste Problems

Pulp and paper mill wastes were a major source of water pollution, and requests for accommodation of such pollution through downgrading of stream classifications were to be expected. Early in 1958, the North Carolina Pulp Co. at Plymouth requested a reclassification of receiving waters of the Roanoke River from C to E. The SSSC was advised by staff that the lower portion of the river was used by rockfish, herring, and shad during migration. One committee member pleaded for postponement of a decision. Another asked if there would be any objection to asking the pulp company "to at least try to do something toward treatment of its wastes." Actions of other pulp mills in North Carolina to comply were cited.[228]

The classifications for the French Broad River were approved early in 1958. These included a change to down grade a portion of Homing Creek at the behest of the Champion Paper and Fibre Company from D to E. Tennessee requested that waters of the Pigeon River be classified no lower than C, but the committee was told that studies showed that waters from Canton to the state line "are presently polluted to such an extent as to make them unusable" for purposes specified under a C classification. Staff advised that the required additional treatment "will entail a large expenditure of money on the part of the paper company, and to require a higher degree of treatment . . .

would not appear realistic in the light of present downstream uses and the economics involved."[229]

There were no objections to a proposal by the Union Bag Camp Paper Corporation to build a 600 ton-per-day pulp and paper mill near New Bern. The Wildlife Resources Commission requested that "every practical effort be made to minimize the deleterious effects of the mill wastes on the fishery resource in the downstream waters." Union Camp requested reclassification of Neuse River waters around New Bern as swamp waters and the down grading of Batchelders Creek below their proposed point of discharge to Class E. The limited objectives of the proposed E classification were simply to prevent nuisance conditions in the Creek and maintain a minimum dissolved oxygen level in the river.[230]

A request for a rehearing on classification of the Roanoke River by the North Carolina Pulp Co. was denied and the Comprehensive Pollution Abatement Plan for the Roanoke River adopted.[231]

Another major source of industrial wastes was the textile industry. There was interest in the treatment of textile wastes by municipal wastewater treatment plants. Proposed studies by Greensboro and Cone Mills were approved "provided they do not result in unduly delaying the completion of adequate waste treatment facilities."[232]

Enforcement

Despite occasional statements to the contrary, progress in pollution abatement was slow and required both special legislation and enforcement actions. Raw sewage was still being discharged to the Neuse River with endangerment of public water supplies. In 1957, the General Assembly adopted an Act to Prohibit the Discharge of Raw Sewage, Industrial Waste and Other Noxious and Deleterious Substances into the Waters of Neuse River or its Tributaries Which Shall Render Said Waters Harmful to the Public Health and Fish Life. Wastes which caused the waters of the Neuse River to become unsatisfactory for "best usage" under assigned classifications and contravention of associated water quality standards was declared to be unreasonable use of such waters, against public policy, and a public nuisance. Violators were to be found guilty of a

misdemeanor. Injured parties were given the right to take civil actions for injunctions and recovery of damages.[233]

Typical enforcement actions of the period included the failure of the Wade Manufacturing Co. at Wadesboro to take any action to comply with the Yadkin River Comprehensive Pollution Abatement Plan. A show-cause order was requested from the Attorney General.[234] The Town of Wilkesboro was granted until November 15, 1957, to retain a consulting engineer to study its waste disposal problems and submit an acceptable compliance schedule. Most polluters in the White Oak River Basin had not made any plans for compliance.[235] In 1959, various town officials were asked to appear before the SSSC to explain their inaction.[236]

In its review of compliance with water pollution control plans, the SSSC found that "progress toward abatement of pollution by Ellerbe; Kernersville; Mt. Gilead; Mt. Pleasant; Rockwell; Mt. Farms, Inc. at Hiddenite; and the Aleo Mfg. Co., Beaunit Mills, Carolina Paper Mills, J. P. Stevens & Co., and Safie Mfg. Co. at Rockingham has been unsatisfactory to date." Responsible officials were requested to appear before the committee for an explanation. The Rockingham situation included difficulty in determining responsibility for providing sewer service and sewage disposal at mill villages where the mills sold homes to employees.[237]

Progress at the interstate level was about the same, as evidenced by a letter received from the Tennessee State Pollution Control Board in April 1959 "deploring pollution" in the Nolichucky River.[238]

A Home For Water Pollution Control in State Government

Organization and location of the state water pollution control program in state government continued to attract attention. A proposal for a new Department of Water Resources in 1958 did not envision the continuation of the SSSC. This brought expressions of concern from Chairman Whitfield who was assured by Governor Hodges "that it was not intended that the Committee and its program be interrupted."[239] Senator Whitfield had written Governor Hodges that, "we of the SSSC felt confident that we could convince the Legislative Committee on Reorganization that it was imperative to

continue our Committee under any proposed Water Resources Department until we had finished classifying the streams of North Carolina. One of the major contributing factors in our success . . . has been due to the fact that we have been permitted to have our own team. We have proven to business and municipalities that we are always patient and fair and, 'believe it or not,' they agree with us that 'as goes the State Stream Sanitation Committee so goes the future of North Carolina.'"[240]

Interest in the creation of a Department of Water Resources continued to grow. The SSSC considered substitute legislation in May 1959 and noted a "vast improvement" over the original legislative proposal.[241]

Cape Fear River Basin Report

The river basin pollution survey reports addressed major sources of pollution in descriptive terms. There were neither the personnel nor financial resources to undertake detailed stream surveys. But the effects of pollution were usually so evident that extensive data collection was probably unnecessary at that stage of development of the state's program. The Cape Fear River Basin Pollution Survey Report is illustrative of the findings.

In that basin, the survey of the Haw River watershed, for example, revealed major discharges of untreated or poorly treated wastes with obvious adverse effects on receiving water quality that were clearly apparent to the eyes and nose.[242] The Greensboro wastewater treatment plants were overloaded and provided inadequate treatment of domestic and industrial wastes. Untreated wastes from the City of Burlington "materially retarded" stream recovery from the impacts of the Greensboro discharges and downstream waters "had an objectionable gray color and at times an offensive odor." The Mebane treatment plant was overloaded and the inadequately treated wastes created "foul conditions in Moadams Creek." Untreated wastes from textile and other industries were important contributing factors to stream debilitation. Organic pollution from all sources in the Saxapahaw area had a population equivalent of more than 2.6 million giving the Haw River a "soapy appearance and a chemical odor." These are but a few examples of polluting discharges and their effects at the time.[243]

One encouraging sign was planning by the Cities of Greensboro and Burlington for improvements to municipal treatment plants. Findings in the Deep River watershed and the main Cape Fear Basin down to the City of Wilmington and Southport were similar. The latter two communities provided no treatment of municipal wastes prior to discharge to estuarine waters with consequent damage to valuable shellfish areas near the mouth of the river. [244]

XV STATE DEPARTMENT OF WATER RESOURCES ACT OF 1959

The 1959 General Assembly approved An Act to Create a State Department of Water Resources.[245] Its declaration of policy stated "that the general welfare and public interest require that the water resources of the State be put to beneficial use to the fullest extent of which they are capable." The purpose was "to create a State agency to coordinate the state's water resource activities; to devise plans and policies and to perform the research and administrative functions necessary for a more beneficial use of the water resources of the state."

Board of Water Resources

The Department of Water Resources Act created a seven-member Board of Water Resources to be appointed by the governor. The board was empowered to direct the exercise of all the functions of the department and to appoint a full-time director toward that end. The State Stream Sanitation Committee was transferred to the State Department of Water Resources, with its membership reduced from nine to seven, but without change in its powers, duties, responsibilities and function. However, the committee now fell under the jurisdiction of the Board of Water Resources, and it lost some of its independence of action.[246]

The Board of Health's Division of Water Pollution Control and the Department of Conservation and Development's Division of Water Resources, Inlets, and Coastal Waterways were also transferred to the new department. Hydrologic functions were transferred from the latter division to the Division of Water Pollution Control, which was then renamed the Division of Stream Sanitation and Hydrology (DSSH) to reflect the wider array of functions.[247] E. C. Hubbard, director of the Division of Water

Pollution Control and secretary of the Stream Sanitation Committee, was appointed director of the reorganized division and assistant director of the new department.

Program Objective

The goal of the Stream Sanitation Program was said to be to maintain "the quality of our waters . . . for present usage and . . . for future development." To accomplish this goal, the program was to "maintain a satisfactory balance between all the uses of water" by requiring "that sewage and industrial wastes be discharged to the receiving streams only after sufficient treatment to maintain a satisfactory sanitary balance."[248]

The act reflected a definite change from the primacy of public health to an extended horizon of interests encompassing natural resources, recreation, fish and wildlife, aesthetic values, and other water uses.

Discharge Permits

The Department of Water Resources Act extended the provisions of the 1951 act that no wastewater discharge could be made without a permit from the SSSC. No permit could be granted for discharges to waters classified as sources of public water supply or into unclassified waters where the discharge point was sufficiently close to have an adverse effect on public water supplies without written approval of the Board of Health. [249]This authority and responsibility for certain classes of small sewerage facilities and shellfish growing areas left the Board of Health with definite responsibilities for water pollution control, though now as a junior partner.

Voluntary actions to abate pollution were actively encouraged. Certificates of Approval were issued to voluntary projects even though receiving waters had not been classified. Temporary permits covered the continued discharge of sewage and industrial wastes through existing outlets where owners had prepared acceptable plans for providing the required treatment works within a reasonable period of time.[250]

Watershed Improvement Districts

The 1959 General Assembly also adopted An Act . . . to Provide for the Establishment of Watershed Improvement Districts. While not directed specifically

toward water pollution control, the act did deal, tangentially at least, with the agricultural runoff or "nonpoint" source pollution which would receive increased attention in subsequent years. The stated policy of the legislation was to provide for the prevention of soil erosion, control of flood water and sediment damage, and furtherance of soil and water conservation. The new districts were to be located within soil conservation districts with powers to conduct surveys and investigations, disseminate information, cooperate with state and local governments and industry, acquire debt and property, develop comprehensive plans for prevention and control of soil erosion and make equipment and fertilizer available for the control of soil erosion. The act encouraged soil conservation measures such as terraces, check dams, desilting basins, strip cropping, and the many other soil conservation techniques similar to the best management practices specified later for the control of nonpoint water pollution from agricultural land runoff.[251]

XVI Moving into the 1960's

By early 1960, Comprehensive Pollution Abatement Plans had been prepared for seven major river basins. Detailed pollution surveys of unclassified river basins were scheduled for completion late that year. Classifications had been assigned to the waters of seven major basins representing nearly 67 percent of the state and were expected to be completed by the end of 1962.[252]

Monitoring Programs

Treatment plant and stream monitoring were receiving increased attention. These involved routine and special plant investigations and establishment of a system of permanent stream monitoring stations. There were special studies of waste discharges and effects on receiving streams to determine permissible stream loadings and degree of waste treatment required. Stream gaging and physical/chemical water quality monitoring programs were conducted by the U. S. Geological Survey on a cost-sharing basis. This included 134 continuous record gaging stations, 98 low flow partial record stations, 209 small stream gaging sites, and 320 sampling stations.[253]

By this time, DSSH had a central laboratory located in the State Laboratory of Hygiene Farm Building near Cary and three mobile laboratories—two owned by the state and one on loan from the Public Health Service. Laboratory facilities provided all analyses of sewage, industrial wastes, and surface water quality. The laboratory section was also responsible for research and pilot plant studies.[254]

Governor Terry Sanford Visits SSSC

In early 1961, Governor Sanford met with the SSSC and observed that "the program is important to the future of North Carolina." He said that a visit to the more highly industrialized states would reveal what could happen in North Carolina should it

become as highly industrialized as we hope it will. "The State hopes to attract and keep the right kind of industry while at the same time protecting our water resources."[255]

Dissatisfaction With Chowan River Cleanup

At the March 1961 meeting of the SSSC, member J. N. Vann expressed disappointment in the progress being made on the Chowan River. He was afraid, he said, that "at the rate progress has been made by the towns in the area . . . his grandchildren would be his age before the Chowan River is cleaned up." "Edenton," responded Executive Secretary Hubbard, "is the key problem in the basin because other towns are looking to see what is going to be done about Edenton."[256]

Representatives of the Union-Camp Paper Co. upstream on the Chowan River met with the SSSC shortly after this to discuss plans for waste disposal at their mill in Franklin, Virginia. They proposed that all wastewaters be retained during spring and summer months when stream flows were low, with discharge during the winter. No action was taken on their request for reclassification of the Chowan River as swamp water after Hubbard said that the lower portions of the river did not conform to criteria for that classification.[257] The request was subsequently denied.[258]

Excellent Progress Reported Elsewhere

The Department of Water Resources reported "excellent progress" during the 1960–1962 biennium. The waters of five major river basins were classified, bringing the total to twelve river basins representing about 89 percent of the state. Comprehensive Pollution Surveys were completed in all river basins. All streams were expected to be classified by the end of 1962. Substantial progress was also made by municipalities and industries toward pollution abatement with 125 projects costing $26 million completed and another 51 projects placed under construction. The cooperation of municipalities and industries was said to have been "most gratifying."[259]

Commentary on Waste Treatment Technology

Completely new methods of waste treatment should be sought, wrote Mark D. Hollis of the Public Health Service in 1960. The technology, in his view, "should be capable of removing practically any and all types of contaminants. There has been no

basic scientific breakthrough in this field for over 40 years," he noted. According to Hollis, biological processes employed at that time had been stretched to their limit, and there was still the task of removing contaminants not amenable to biological treatment.[260]

A year later, Hollis again spoke out on the proliferation of synthetic organic chemicals being discharged to the nation's waterways. In his view,

> Metropolitan and new industrial wastes include[d] increasing amounts of new synthetic chemical contaminants. Most . . . were practically nonexistent in 1940. These synthetic organics do not breakdown like natural organics, they are persistent over a long period. To a large extent, they are not removed by either sewage treatment or by normal water purification processes. They add the question of toxicity to the age-old problems of typhoid fever and similar diseases.[261]

Federal Water Pollution Control Act Amendments of 1961

Amendments to the Federal Water Pollution Control Act in 1961 emphasized the nonhealth aspects of water pollution control by transferring responsibility for the federal program from the Surgeon General of the U. S. Public Health Service to the Secretary, Department of Health, Education and Welfare within a new Federal Water Pollution Control Administration. The relationship between water quantity and quality was underscored by authorizing inclusion in federally sponsored reservoirs storage capacity for water quality control. Other changes included increased research activity, larger authorizations and dollar ceilings for construction grants, and increased state program grants. It also expanded federal enforcement authority to include pollution of navigable or interstate waters in or adjacent to any state or states.[262]

Sewage Treatment Facilities in North Carolina

An inventory of municipal sewage treatment facilities in North Carolina in 1962 disclosed 85 communities and sanitary districts still without sewage treatment. The remaining 133 communities were providing varying degrees of treatment as follows:[263]

Primary Treatment	No.
Imhoff Tanks	41
Primary with Septic Tank	12

	Primary with Separate Sludge Digestion	5
Total		58

Secondary Treatment	No.
Trickling Filters	39
Activated Sludge	9
Sand Filter	5
Extended Aeration	22
Total	75

Polluters Asked to Explain Inaction

It was typical of the period to ask polluters to appear before the SSSC "to explain why appropriate action has not been taken toward providing adequate waste treatment facilities." Examples follow:[264]

- Weyerhaeuser Paper Mill at Plymouth: A conference was scheduled to consider additional treatment during periods of low flow.
- Carolina Paper Mills at Rockingham: Series of conferences failed to produce a satisfactory pollution abatement plan.
- Mozur Laces at Wilmington: Lagoon was not providing adequate treatment
- Beaufort and Morehead City: Time schedules were not met and cities were unable to comply with requirements of a temporary permit.

Phosphate Mining Comes to North Carolina

The SSSC was advised in 1962 of a proposal to lease certain segments of the Pamlico River below Washington for phosphate mining and concern over possible effects on water quality were expressed. Chairman Whitfield suggested a letter to Gov. Sanford "advising him that the committee is greatly concerned about the effects of such mining operations on the waters of the Pamlico River and its tributaries."[265]

The phosphate mining proposal continued to be an important item on the SSSC agenda. "An Evaluation of the Effects of Proposed Phosphate Operations Upon the Waters of Pamlico and Pungo Rivers in North Carolina" by Hubbard and Clary added to

the discussion. Staff Attorney R. T. Sanders advised that a state contract for mining "did not repeal the stream sanitation laws." He recommended that the committee "proceed to apply its legal and regulatory requirements to this operation just as it does (for) any other operation." The Hubbard-Clary report was adopted and copies were sent to the governor, council of state, and attorney general.[266] Chairman Whitfield said later that "the operations of the (mining) companies should be halted upon a finding that the waters are being polluted."[267]

A proposal from the Texasgulf Sulphur Co. for mining in Lee Creek was interpreted to mean that the mining would destroy the creek. Authority of the SSSC to authorize such destruction was discussed and Whitfield commented that "the Committee has no authority to destroy a stream."[268] The committee was advised by its attorney "to disavow responsibility with regard to the contract." He said that "in his opinion the General Assembly does not have the right to destroy a stream, since such resources belong to the people and are only held in trust by the State."[269] Hubbard subsequently reported that the proposed "option-to-lease" agreement between the state and the Texas Gulf Co. preserved SSSC rights.[270] Early in 1963, Hubbard suggested that the SSSC suspend classification on Lee Creek rather than consider reclassification.[271] On September 1, 1963, the SSSC suspended classification "until such time as the public interest requires their reinstatement."[272]

Additional Public Works Programs

While federal grants for the construction of waste treatment works under the Federal Water Pollution Control Act may have loomed largest in the public eye, there were other conduits for the flow of federal funds to local governments for this purpose.

As during the Great Depression, public works programs enacted by the Congress to stimulate employment usually had substantial payoff for the construction of municipal sewage treatment works. Thus, the Federal Public Works Acceleration Act of 1963 gave added impetus to the state pollution abatement program. Federal grants for interceptor and outfall sewers, pumping stations, and treatment plants, were administered by the Public Health Service and sewage collection systems by the Housing and Home Finance

Agency.[273] Fifty-five applications for $6.7 million in partial support of $13.8 million of construction were filed for 38 municipalities by January 1, 1963.[274]

Availability of federal financial aid under the Federal Water Pollution Control and Public Works Acceleration Acts was said to have "greatly stimulated construction of municipal sewage collection and treatment works." Nevertheless, the funds were reported to be insufficient "to satisfy all the requests filed by North Carolina municipalities."[275]

Within a year or so after the Public Works Acceleration Act, there was additional federal legislation authorizing financial aid for local sewerage systems. This included the Consolidated Farmer's Home Administration Act which authorized 50 percent grants for basic water and sewer facilities in rural communities of less than 5,500 inhabitants; the Housing and Urban Development Act to provide loans and grants for 50 percent of the cost of water and sewer facilities (but not for wastewater treatment works), and the Public Works and Economic Development Act under which eligible projects had to be located in economically depressed areas designated by the Secretary of Commerce. There was also an Appalachian Regional Development Act which provided 30 percent grants for wastewater treatment projects.[276]

XVII A FULL AGENDA FOR THE 1960'S

A typical meeting agenda for the SSSC in the mid 1960's included fish kills, sources of pollution, wastewater treatment and disposal, compliance and enforcement, studies and research, organizational problems, legislation and other matters. It was a full agenda for such a modestly staffed and financed agency of state government.[277]

Fish Kill Leads to Legislation

Fish kills have been perennial experiences in North Carolina. Their causes have ranged from explicit pollution episodes to conditions brought on by adverse natural conditions—or a combination thereof. Rarely, however, have they triggered responsive legislation from the General Assembly. One such episode occurred on the Roanoke River in 1963.

At daybreak on April 21, 1963, fishermen along the Roanoke River near Weldon reported large numbers of fish in obvious distress "jumping and attempting to escape the tributary runs." The fish kill developed from a spill of black liquor at the Albemarle Paper Products mill at Roanoke Rapids and affected 120 miles of the river. Some 25,000–30,000 catfish, 2,000–3,000 panfish, and other species were killed.[278] But out of this tragic experience came action by the General Assembly to authorize the SSSC to collect damages—a milestone in the North Carolina stream sanitation program.[279]

Mining and Sediment Pollution

Sediment from mining operations on the Toe River and a proposed discharge to a mountain creek came to the forefront in 1963. The SSSC adopted a resolution that "all of the mining industry discharges to the North and South Toe Rivers shall cease . . . otherwise, such operations shall be construed to be in violation of the General Statutes of North Carolina . . . and shall be subject to legal action."[280]

SSSC authority to regulate direct discharges of sediment was addressed through a request from the Lake Junaluska Assembly in 1963 to dredge Lake Junaluska and discharge an estimated 200,000 cubic yards of dredge material into Richland Creek. The Attorney General's office advised that the SSSC did have responsibility for regulating such discharges, that the clause eliminating silt and sand from the committee's jurisdiction was repealed in 1957, and that discharges of this type were covered in laws relating to stream sanitation.[281]

Champion and the Pigeon River

Pollution of the Pigeon River from wastes discharged by the Champion Paper Mill at Canton continued to attract attention. Staff reported that "the condition of the Pigeon River is no better than when the stream was classified in 1958." Champion agreed to provide primary treatment along with process changes. The population equivalent (BOD) of the wastes was reported to be about 400,000.[282]

There was discussion of the possible use of federal enforcement powers on interstate streams such as the French Broad, Pigeon, and Little Tennessee Rivers if the polluters failed to carry out realistic pollution abatement programs. Champion was granted a three-year extension of its permit with respect to temperature "provided the company will complete the outlined in-plant pollution reduction program, provide the proposed primary treatment, conduct necessary studies, and submit plans . . . for required additional treatment facilities."[283]

Urban Land Runoff

Nonpoint pollution from stormwater runoff was beginning to receive national attention in the early 1960's. The information being collected at other locations had begun to demonstrate the importance of urban land runoff as a source of stream pollution. Earlier work in Europe, Seattle, Detroit, and Cincinnati led to the conclusion that urban stormwater runoff could not be neglected in considering wastewater loadings from urban sources.[284]

Concept of Minimal Treatment Challenged

The concept of some minimal degree of wastewater treatment took root fairly early in the course of federal and state pollution control programs. At first, the minimal requirement was primary treatment with its simple removal of settleable and floatable solids. After a great deal of debate, this was gradually replaced by a policy requiring secondary treatment with its partial stabilization of residual organics.

In 1965, the focus on minimum treatment was said to be outmoded. M. D. Hollis of the Public Health Service challenged the idea of minimal treatment and said that it should give way to a concept of maximum treatment, with cost/benefit ratios computed on a drastically revised system of values. Hollis said that public opinion demanded pollution abatement and had moved out ahead of professional action and plans. "The public is expecting more than it is getting," he alleged. "We have been too cautious, too conservative, and often apologetic in our justifications of [budgets] . . . to combat pollution," he said, "and too optimistic in reporting progress."[285] The concept continued, however, probably because of the great difficulty in developing a value system for benefits and costs of pollution control that could stand up under dollar-oriented analysis. Later studies disclosed broad support for continuation of secondary treatment as a minimum requirement with additional treatment required where needed to meet ambient water quality standards.

Enforcement

The state continued to encourage voluntary pollution abatement action. When this failed, polluters were asked to appear before the SSSC to explain their lack of action. The next step for recalcitrants was to issue consent and special orders. The orders directed polluters to proceed with construction of necessary waste treatment works within a specified time schedule.[286]

Typical enforcement problems of the mid 1960's included a development at Spruce Pine where an inadequate sewer system resulted in manhole overflows into a creek causing "unsightly and odorous conditions and a health hazard." The developer was ordered to appear before the SSSC "with a definite plan for pollution abatement."

In another case, a hosiery plant at Belmont failed to obtain a permit before starting operations. Despite numerous conferences, no treatment had been provided. Officials were said to "take the attitude that there is no reason why they should do anything about the pollution problem." The owner was requested to appear at the next meeting to "show cause."[287]

When an industry failed to make satisfactory progress with its pollution abatement plan, the SSSC held "show cause" hearings and directed that the necessary treatment facilities be provided. During 1964, six hearings were held and special orders issued. Five consent orders were also issued.[288]

The City of Wilmington was one of the state's laggard cities and was still discharging raw sewage to the Cape Fear River in 1965 when it was ordered to proceed with planning and construction of wastewater treatment facilities.[289]

The discharge of treated wastewater directly to the ocean rather than the sounds was periodically considered, but never implemented. Wrightsville Beach discharged its effluent to Moore Inlet, which it proposed to close in 1965 as part of a hurricane protection project. This action required an alternative discharge point and the town notified the SSSC that it was prepared to provide an ocean outfall "upon instructions" to do so. While the committee staff expressed concern about possible damage to the beach, a resolution was adopted calling for the town "to install a properly designed outfall to conduct the effluent from its sewage treatment plant to the ocean within a period of three to five years.[290] The ocean outfall was never constructed.

Treatment Plant Operation

All municipalities had been issued temporary permits with time schedules for pollution abatement. In cooperation with the Public Health Service, 36 performance audits were made of facilities constructed through assistance of federal funds. Only four were found to be not performing satisfactorily. The importance of well-trained operators for wastewater treatment plants was a theme to be repeated throughout the course of stream pollution control. Staff reported a shortage of trained operators and asked the SSSC to categorize wastewater treatment plants and to require operators certified for each category. It was noted that a plan for operator certification was then under study

by the State Board of Health for water treatment plants. The SSSC was asked to consider a similar plan for wastewater treatment plant operators.[291]

Pollution Studies, Stream Classification and Monitoring

During the first 10 years of the state program, comprehensive stream pollution studies had been completed in 16 major river basins. Classifications had been assigned the waters of 13 basins, representing 92.5 percent of the state. All river basins were to be classified by mid-1963. Comprehensive pollution abatement plans had been issued for 12 of the 13 classified river basins.[292]

The pollution surveys, stream classification, and comprehensive pollution planning programs were concluded in 1963. Progress from inception is shown in Table 4. With completion of this phase of the program, all waters of the state had been brought under the enforcement provisions of state law. A state-wide network of water quality monitoring stations had been established for the collection of water quality data to assess program effectiveness. The data derived from this system indicated a "marked improvement in water quality" below all points of waste discharge for which treatment facilities had been provided under comprehensive pollution abatement plans. The U. S. Geological Survey continued to provide stream flow and chemical water quality data under its cooperative program with the state.[293]

Research

The research arm of the state water pollution control program was strengthened in 1964 with enactment of the Federal Water Resources Research Act. The objectives were to develop new technology and more efficient methods to resolve national, state, and local water resource problems; to train water scientists and engineers, and to facilitate the transfer of research findings into practice. Most importantly from the standpoint of the individual states was its provision for state water resources research institutes and matching funding for their research programs. The North Carolina Institute was established in 1965 as a unit of the University of North Carolina system. One of the Institute's initial actions was to establish a close working relationship with

Table 4: Status of Stream Pollution Studies - 1964

River Basin	Drainage Area (Sq.Mi.)	Date of Committee Action: Report Adopted	Classification Adopted	Effective Date Established	Pollution Abatement Plan
Yadkin	7,180	4-20-54	12-14-54	4-6-55	8-2-55
White Oak	1,340	5-6-55	2-9-56	6-1-56	4-30-56
Chowan	1,365	10-28-55	3-7-56	7-2-56	4-30-56
Roanoke	7,895	11-5-56	6-18-57	9-1-57	1-30-58
French Broad	2,825	9-10-57	1-30-58	4-1-58	7-25-58
Cape Fear	8,530	7-25-58	1-20-59	4-1-59	5-8-59
Neuse	5,640	5-28-59	12-17-59	4-1-60	4-29-60
Pasquotank	1,320	6-3-60	1-6-61	4-6-61	4-5-61
Little Tennessee	2,190*	9-27-60	4-5-61	7-1-61	9-7-61
Hiawassee	650	9-27-60	5-17-61	7-1-61	9-7-61
Catawba	3,250	5-18-61	12-15-61	3-1-62	5-31-62
Tar	4,200	9-7-61	4-6-62	6-6-62	7-24-62
Broad	1,450	5-31-62	12-19-62	3-1-63	3-12-63
New	760	9-7-62	2-8-63	5-15-63	7-9-63
Watauga	220	9-7-62	2-8-63	5-15-63	7-9-63
Lumber	3,470	5-7-63	8-22-63	12-1-63	12-17-63

* Includes Savannah River Drainage Area

Source: N.C. Department of Water Resources, Biennial Report 1962-1964. See footnote 292.

the State Stream Sanitation Committee to facilitate research directed toward water quality problems in North Carolina.

Of the 248 reports published by the Institute by 1990, nearly half addressed some aspect of water pollution control and water quality management. The greatest emphasis was on the management of municipal, industrial, and agricultural wastes. Eutrophication of reservoirs and estuaries, water quality monitoring, and pollution from stormwater runoff also received a great deal of attention. The Institute unquestionably helped to bring resources of the university system to bear on the state's water pollution control problems.

Federal Water Pollution Control Act Amendments of 1965

In the face of growing dissatisfaction with enforcement and progress on other fronts, the Congress moved to correct perceived deficiencies through enactment of the Water Quality Act of 1965. The administration of the Federal Water Pollution Control Program was upgraded through creation of a new Federal Water Pollution Control Administration (FWPCA) within the Department of Health, Education and Welfare and subsequently the Department of the Interior.

State ambient water quality standards were mandated for interstate waters, along with plans for implementation and enforcement. All were subject to federal review and approval. The enforcement provisions strengthened the federal hand by providing for prosecution by the Attorney General, though the circumstances wherein such action could be taken and associated procedures were said to be limited and cumbersome. The Secretary of Interior could request the Attorney General to bring suit when pollution of waters in one state was found to be caused by wastewater discharges originating in another. The governor of a state had to give written consent where prosecution involved water pollution and discharge within the same state.[294] The SSSC notified the Federal Water Pollution Control Administration that it was North Carolina's intent to adopt the required water quality standards for interstate and coastal waters by October 2, 1966, and an implementation plan by June 30, 1967.[295]

The 1965 act also increased the authorization for annual construction grants appropriations, incrementally, from $150 million in 1966 to $1.25 billion in 1971. Actual appropriations fell far short of these amounts, however. The federal construction grants program was under constant attack from the administration and others philosophically opposed to federal funds for this purpose. This was offset to a considerable degree by lobbying from those interests supportive of continuation of the program. Not the least of these was the National League of Municipalities and affiliated state organizations. A message from the N. C. League of Municipalities in 1966 advised the SSSC that the National League was asking for contacts with municipalities interested in supporting federal construction grants to contact members of Congress toward that end. The committee sent the following telegram to the leading program proponents in the U. S. House of Representatives:[296]

> Urge passage of appropriate water pollution control legislation this session. Most important that grants be extended. North Carolina has 44 pending applications requesting grants in excess of $5.8 million.

The Congress obliged by passing further amendments in 1966 which increased authorizations for construction grants, removed dollar ceilings on grants, and raised the federal share from 30 percent to a maximum of 55 percent.

The *Journal of the Water Pollution Control Federation* characterized the federal legislation and executive branch response in 1966 as "an all-out war on pollution." A "flood of bills" had been introduced in the Congress, all aimed at increasing the federal funds and pace of the federal program. All involved more federal money and control. The President shortly thereafter transferred the new Federal Water Pollution Control Administration from the Department of Health, Education, and Welfare to the Department of the Interior, where other federal water resource programs were lodged.[297]

Despite the rather euphoric characterization of the federal program under the new legislation as an "all-out war," there were problems, particularly with enforcement. The ambient water quality standards and associated regulatory provisions were not coupled to effluent limitations designed to satisfy the standards, and without this, it would prove to be very difficult to assign responsibility for infractions of the standards. As noted by the Nader report *Water Wasteland*, the lines between ambient water quality

standards and effluent requirements were so weak as to be almost certainly unenforceable.[298]

While the new federal law offered the promise of increased water pollution control activity in North Carolina, there were many unresolved problems from the coast to the mountains. Examples were lingering pollution in the Beaufort area and the French Broad River in the highlands.

Pollution in the Beaufort area was proving difficult to correct. In 1966, E. C. Hubbard had reported that "no real progress had been made" and suggested that the SSSC issue an order requiring the town to proceed. Having received no reply to the order, he informed the committee that the "Town of Beaufort seems to be doing everything possible to avoid its responsibility." The staff was instructed not to approve any more sewer extensions until progress had been made.[299]

In its report on Development of the Water Resources of the French Broad River Basin in 1966, the Tennessee Valley Authority reported a marked increase in stream pollution attributable to population growth and industrial development. For many years, it said, the French Broad River between Davidson River and Mud Creek had been "one of the most polluted rivers in the South." Water quality reportedly fell below North Carolina's lowest E classification. Organic wastes discharged to the river far exceeded the stream's capacity to assimilate. The State Stream Sanitation Committee had requested the industry primarily responsible for the major pollution problem in the Davidson River Area to provide secondary treatment and this was expected to improve conditions. Storage in the proposed reservoir system was expected to augment streamflow sufficiently to raise the classification from E to the more desirable C classification. Flow augmentation was also expected to reduce nutrient levels sufficiently to help avoid nuisance levels of benthic weeds in the river and algae in Douglas Reservoir.[300]

A study of the effectiveness of federal and state legal and administrative processes applicable to intrastate streams in North Carolina, commenced in 1966, reached several conclusions relative to stream classification and water quality standards. The study was based on experience with the New Hope and lower Haw rivers. The

author, T. J. Schoenbaum—associate professor of law at the University of North Carolina, noted that when water quality standards were violated on such intrastate streams, only the cumbersome conference-hearing-court action procedure would be available to the federal government and that would be subject to the concurrence of the governor of North Carolina. There had not, he said, been any significant federal enforcement activity with regard to navigable intrastate waters.

As noted earlier, North Carolina adopted water quality standards 14 years before required to do so by the 1965 federal act. State initiatives in this area were, however, to be increasingly subject to federal law in the years ahead. In 1968, in response to federal guidelines under the 1965 act, the E and SD classifications for navigation and disposal of wastes were eliminated. Schoenbaum saw a number of problems in the classification system. First, he considered classification to be a form of stream zoning which emphasized the refereeing of various conflicting uses. Second, he said that in the classification process only the then-current uses of stream segments were considered, ignoring the effects of upstream discharges or downstream uses. Third, he viewed segment classification as illogical in that a stream like the New Hope could be assigned a C classification when every tributary had been designated D. Fourth, he alleged that the system reflected the number and kinds of beneficial uses considered important in the 1950's and early 1960's. [301]

While North Carolina did not have effluent standards of the nature adopted under later federal legislation, it did specify a minimum degree of treatment and percent reduction in such parameters as suspended solids and biochemical oxygen demand. The latter was the dominant measure of the "strength" of sewage and other wastes regardless of applicability. There was also the question of allocation of assimilative capacity among different discharges. Schoenbaum asked,"Should the entire capacity be initially allocated or should a portion be reserved for future dischargers?" He also stressed the need for a nondegradation policy to protect high quality waters. Without this, he said, state policy allowed the reduction of quality to the level set by the water quality standards.[302]

XVII WATER POLLUTION CONTROL IN THE LATE 1960'S AND EARLY 1970'S

In 1967, the General Assembly expanded the Board of Water Resources' responsibility to include both air and water resources. Members of a new board of Water and Air Resources were taken largely from the State Stream Sanitation Committee and Board of Water Resources. Responsibility for pollution control activities under the board's general direction was administered by a renamed Water and Air Pollution Control Committee (W&APCC). The legislation "was not to be construed as affecting in anyway" the authority of the State Board of Health with regard to public water supplies and the "sanitary disposal of sewage." This interpretation continued the ambiguity with respect to the relative responsibilities of the two boards in the field of water pollution control.[303]

Upgrading of Stream Classifications

E. C. Hubbard, now the assistant director of the new Department of Water and Air Resources, told the W&AQCC in 1967 that it would be advisable "to strengthen and update the North Carolina classification system and water quality standards adopted by the SSSC in 1953, "in keeping with present day technology." The FWPCA had "strongly recommended" that the interpretive policies previously adopted by the SSSC be included as a part of applicable rules and regulations "in order to have the full force and effect of law." The Board of Water and Air Resources approved these changes.[304]

The state's lowest stream classification (E) was abolished on January 30, 1968, leaving fish survival (D) as its lowest classification. On recommendations of the W&APCC, the board did not accept "suggestions" that a lower classification be preserved. Variances were to be used in cases where polluters had "done everything

possible to meet [a] standard," but had failed to do so.[305] In 1969, the General Assembly authorized the Board of Water and Air Resources to classify waters for scientific and research purposes.[306] This was in response to expressions of interest by university faculty in the protection of waters used for research and education. The new classification was never utilized.

Permits and Monitoring

The board's authority to issue permits for wastewater discharges did not, at this time, include public schools, state and local institutions, raw milk dairies, farm slaughter houses, shellfish processing plants, and food and lodging establishments supervised by the State Board of Health under other state laws. Permits for discharges to waters classified for use as sources of public water supply required Board of Health concurrence. Other than this, the Water Pollution Control Division of the Department of Water and Air Resources (DWAR) had primary responsibility for administration of a comprehensive, state-wide water pollution control program. That program was financed by a combination of state appropriations and federal grants. [307]

There had been no adequate system of monitoring prior to 1968 because of insufficient funds. Special stream sampling surveys were required for the water pollution survey reports. A monitoring staff was established on March 1, 1968, and actual sampling started on April 1, 1968. A total of 224 sampling stations were established by mid-year. While the pollution survey reports and comprehensive abatement plans had been completed in 1963, changing conditions and requests for reclassifications imposed continuing needs for monitoring data. Analytical support was provided by a "well equipped and staffed" laboratory.[308]

By 1970, the ambient water quality monitoring system included two networks—primary and secondary. The 102 sampling sites of the primary network were selected to measure long-term water quality trends on the state's main streams and principal tributaries. A secondary network of 1,469 sites was designed to monitor water quality below points of pollution.[309]

Municipal Waste Treatment Works Construction

While federal financial aid reportedly stimulated construction of wastewater collection and treatment facilities, federal funds had not been sufficient to satisfy all applications. In order to meet the perceived need, a request was made to the General Assembly for state appropriations of $2 million per year for the 1970-71 biennium. Funds were to be used to supplement federal grants and aid smaller municipalities unable to qualify for these grants.[310]

The request for state funds resulted in the North Carolina Clean Water Bond Act of 1971. This brought the state into the partial financing of local water supply and wastewater treatment facilities in addition to its traditional regulatory role. The act provided for the issuance of $150 million in state bonds for grants to local governments to stimulate the construction and improvement of wastewater collection and treatment facilities and water supply systems. The problem of polluted and be-fouled lakes, streams and estuaries in North Carolina was characterized by the General Assembly as "already serious and destined to grow worse unless immediate action is taken. A major factor in the pollution problem," it said, "is the discharge of wastes to the waters of this State by municipalities . . . from wastewater systems that are inadequate, antiquated and, in some instances, nonexistent." The question of issuance of the bonds was referred to a referendum and approval of the citizens of North Carolina. Both grants and loans were authorized, with grants limited to 25 percent of total project cost unless a greater percentage was determined to be necessary. The water pollution control grants and loans were administered by the Board of Water and Air Resources with the water supply funds administered by the Board of Health. Bond proceeds were placed in a Clean Water Fund administered by the Department of Administration. One-half of the $150 million was allocated for pollution control facilities and one-half for water supply. Fifty million dollars of the Pollution Control Account was to be used for state matching of federal grants and 25 million was allotted to counties based upon population.[311]

North Carolina had now been delegated authority for administration of the federal construction grants program. Basic federal participation, previously limited to 33 percent of the cost of eligible projects, had risen to 55 percent. With state matching

grants of 25 percent, it was now possible for local governments to construct needed treatment facilities with 80 percent federal/state funding, leaving only 20 percent to be borne by the cities and towns of North Carolina. The estimated cost of all municipal and industrial wastewater collection and treatment systems for period 1953 to 1970 is shown by Figure 4.[312]

Waste Treatment Plant Operation

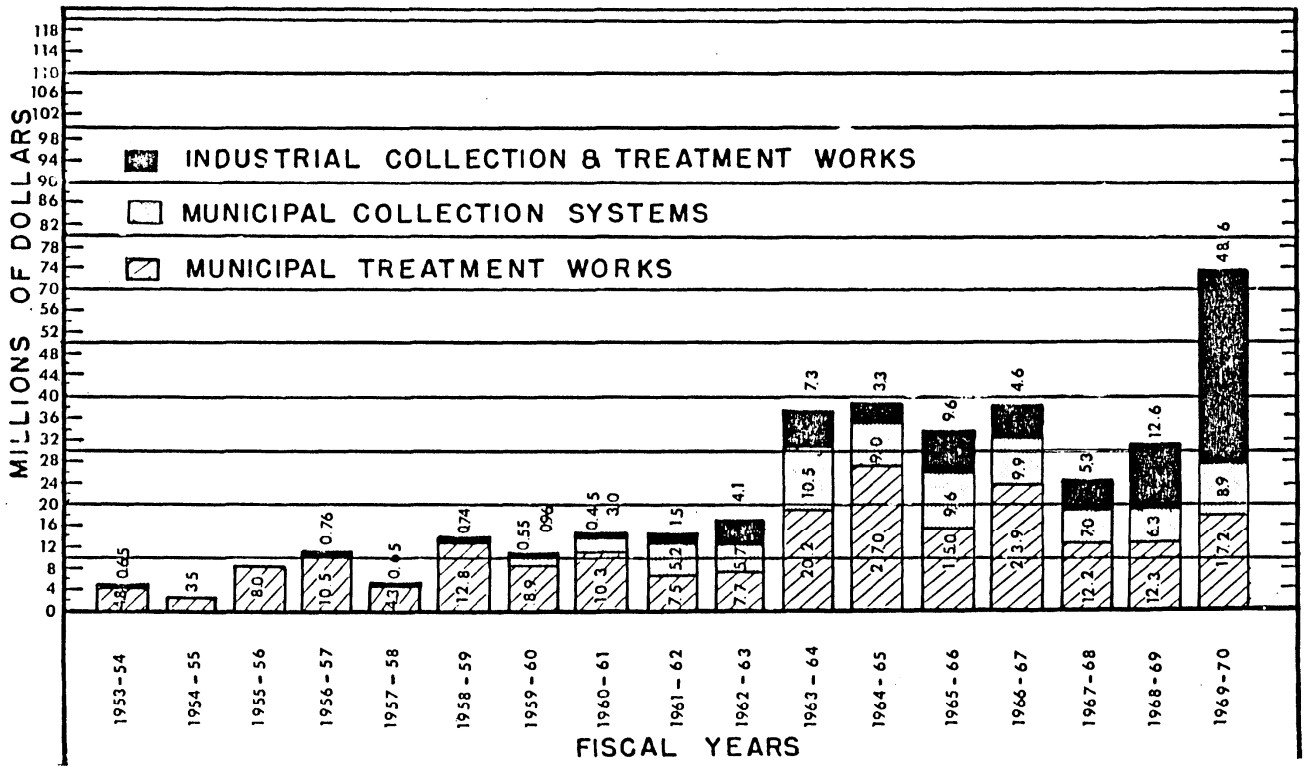
Construction of wastewater treatment facilities must be followed by dependable operation and maintenance if pollution control objectives are to be realized. Many wastewater treatment plant operators in the late 1960's were still relatively unskilled. Pay levels were frequently too low to attract qualified operators, and sponsors tended to consider their problem solved once a needed treatment plant had been built.[313]

Prior to 1969, the state program for operator certification was voluntary and was administered by the North Carolina Water Pollution Control Association and certain educational institutions. A five-day school was held annually at the University of North Carolina in Chapel Hill. Examinations were given on a voluntary basis at the end of each school.[314]

In 1969, the association voted to sponsor legislation for the classification of treatment plants and the mandatory certification of wastewater treatment plant operators in North Carolina. The stated purpose was to protect the quality of water resources, protect public investment in treatment facilities, provide for the classification (as to complexity of operation) of wastewater treatment facilities, require the examination of plant operators, and certify as to operator competency. The legislature created a Board of Certification composed of seven members representing operators, local governments, private industry, university faculty, and a staff member of the N.C. DWAR to serve as chairman. The board operated under the aegis of the department's assistant director responsible for the state's water pollution control program.[315]

The department was soon awarded a contract by the U. S. Department of Labor for a 44-week training program involving 80 treatment plant operators. Implementation began in late 1969 and early 1970. The course of instruction included 330 hours of classroom and 1,430 hours of on-the-job training. This was a one-time event to be

Figure 4. Estimated Cost of Approved Water Pollution Control Projects for Period July 23, 1953 - June 30, 1970



Source: N.C. Department of Water and Air Resources Sixth Biennial Report 1968-1970. See footnote 312.

completed by the end of 1971. It involved the Fayetteville, Pitt, and Buncombe Technical Institutes and Central Piedmont Community College.[316]

Industrial Wastes

David D. Dominick, commissioner of the Federal Water Pollution Control Administration, wrote the Department of Water and Air Resources in late 1970 about "the lack of information on industrial wastewater discharges" and the "increasingly serious problem this posed in the planning and execution of water pollution control and abatement programs." He requested state cooperation in a national survey of industrial plants to obtain the required data.[317]

New FWPCA regulations, adopted in 1970, required cities receiving industrial wastes into their sewerage systems to adopt sewer use ordinances providing for the collection of user charges from industrial discharges sufficient to reimburse the cities for the cost of treating industrial wastes.[318]

The regulation of industrial wastes discharged to municipal sewer systems had been increasingly viewed as imperative because of the effect of such wastes on wastewater treatment processes, pass-through of wastes not amenable to treatment, and the increased costs imposed on municipal sewerage systems. The Water Resources Research Institute released a series of publications in early 1972 which provided guidance to municipalities of North Carolina on the imposition of surcharges on industrial wastewater discharges based on the strength of such wastes. The incentive for surcharges came from federal and state requirements that industries be charged "equitable" amounts for water and sewer services as a basis for eligibility for wastewater treatment plant construction grants.[319] [320]

The City of Raleigh's response to the need to regulate industrial wastewaters discharged to its sewerage system is illustrative. While the city had considered sewer ordinances as early as the late 1950's, "a $7 million federal grant for Raleigh's planned $24 million sewage treatment plant . . . catapulted the ordinance into active consideration." The ordinance required all industries to get a permit to use the city system and to pay a surcharge for wastes stronger than domestic wastes. This provided "an economic incentive for industries to reduce the strength of its wastes," according to

the Water Resources Research Institute guidelines. Charlotte, Greensboro, Durham, Monroe, and Winston-Salem were cited as cities which had already adopted sewerage ordinances. As the Raleigh director of public utilities said, "If you start hitting them in the pocketbook, they start finding ways to reduce waste by pretreatment."[321]

The use of groundwater aquifers as an alternative to surface waters as receptors for industrial waste discharges first came before the SSSC in late 1966. This was in the form of a proposal from the Hercules Powder Company in Wilmington "to pump chemical wastes into underground waters." The alternative was to treat the wastes for discharge to the Northeast Cape Fear River. Industrial waste disposal through deep-well injection was to cease immediately should monitoring data indicate adverse effects.[322] Failure of the system was acknowledged in 1971 and the company was asked to proceed with planning and construction of conventional treatment facilities and discharge to the Northeast Cape Fear River.[323]

Agricultural Wastes

The first attention to synthetic organic chemicals as pollutants focused on agricultural pesticides. On October 16, 1969, a spokesman from the Board of Water and Air Resources presented a statement at a Board of Agriculture hearing concerning the manufacture, sale, and use of DDT and other persistent chlorinated hydrocarbon pesticides. This was in response to a request from the North Carolina Wildlife Federation for new pesticide regulations from the Board of Agriculture. The statement said that "the lack of technical information concerning the full effects of chlorinated hydrocarbon pesticides on the health of fish, wildlife, and humans, precludes a recommendation by this Department that the sale and use of such pesticides be completely banned." However, the spokesman said that "until sufficient evidence is produced through research and study . . . the public interest might be served through the establishment of rigid controls over the manufacture, sale, and use of DDT and related pesticides." The statement continued, "as effective degradable and safer substitutes are developed, these highly persistent materials should be prohibited."[324]

Shortly afterward, the Legislative Research Commission was directed to study the use and effects of pesticides and to report its findings to the 1971 General Assembly. The commission concluded that health and environmental problems resulting from the use, misuse, overuse, and misapplication of some chemicals, and the disposal of unused chemicals and containers was approaching "significant proportions." There was recognition of the fact that the drifting or washing of pesticides into streams or lakes could cause appreciable danger to aquatic life. As a result, the General Assembly enacted the North Carolina Pesticide act of 1971, which established the North Carolina Pesticide Board as the governing body to implement the legislation through the commissioner and the Department of Agriculture. Under the act and subsequent amendments, the Pesticide Board was authorized to regulate the use of pesticides and to examine and license pesticide dealers and applicators. The board was also authorized to adopt rules restricting or prohibiting the sale and use of pesticides to prevent damage or injury to plant and animal life outside the target areas. This included fish and other aquatic life in waters "in reasonable proximity" to the areas to be treated.[325]

The control of pollution from agricultural chemicals required surveillance from manufacture to the farmer's fields. At its June 24, 1971, meeting the committee was told that a Farmville warehouse containing several hundred thousand pounds of pesticides and herbicides had burned with consequent loss of these chemicals to the environment. Dikes were constructed in nearby ditches to retain the contaminated water used in fighting the fire. Disposal of runoff water containing a mixture of stored chemicals and contaminated solid wastes "posed a real problem."[326]

Assistant Department Director Hubbard told the Pollution Control Committee in 1971 that it was time for the committee and the board to give serious consideration to the problem of feedlot waste disposal. Attention was called to a Water Resources Research Institute project to determine the extent of the problem and acceptable methods for the disposal of these wastes.[327] The project found animal waste management to be primitive and recommended the prohibition of the direct discharge of animal wastes to surface waters. Criteria were recommended for improved land disposal practices.[328]

Increasing awareness of the importance of agricultural wastes in pollution control brought federal assistance in the construction of animal waste lagoons through the Agricultural Stabilization and Conservation Service (ASCS) in 1970. The Department of Water and Air Resources was requested to work with ASCS, the N. C. Board of Health, the Agricultural Research Service, and the Water Resources Research Institute in the development of interim criteria. Hubbard told the board's pollution control committee that he estimated the waste from farm animals in North Carolina to be almost as great as from the human population and that it would eventually be necessary for the state to control drainage from animal feedlots.[329]

Urban Land Runoff

The Water Resources Research Institute was also interested in pollution from urban land runoff and sponsored a study to determine the quality of stormwater drainage from urban lands. The study site was a small watershed in Durham. Findings disclosed urban stormwater runoff to be a significant source of pollution, with a biochemical oxygen demand (BOD) approximately equal to effluent from a secondary sewage treatment plant.[330]

A subsequent study of the same watershed confirmed these findings. It was concluded that investment in the upgrading of secondary sewage treatment plants serving urban areas was of questionable value without concomitant steps to moderate the adverse effects of urban land runoff.[331]

Mecklenburg County Water Quality Study

A two-year cooperative water quality study of the Catawba and Yadkin Rivers and tributaries in Mecklenburg County by the Water Pollution Control Division and the Mecklenburg County Department of Public Health, concluded in 1970, gave some insight into stream quality conditions in the state's largest metropolitan area at that time. There were 82 significant sources of pollution. Of the 56 under the jurisdiction of the county and the State Board of Water and Air Resources, pollution abatement was found to be satisfactory at 17, adequate treatment facilities were not properly operated at 12,

adequate facilities were under construction at two, and additional pollution abatement measures were needed at 25.

Of the 26 sources under the joint jurisdiction of the county and the State Board of Health, pollution abatement was satisfactory at five, adequate facilities were not properly operated at 17, and additional measures were needed at four. While stream quality was generally found to be acceptable, several stream segments required corrective measures. One of these involved the integration of smaller sources into a regional system to enhance operation and maintenance and eliminate plant overloading. Area growth and integration into a regional system required a high quality treatment plant effluent approaching the quality of relatively unpolluted natural streams.[332]

The Chowan River Revisited

A two-year study by the Department of Water and Air Resources and the Wildlife Resources Commission to determine the effects of waste discharges from the Union Camp Corp. at Franklin, Virginia, concluded that there was no concrete evidence that the resulting pollution was causing fish to migrate out of the Chowan River.[333] But pollution of the river was to prove to be of long duration. The principal source was believed to be the Farmers Chemical Company in North Carolina, a major producer of fertilizer. Wastewater treatment was not found to be as effective as anticipated, and the Water Pollution Control Division staff reported that "the waste characteristics are entirely different from those originally predicted and the effect on the receiving stream is severe." The company had been issued a permit for "control facilities" rather than waste treatment facilities since it had advised the state that there would be no industrial waste discharges. To the contrary, the records showed the company to be discharging some 4,000 pounds of nitrogen daily. Because of equipment failures, all storage ponds were completely filled and overflowing to the Chowan River, resulting in a "bad situation of algal blooms and slime." Company officials were directed to appear before the committee at its June 1971 meeting with a pollution abatement program and time schedule.[334] At that time, company officials admitted that it had been discharging wastes into the river. Its proposal to build a complete wastewater system was approved by the committee. But, as will be seen later, this did not end the problem.[335]

Pollution of the Chowan River was of mounting concern to the W&AQCC, and the following year it adopted a resolution calling for the further investigation of algal blooms. In 1972, a staff member told the committee that persons living along the river had said that there had "always been" algal blooms, though they were more severe in 1970, worse in 1971, and much worse in 1972. As to causes, he said that "there are several small towns on the river and a million acres of farmland on which a great deal of fertilizer is used." The Farmers Chemical Company started operations "in the last few years" and its discharge was believed to be "responsible for triggering the excessive blooms in 1972." The committee was told that any further discharges to the river would be a "serious mistake." A court order was issued to Farmers Chemical Company on November 23, 1972, to cease all discharges and the committee adopted a motion to ask for federal assistance in the development of studies leading to a plan for control of nutrients in the Chowan River.[336]

The Chowan River was the first coastal river in North Carolina to suffer eutrophication. It was also the first major water quality problem to be addressed through the cooperative efforts of North Carolina, the U. S. Geological Survey, the U.S. Environmental Protection Agency, and the North Carolina and Virginia Water Resources Research Institutes. The studies led to a water quality management plan for the prevention of nuisance algal blooms and preservation of water quality.[337]

Fish Kills

Fish kills were reported at nearly every meeting of the W&AQCC. In 1971, the Neuse River upstream from Raleigh was impacted by wastes discharged by the Burlington Industries Wake Finishing Plant resulting in the death of more than 1,700 pounds of fish. Burlington accepted responsibility and paid a $6,888 fine. Other fish kills were reported at that time in Cabarrus, Duplin, Gaston, Halifax, Hyde, Nash, Pasquotank, Robeson, and Yancey Counties. Causes ranged from accidental discharges, broken sewer lines, agricultural chemicals, and inadequate wastewater treatment to natural events.

Table 5: Status of Compliance with Stream Standards - 1971

Status of Compliance with Water Quality Standards
North Carolina Surface Waters

River Basin	Date Streams Classified	Percent of Streams In Compliance at Classification	Approx. Miles of Streams In Basin	Miles of Streams In Compliance at Classification	Miles of Streams In Compliance 1971	Percent of Streams In Compliance 1971
Broad	12/19/62	65	1,144	744	975	85
Cape Fear	1/20/59	78	7,016	5,472	6,500	92
Catawba	12/15/61	76	2,496	1,896	2,100	84
Chowan	4/7/56	79	1,000	790	915	91
French Broad	1/30/58	44	2,160	950	1,850	86
Hiwassee	5/17/61	93	490	453	490	100
Little Tennessee	4/5/61	31	1,492	462	1,350	90
Lumber	8/22/63	49	2,544	1,246	2,100	82
Neuse	12/17/59	86	4,852	4,173	4,500	92
New	2/8/63	34	580	197	580	100
Pasquotank	1/6/61	50	2,812	1,406	2,700	96
Roanoke	6/18/57	45	2,740	1,233	2,400	87
Tar-Pamlico	5/6/62	25	4,108	1,027	3,980	96
Watauga	2/8/63	76	140	106	140	100
White Oak	2/9/56	20	938	187	780	83
Yadkin-Pee Dee	12/14/54	65	5,488	3,567	4,800	87
			40,000	23,909	36,158	

Source: N.C. Division of Environmental Management, Water Quality in North Carolina 1971. See footnote 340.

Some of the difficulties in controlling pollution from agricultural chemicals can be illustrated by the Hyde County fish kill where the court refused to issue a temporary injunction to stop pesticide spraying because of its view "that spraying has to be done in order to kill the insects and the economic loss to the state would be greater than the fish kill." Action on the adoption of standards for pesticides in water was postponed by the committee.[338]

Fish kills continued to remind state officials of the work yet undone. The Final Report of Investigation of Fish Kills on the Yadkin River and High Rock Lake covered six kills. All known sources of pollution capable causing a massive fish kill in the vicinity of the Winston-Salem outfall were investigated. These included the Joseph Schlitz Brewing Company, R. J. Reynolds Tobacco Company, Archer Products, Carolina Insulating Yarn Company, Western Electric, Bassick-Sack, and Haynes Dye and Finishing Company. The Winston-Salem wastewater treatment plant was found to have been overloaded by 73 percent due to industrial wastes and population growth. The treatment efficiency was reduced to 45-50 percent. As a result, in 1970 the Winston-Salem plant was discharging three times the pollution load that it had the previous year. The brewery was found to have contributed the largest incremental increase to the city's waste load resulting in inadequate treatment by Winston-Salem.[339]

Enforcement

Fair and equitable enforcement of water pollution control statutes and regulations had long been recognized as a vital component of the state's water pollution control program. Compliance with water quality standards was the ultimate measure of program effectiveness in the control of water pollution. The status of compliance in North Carolina in late 1971 is shown by Table 5. Miles of streams in compliance in 1971 were 90 percent as compared to 59 percent at time of classification. However, instream compliance with water quality standards is quite different from compliance with discharge permits. Sources of pollution in compliance with consent orders have been reported as "in compliance" even though stream standards may have been contravened.[340]

Self monitoring and reporting systems pertaining to the discharge of wastes to state waters were mandated by the Water and Air Quality Reporting Act of 1971. Monthly reports setting forth the volume and characteristics of wastes discharged were mandated. Provisions for the safeguarding of proprietary interests were included.[341] The law, as with the Clean Water Bond Act and subsequent legislation, was enacted to meet requirements of federal water pollution control legislation as well as state needs.

Pending Issues

Issues before the Board of Water and Air Resources at the end of the 1960's ranged from waste heat discharges from electric power generating plants to wastes from feedlots. They encompassed the usual menu of pollution problems from municipal and industrial wastes.

The Carolina Power and Light Company had requested a permit for the discharge to the Atlantic Ocean of cooling water from its proposed Brunswick nuclear-powered, steam-electric plant near Southport. The permit was approved by the board at its January meeting in 1970. There was also a proposal by the Duke Power Company for a variance in the temperature standard for its cooling lake in Stokes County.[342]

The City of Greensboro was still trying to cope with its pollution problems on S. Buffalo Creek. Proposed corrective actions were not expected to eliminate nuisance conditions, but the installation of stream aeration equipment was expected to upgrade the quality of the water.[343]

U. S. Plywood-Champion at Canton advised that it would be necessary to close its treatment plant on three occasions in order to make certain installations and connections, at which time the waste would bypass the plant and be discharged directly into the receiving stream. Pollution Control Committee Chairman Greer Johnson said the committee would rule these to be "mechanical problems" and instruct the staff to keep the matter under surveillance.[344]

Further Reorganization

A 1971 Act to Reorganize State Government created a Department of Natural and Economic Resources (NCDNER) and transferred the Board and Department of

Water and Air Resources to the new department. An Office of Water and Air Resources became one of six functional offices. Its Division of Water Quality administered the state's water pollution control program.[345]

There was also a substantial change in organization at the federal level when, on July 9, 1970, President Nixon signed an executive order transferring the Federal Water Pollution Control Administration and other federal environmental programs to a new Environmental Protection Agency (EPA).

XIX NEW FEDERAL INITIATIVES

Each set of amendments to the original 1948 Federal Water Pollution Control Act increased the federal role despite a repeated declaration that it was the policy of Congress "to recognize, preserve, and protect the primary responsibilities and rights of the states to prevent, reduce, and eliminate pollution." Public support for a strong federal-state partnership has continued to the present day.

Rediscovery of the 1899 Refuse Act

The relative ineffectiveness of enforcement provisions under the Federal Water Pollution Control Act led to a search for additional legal enforcement tools. This resulted in rediscovery of the 1899 Refuse Act in the late 1960's. Section 13 of the River and Harbor Act of 1899, known as the Refuse Act, prohibited the discharge or deposit of refuse other than liquid wastes flowing from streets and sewers into navigable waters without a permit. Administered by the Corps of Engineers, the act's purpose was to prevent obstructions to navigation. The courts held, however, that the act was not limited to refuse and could be used as an additional enforcement tool for the regulation of wastewater discharges. It was quickly utilized to this end and was the basis of federal law suits in 1970 to halt mercury discharges into navigable waters by eight industries at 10 locations in the United States.[346] There was a flurry of enforcement actions in the early years of the Nixon administration until enactment of the 1972 Federal Water Pollution Control Act amendments when use of the 1899 law was no longer needed.[347]

1972 Amendments to the Federal Water Pollution Control Act

In the minds of some Congressional leaders, the 1965 amendments to the Federal Water Pollution Control Act had been grossly inadequate. Senator Edwin S. Muskie asserted that "the program begun under the Water Quality Act of 1965 has failed." He had concluded that it was virtually impossible to establish a precise and enforceable

relationship between a waste effluent and water quality except where a single source of pollution was involved. Muskie felt that the Refuse Act of 1899 provided a model for future legislation in that it had demonstrated that the effluent discharge permit was a legal tool that could be used quickly and directly against polluters. He concluded that effluent limitations could be applied to all waters in all parts of the country. "Reliance on water quality standards and assimilative capacity can result only in continued use of the waterways as a national sewer system," he asserted. "The most effective way to stop pollution," said Muskie, "is to stop the discharge of pollutants."[348]

Senator Muskie's Senate Bill 2770, providing extensive amendments to the 1965 act, passed the Senate by vote of 86-0 and following House approval, was sent to the White House to be vetoed by President Nixon. The veto was overridden and the bill became law as P. L. 92-500 (Clean Water Act). Its two national goals called for the elimination of the discharge of pollutants into navigable waters by 1985 and "wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and . . . for recreation in and on the water [to] be achieved by July 1, 1983." The stated objective was "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[349]

A Brookings Institution study later concluded that several provisions of the 1972 act "implicitly or explicitly, embodied points proposed by the President." These included the extension of the federal-state program to all navigable waters of the United States, effluent standards for industrial and municipal wastewater discharges, mandatory use in new facilities of best available and economically achievable technology for pollution control, stringent federal standards for toxic discharges, a permit system for all wastewater discharges, stronger and more streamlined federal enforcement procedures tied into the effluent standards and permit systems, heavier fines, and provision for citizen legal action to enforce standards. More emphasis was placed on research, demonstration, river basin planning, and area-wide treatment systems.[350]

Several sections of the 1972 Clean Water Act authorized federal grants for water quality planning. Section 201 pertained to facilities planning at the local level, Section 208 to area-wide planning on a regional basis, and Section 303(e) to river basin-wide

planning. In May 1974 the Triangle J Council of Governments was awarded a grant to conduct the nation's first 208 area-wide water quality management plan. This was to serve as a "pilot project" for similar planning efforts elsewhere.[351]

The 1972 amendments also placed heavier stress on matching federal grants for the construction of publicly owned waste treatment plants. The maximum federal contribution was raised from 55 to 75 percent of costs, and the amendments authorized appropriations up to $5 billion for fiscal year 1973, $6 billion for 1974, and $7 billion for 1975. These authorizations were the principal reason for the President's veto.[352]

Influence of 1972 Federal Act on State Program

The influence of federal water pollution control legislation was increasingly felt in North Carolina and other states. At its July 1972 meeting, the Water and Air Quality Control Committee was advised by staff that EPA had adopted tentative guidelines to establish effluent limitations for certain types of industry and had requested the state to assist in contacting industries to obtain voluntary compliance. The state attorney general took the position that "North Carolina does not have statutory authority to require effluent standards." A resolution was adopted by the committee that "we cooperate with EPA in these activities."[353]

In response to the federal legislation, the General Assembly authorized and directed the Board of Water and Air Resources to develop and administer effluent standards and limitations as necessary to "prohibit, abate, or control water pollution." By subsequent legislation in 1973,[354] the board was directed to "be guided by the same considerations and criteria set forth . . . in federal law." Such effluent standards and limitations were to be "no more restrictive than the most nearly applicable federal effluent standards and limitations."[355]

As a result of its review of plans for the proposed Harris Nuclear Power Plant in Wake County, the EPA advised the state in 1973 that an exception to water quality standards was not justified and was not consistent with the goals and requirements of the Clean Water Act. "All streams," said the EPA, "should be classified at a minimum level of class 'C' for fish and wildlife propagation and secondary contact recreation."[356]

The Clean Water Act provided for the delegation of responsibility for the administration of National Pollutant Discharge Elimination System (NPDES) permits to the states. In late 1974, state officials met with EPA officials in Washington to discuss delegation to North Carolina. The federal agency challenged eight "deficiencies" in state law[357] which were corrected by the 1975 General Assembly.[358] Environmental Management Commission (EMC)—successor to the Board of Water and Air Resources—regulations were then modified to incorporate federal requirements[359] and delegation was approved by EPA on October 19, 1975,[360] thus moving to a single federal/state permit system.

The federal requirement under the 1972 act that area-wide waste treatment management plans be developed by 1978 dictated a shift in planning emphasis from point source management to "all source management." Area-wide "208" planning was being carried out by designated local or regional agencies in two areas. Responsibility for the remaining planning fell to the state.[361]

In January 1976, the Environmental Management Commission adopted the federal effluent limitations by reference, thus evidencing further the influence of federal legislation on the state program. There were, by this time, instances of mounting irritation over the steady increase in federal influence. The director of the new Division of Environmental Management (DEM) advised the commission of numerous instances of "parallel enforcement actions by the EPA" on top of state actions. The director recommended that state reports no longer be routinely sent to the EPA. The state would thereafter only respond to federal requests for information. Commission approval was forthcoming.[362]

National Water Commission

The National Water Commission, created by the National Water Commission Act of 1968 to review national water resources problems, submitted its report to the President and the Congress on June 15, 1973.[363] The commission concluded that the development of the nation had exacted a high price in "the deteriorating quality of its water resources." Surface waters were said to have been heavily damaged by the uncontrolled discharge of waste; by polluted runoff from urban, agricultural, and mining

development; and by accelerated erosion and sedimentation. The commission reported that the condition of many of the nation's waters was a "national disgrace." "For the next decade," it said, "the primary national water resource priority should shift from water development to the achievement of high standards of water quality." A new ethic of water conservation and reuse to replace the history of exponential growth in the production of waste was recommended. It concluded that the nation could no longer safely rely on "free waste disposal" to achieve its national development goals.

The National Water Commission took the position that the national water quality goal should be the achievement of water quality standards which would assure that public water bodies are suitable to accommodate the highest use society wishes to make of them. To be effective, the standards would have to be coupled with a rigorously enforced permit system, including a prohibition of the discharge of toxic substances. While acknowledging that the Clean Water Act had made "landmark improvements in the Nation's attack on water pollution," the commission felt that the Congress had made a fundamental error in establishing as a national goal the elimination of all pollutant discharges by 1985. The goal, in the commission's view, had strong emotional appeal, but was impractical and unattainable. Experience since that time appears to support that judgment. Similarly, the act's requirement of "best available treatment" by 1983 was seen as prohibitively costly and unachievable. The commission espoused the "polluter-pay" principal as an incentive to reduce pollution. This implied a system of user charges in combination with regulation to place the cost of water quality maintenance on those who occasion the costs.

The commission also suggested full funding of the federal construction grants program for 10 years, when it would be terminated upon achievement of the national cleanup goal. It proposed an increase in research and development on alternative methods of waste treatment and disposal, productive use of nutrient values, the utility of land disposal, and control of nonpoint pollution sources. The commission concluded that construction grants should be contingent upon local adoption of service charges sufficient to recover full capital and operation costs once the grant program was terminated. An expanded planning program for regional water quality management for

which the federal government would pick up 50 percent of the cost, and periodic national program evaluations were high on the commission's list of recommendations. It encouraged a national permit program that would provide maximum opportunity for state assumption of responsibility, a national stream surveillance system under the direction of the U. S. Geological Survey, cost effectiveness studies, improved training and education programs, and greater attention to the management of estuarine water quality.

National Commission on Water Quality

The Clean Water Act included provisions for a National Commission on Water Quality to evaluate the long-term implications of that legislation. After an intensive, two and one-half year study at a cost of $17 million, the commission reported its findings to the Congress on March 18, 1976.[364] The commission was encouraged by water quality improvement in many areas of the country but found the program behind schedule in terms of national objectives. Among causes of delay were "the intricacy of the law, bureaucratic complexities, extensive litigation, and the impoundment of construction grants funds." It acknowledged that the original deadlines established by the act could not be met and concluded that there was "still a major lack of information."

Among the commission's recommendations were adjustments in compliance dates and alterations in implementing strategy to give the program greater flexibility and stability, decentralization of regulatory and administrative functions by selective certification of the states, stabilization of funding, and redefinition of the goal of the elimination of pollution discharges as one stressing conservation and reuse of resources.

1977 Amendments to the Federal Water Pollution Control Act

On December 8, 1977, President Carter signed the 1977 amendments to the Federal Water Pollution Control Act. This was the product of a three-year effort by Congress to enact comprehensive mid-course revisions to the 1972 legislation. The President praised the amendments, saying they emphasized the importance of controlling toxic pollutants, included a long-term funding authorization for the municipal sewage

treatment construction grants program, and reaffirmed the "national commitment to protect the quality of our waters."[365]

The amended effluent control measures were intended to encourage industry to experiment with wastewater and sludge treatment. Generally, industry would be required to follow best management practices when storing and utilizing toxic materials. Rigid pretreatment standards were to be applied to industrial effluent discharges into municipal sewage treatment systems. New deadlines required industry to control conventional pollutants by July 1, 1984, and nonconventional pollutants (nontoxic organic, chemical or thermal pollution) by July 1, 1987. The deadline for the control of toxic pollutants, the main focus of the new effluent controls, was July 1, 1984.[366]

Sixty-five toxic pollutants were listed by the EPA on January 31, 1978. These were to serve as a basis for developing effluent limitations. The pollutants were those specified in the 1976 *Natural Resources Defense Council v. Train* consent decree and subsequently adopted in the 1977 amendments.[367]

There was a new emphasis on innovation in wastewater treatment with fund set-asides for this purpose. This was accompanied by increased emphasis on cost effectiveness in pollution control. Also stressed was the need for a more stringent water conservation and reuse policy to reduce the cost of water supply and wastewater treatment.[368]

XX CHALLENGES OF THE 1970's

To a large extent, the 1972 Clean Water Act cast the mold for the North Carolina program from 1972 on. The centralizing effect of that legislation was partially offset by delegations of authority for administration of elements of the federal program to state government. Nevertheless, the underlying goals, objectives, and time tables were set at the federal level. State law and regulations were modified to encompass federal requirements. The exercise of federal oversight left little doubt as to the preeminence of federal law.

New State Legislation

1973 was an exceptional year for enactment of water pollution control legislation by the General Assembly. In addition to new legislation to reconcile state law with the 1972 Clean Water Act, the state took a firm stand against subsurface waste disposal by prohibiting the discharge of any wastes to groundwaters by means of wells. The discharge of wastes, including thermal discharges, to open waters of the Atlantic Ocean were prohibited "except where such discharges are permitted pursuant to regulations duly adopted by the Board of Water and Air Resources." The General Assembly clarified and extended enforcement tools and procedures and judicial review, and dealt further with construction grants, animal wastes, and oil pollution. It authorized the issuance of revenue bonds to finance industrial pollution control facilities and created the Environmental Management Commission to replace the Board of Water and Air Resources. The new commission was to operate through a Division of Environmental Management (DEM) within the Department of Natural Resources and Community Development.

In recognition of the fact that sedimentation of surface waters constituted "a major problem," the General Assembly broke new ground with enactment of the Sedimentation Pollution Control Act.[369]

The year 1975 was another busy period for water pollution control legislation. In addition to an act to authorize the state to administer the federal NPDES permit program, the General Assembly passed legislation to authorize creation of pollution control authorities to issue revenue bonds to finance pollution control projects for industry and public utilities. There was also legislation pertaining to cleanup of oil spills, relatively minor changes to the Sedimentation Pollution Control Act, permit fees, and powers of the Environmental Management Commission. While the authorization for permit fees "to offset anticipated reduction in Federal funds" was a step in the right direction, the $100 ceiling was hardly sufficient to cover the costs involved. Efforts to coordinate state and federal programs resulted in an authorization for the commission to accept evidence of compliance with corresponding federal law in lieu of state permits.[370]

But, overlap was not restricted to the state/federal relationship. There continued to be confusion as to the relative responsibilities of health and environmental agencies with respect to small wastewater discharges. There was also evidence of overlap in permitting authority between the Environmental Management Commission and Coastal Area Management Commissions.[371]

Water pollution control was also the subject of numerous bills in the 1979 session of the General Assembly. Legislation was passed to reconcile state law with federal law in the areas of oil pollution, hazardous substance control, water quality standards, classifications, and NPDES discharge permits. An Act to Revise Water Quality Standards authorized downgrading of water quality standards under conditions where stream conditions and economics supported such action. Standards could not, however, be less stringent than those promulgated by EPA or endanger human health or safety. The Act to Control the Disposal of Toxic Substances established a Toxic Substance Task Force to respond to incidents involving toxic or hazardous substances. The dumping of toxic substances was prohibited except when in compliance with state law, regulation, or permit. Substantial criminal penalties were authorized.[372]

Sedimentation Control

Sediment has often been cited as the most serious pollutant in North Carolina. After many months of debate and interest group prompting, the General Assembly had adopted the Sedimentation Pollution Control Act of 1973. A new program was authorized under the direction of a Sedimentation Control Commission within the Department of Natural and Economic Resources. The commission had exclusive jurisdiction over land-disturbing activities conducted by federal, state, and local governments or persons having power of eminent domain. It also had exclusive jurisdiction over activities licensed by the United States or financed in whole or in part by the state or the United States. There was authority to delegate jurisdiction to other state agencies. State and local governments had concurrent jurisdiction over land disturbing activities. The act imposed three mandatory standards related to buffer zones, slopes, and ground cover. Local erosion control programs could be established upon approval by the commission. While the legislation provided for modest civil penalties and injunctive relief, experience was to prove that enforcement provisions would need to be strengthened. Agricultural, silvicultural, and mining activities were excluded.[373] Clarifying amendments were enacted the same year.[374]

Mining Wastes

Pollution from mining wastes arose from both the mining operations and processes. Ore concentration was an important source of slime wastes from phosphate mining in the coastal region to minerals mining in the mountains. Sediment discharges from mining sites, particularly sand and gravel operations, were of continuing concern. One of the major difficulties was to condition the issuance of mining permits on pollution control measures. Enactment of the Mining Act of 1971 was intended to resolve this problem.

The act stated that "no mining shall be carried on in the State unless plans for such mining include reasonable provisions for the protection of the surrounding environment." Before deciding whether to grant a new permit, state agencies were to circulate the application for review and comment. Permits could be denied if the mining

operation would adversely affect wildlife or freshwater, estuarine, or marine fisheries, or violate water quality standards. Performance bonds were required. Applicants were to describe water and wastewater handling, and location and nature of discharges. Erosion and sediment control measures to prevent off-site sedimentation were also to be described. Acid mine drainage was to be controlled. Procedures were adopted for referral of permit applications to the state's Division of Environmental Management for review and comment with respect to the control of water pollution.[375]

Water Quality Standards

Triennial reviews of North Carolina's water quality standards were now required under Section 303 of the Clean Water Act. By May 1978, the Division of Environmental Management reported that it had been studying proposed revisions for the preceding one and one-half years and was ready to go to public hearings. This would be only the second time that the standards had been reviewed in their entirety since 1953. The principal proposed changes involved mixing zones, toxic chemicals, and nutrient standards.[376]

The EMC later approved revisions to water quality standards to provide schools and other small dischargers of domestic wastewater the opportunity to request an exception on the basis of economic hardship associated with required stringent levels of treatment.[377]

By 1979, there were still no regulations to control nitrogen and phosphorus levels in point and nonpoint sources of pollution and the staff asked the commission to authorize hearings for standards to meet this need. Actions on pending applications for permits and construction grants were to be held in obeyance pending rule-making.[378] At its May 1979 meeting, the commission approved a supplemental Nutrient-Sensitive Water Classification for surface waters experiencing excessive algal or other aquatic plant growth. The first application was to the Chowan River.[379]

An EPA comment that the state's antidegradation statement lacked an adequate mechanism to prevent the degradation of high quality waters prompted the initiation of a study of new water classifications. This included "a special use classification for the designation of waters considered to be of exceptional recreational or ecological

significance" and improved water supply classifications to reflect a wider range of conditions than could be handled by the two classifications then in force.[380]

Toxic Pollutants

While the Clean Water Act called for the regulation of toxics, little attention was given to toxic substances by the EPA in effluent limitations and permitting until the aforementioned litigation initiated by the Natural Resources Defense Council in 1976 brought forth a list of 126 "priority pollutants" to be regulated. Progress in the complex area of the regulation of toxics had been slow and was yet to fully mature—mainly because of the vast and ever-changing number of toxic substances, relatively unknown health effects, and risk factors.[381]

The State Program Plan for fiscal year 1976–77 had more to say about toxics. Referring to the "large number of new organic chemicals" introduced to surface waters, the plan stated that the effects were unknown and "monitoring for them with present manpower and facility resources is an impossible task." The Division of Environmental Management concluded that there was a need to establish an analytical capability to monitor new organic chemicals and determine their fate in the aquatic environment. It was of the opinion that EPA should take the lead in providing analytical support since it was not "practical or economical" for the individual states to maintain and operate the necessary and complex analytical equipment.[382]

Toxic substances in wastewater were to receive increased attention in the years to come. The earlier pollution control program had emphasized conventional pollutants normally associated with domestic sewage. Staff reported that "we are just beginning to recognize nutrients as a pollutant." With respect to toxics, it said that its program fell short of providing adequate control of toxic materials. Permits were being issued for the discharge of industrial effluents that in many cases "contained materials that we do not know about, are unable to control, and . . . may be more harmful than those constituents that we are limiting in . . . permits." Legislative constraints prohibited effluent limitations more restrictive than promulgated by EPA unless needed to protect water quality standards. Staff concluded that "within the limitations imposed by statutory

requirements and manpower availability, it was addressing the control of toxic materials." The EMC adopted a motion requiring staff in its report on proposed reclassifications to A-II water supply waters to include information on the composition of upstream industrial wastewater discharges in addition to a determination as to whether these waters met existing standards. Staff was also asked to review existing A-II waters to determine whether corrective steps needed to be taken and to make proposals for amendment of state standards to include the "priority pollutants" cited by EPA.[383]

Agricultural Wastes

Pollution from agricultural animal wastes was receiving closer scrutiny and agricultural interests were requesting an increased role in its regulation. As a result, the 1973 General Assembly established an Advisory Committee Concerning Animal Waste Pollution. Its purpose was to assist and advise in the development of criteria, standards, policies, rules, and regulations for animal waste disposal. The committee was authorized to examine matters on its own initiative as well as by referral from the Environmental Management Commission.[384]

The advisory committee completed its study in early 1975 and advised that the "results indicate certain animal waste management practices can have the potential to pollute water, especially cattle and swine, certain turkey operations, and the discharge from milking parlors. The extent to which the surface waters of our State are being polluted by these waste management practices is not known at this time," it reported. So the advisory committee considered it to be "unwise to make recommendations now." It did recommend a stream study to determine the quality of water in relation to the types of waste management systems employed. The staff was directed to proceed with the implementation of the advisory committee's recommendations.[385]

Nonpoint Sources of Pollution

The importance of nonpoint pollution received additional emphasis in late 1977 with publication of a report to the Congress from the Comptroller General of the United States. The report concluded that nonpoint sources of water pollution were producing more than half of the pollutants entering the nation's waterways. Efforts to

control nonpoint sources of pollution were viewed as "minimal." "If not controlled," it was said, "nonpoint pollution will prevent attainment of national water quality goals and will continue to grow in significance as point sources of pollution . . . are brought under control." The report stated that the best way to control nonpoint pollution is to prevent its reaching surface waters through proper management of the land. It encouraged the EPA to increase data collection, elicit more help from other federal agencies, and develop legislative proposals for additional resources.[386]

Area-wide water quality planning under Section 208 of the 1972 amendments to the Federal Water Pollution Control Act encompassed both point and nonpoint sources of pollution. With respect to nonpoint sources, attention was focused on agriculture, silviculture, mining, construction, solid waste disposal, and urban development.[387]

Oil Pollution

Oil pollution has long been of concern to North Carolina. Yet, specific legislation to cope with the problem was slow in coming. It was in 1973 when the General Assembly adopted its first Oil Pollution Control Act. There was to be no effort to exercise jurisdiction over matters under the jurisdiction of the federal government, but rather "to support and complement applicable provisions of the Federal Water Pollution Control Act." It became unlawful for any person to discharge oil into any waters, tidal flats, beaches, or lands—or into any sewer or surface water drain without a permit. There were exceptions such as "acts of God," negligence on the part of federal or state governments, and so forth. An Oil Pollution Protection Fund was established to defray clean-up expenses. Offenders were liable for damages in amounts necessary to restock and restore affected lands and waters.[388]

In 1979, an EMC member expressed "great concern over the recent oil spills along the coast and stated that no one appears to know where it comes from." He asked if anyone was watching over the events. Staff responded that the U.S. Coast Guard was responsible for oil spills along the coast and that there was a regional response team with a representative from the Division of Environmental Management. While the Coast Guard did not know the source of the oil, it suspected that it came

from international shipping channels outside their jurisdiction.[389] The Coast Guard later advised that it had an ongoing oil spill program at the coast involving three flights per week. It requested that more flights be authorized and that a special oil spill surveillance plan be provided. Float tests were being conducted to determine trajectory patterns. It also had undertaken an educational program for mariners. [390]

Coastal Problems

In the early 1970's, coastal development began to receive increased attention. The staff advised the Air and Water Quality Control Committee at its February meeting in 1973 that problems were emerging on the Outer Banks in the Nags Head-Kill Devil Hills-Kitty Hawk area due to "the extremely rapid increase" in apartments, condominiums, and other high density development and lack of space for wastewater treatment facilities.[391]

The problem of sewage disposal in Dare County had "become acute in the last 15 months" according to a report presented to the committee at its March 1973 meeting. The Dare County Water and Sewer Authority, chartered in 1971, was said to be considering the construction of a central system to serve the area. In the discussion, a committee member said that "the Board [W&AR] should take some positive action. If we are going to protect this part of the State, the Board will have to take drastic action as the people of the State are looking to somebody to save the beaches." Staff advised that "the beaches will be in a very hazardous situation unless definite steps are taken." It suggested that "perhaps, legislation should be enacted to provide the board [with] authority to delineate critical areas and to establish whatever control measures are necessary to prevent pollution."[392]

As noted earlier, the discharge of wastes to the open waters of the Atlantic Ocean over which the state had jurisdiction was prohibited by 1973 legislation "except where such discharges are permitted pursuant to regulations duly adopted by the Environmental Management Commission (formerly the Board of Water and Air Resources."[393] No ocean outfalls have ever been constructed.

The concept of pollution of coastal waters was broadened in 1976 to include the dilution of saline waters by fresh water drainage. Fresh water intrusion into Rose Bay at

the coast had resulted in the killing of oysters, and the new Environmental Management Commission requested a comprehensive investigation of this phenomena in Pamlico Sound.[394] A commercial fisherman alleged later that it was true that oyster beds were being wiped out in Rose Bay where fresh water was a problem. The Bay, he said, was "producing only 20 percent of the oysters it was producing five years ago." Similar problems with shrimp production were cited. However, a permit for the discharge of fresh water drainage from one corporate farm was approved after reported studies disclosed that the primary drainage through the Alligator and Scuppernong Rivers was not damaging existing saline conditions.[395]

By 1978, no public sewer systems had yet been provided on the barrier island where Surf City, Topsail Beach, and W. Onslow Beach were located. All service was provided by individual septic tanks, and sewage was reportedly "running on the ground" during rainy periods. This condition led to the closure of shellfish growing areas. There was an obvious need for a unified collection system. As to disposal, land application was said to be the "only reasonable solution."[396]

A year later, the staff advised the Environmental Management Commission that the problem of sewage disposal in the coastal region was a matter of increasing concern. The rapid development had begun to take on an urban character which increased interest in central collection and treatment systems which would discharge to the Atlantic Ocean rather than to the estuaries. A study, sponsored by the Coastal Plains Regional Commission and the N.C. Department of Administration and completed in 1979, concluded that effluent from a well-designed and operated secondary treatment plant could be discharged to the ocean without an adverse effect on fishery resources and recreation. This would allegedly permit the reopening of estuarine areas closed to shellfishing because of contamination by inadequately treated wastes.[397]

Management Plan for the Chowan River

The Chowan River was experiencing recurring problems with nutrient enrichment and algal blooms in 1976. The year 1972 was said to have been "the last time there has

been anything worse than now." A combination of discharges, stream flows, and temperature were thought to be responsible.

Expecting that any nitrogen contribution from the Farmers Chemical Company would be in the plant's effluent, DEM staff continued to assert that "there is no reason to believe there is any discharge of industrial wastes from the fertilizer plant" and that the plant "is still living up to its agreement."[398] It was not until 1976 that staff discovered that the wastes were seeping into the river from holding ponds. There was no discharge from the plant in the conventional sense. As one commission member said, "whatever we have done in the past is not good enough . . . we have got to get a handle on this situation and get the problem solved by whatever means it takes."[399] The problem with nuisance algal blooms in the Chowan River set the stage for increased attention to the need for nitrogen and phosphorus water quality standards.

The Division of Environmental Management's Chowan River Restoration Project (CHORE) proposal was released by Governor James B. Hunt, Jr. in the fall of 1979. CHORE was a large-scale, bi-state effort to halt algal blooms and restore the valuable and scenic lower Chowan River. The purposes were to halt all unnecessary and excessive nutrient inputs and to launch a joint effort by North Carolina and Virginia to develop a long-term Water Quality Management Plan that would ensure acceptable levels of water quality. An Immediate Action Plan involved reducing nutrient inputs to the river from source dischargers such as C. F. Industries and Union Camp Corporation, and from nonpoint runoff from farms and other sources. A Short-Term Water Quality Management Plan was to develop a management structure for bi-state planning and a schedule for implementation. It also included the development of a continuing planning process and monitoring system.[400]

Jordan Reservoir Controversy

The quality of water in the Jordan Reservoir to be allocated for public water supply became a matter of extended controversy. In early 1978, this prompted a request from the Environmental Management Commission to Governor Hunt for advice. He responded by saying that he did not want to intervene in the debate between opponents and proponents of using the reservoir for public water supply. A letter to him from his

Department of Natural and Economic Resources had recommended that the department should support the project as planned, strongly support all necessary point and nonpoint water pollution control measures necessary to maintain acceptable water quality, and ask for state management of recreational lands by 1980. Questions concerning the fitness of the reservoir as a source of water supply were to continue well into the next decade.[401]

Municipal Waste Treatment Plant Construction

The increasing reticence of the federal government to spend money appropriated by Congress for municipal wastewater treatment works construction in 1975 and 1976 began to raise the anxiety level of state officials as to continuity of the program. First, there was impoundment of appropriated funds and then failure to include funds in the proposed fiscal year 1977 budget. Prophetically, the division director told the EMC at its March 1976, meeting that, "we are heading to a period in time in which the total financial support of construction of publicly owned treatment facilities will become the full burden of local governments."[402] Subsequent cutbacks in appropriations bore out this prediction with state and local governments having to assume an increasing share of the burden.

In 1977, the General Assembly passed the second North Carolina Clean Water Bond Act which authorized the issuance of $230 million in bonds to provide grants to units of government for construction of wastewater collection systems and treatment works, and for water supply systems. The "problem of polluted and befouled lakes, streams and estuaries . . . already serious and destined to grow worse unless immediate action is taken" was said to be "a matter of vital concern" to the General Assembly. A major factor in the pollution problem was said to be "the discharge of waste to the waters of this State by municipalities and other population concentrations from wastewater systems that are inadequate, antiquated, and in some instances, nonexistent." Issuance of the bonds was approved by referendum later that year. The legislation placed great emphasis on use of the funds to match grants and loans from other sources. The federal construction grants program was obviously in mind when grants were limited to 25 percent of construction costs or 50 percent of the nonfederal share

unless a larger grant was needed to qualify for a federal grant or loan and other contingencies. A total of $112.5 million was to be allocated for pollution control.[403]

Conservation as a Water Quality Management Tool

The role of water conservation in reducing the cost of both water supply and wastewater treatment was considered in late 1977 and early 1978. As one state official put it, "we have an opportunity . . . in setting priority criteria for the approval of wastewater treatment plant [grants] to incorporate conservation measures in those systems for which the grants are to be used. It's an opportunity to help North Carolina grow, to grow cleanly, and reduce the per capita expenditures of waste treatment monies." The staff was directed to prepare a summary presentation of how to adjust the priority schedule to best incorporate water conservation measures. The commission then adopted a resolution endorsing the concept of water conservation as an alternative means of bringing water demand into balance with available supplies and reducing the cost of water supply and wastewater treatment systems. The resolution was widely circulated to state agencies, industry, builders, and others.[404]

A public hearing on proposed priority points for water conservation in the priority system for construction grants was held in 1978. One of the principal arguments against the proposal was that it would adversely affect communities that gave volume discounts to large water users—a practice long opposed by proponents of water conservation as a means of encouraging less efficient water use.[405]

A month later, the EMC adopted a resolution amending its rules covering state grants for wastewater treatment systems to include "bonus" priority points for applicants who practiced water conservation and to request the Building Code Council to revise the state plumbing code to require conservation water closets and shower heads. It recommended that all building construction be required to use such fixtures by January 1, 1980.[406]

Permits

A staff report on expired permits in 1973 prompted a member of the Water and Air Quality Control Committee (of the Board of Water and Air Resources, shortly to

become the Environmental Management Commission) to say that "the . . . information which has been made available . . . indicates the magnitude of the problems confronting the . . . Board." He noted that there were 188 expired permits out of a total of about 1000 and that "the holders of many of these show little interest in renewing them." There were some 20 cases where permit holders were in violation of water quality standards. "Our present situation," he said, "is intolerable." "The authority and obligation . . . to issue permits," he continued, "lies at the heart of the Board's power." He called for the board to establish once and for all "a firm, fixed, and fair enforcement procedure; a rule sensitive to equities, but adequate to the public task." He asked the board to demonstrate that it would no longer permit its "overworked staff to waste its time, and the taxpayers' money, pleading with various polluters and delinquents to obey the law."[407]

The transition from federal to state approval of NPDES wastewater discharge permits was not without its problems. The state had to submit certifications of its first 18 permits to EPA by July 1973, or the agency would assume that North Carolina had waived its rights to certify the permits.[408] By mid-1975, there were two wastewater discharge permits for every discharge—one state and one federal. The Federal Water Pollution Control Act provided for the delegation of the NPDES permit program to the states, and the 1975 session of the General Assembly amended state law to meet federal requirements toward that end.[409] Regulations of the Environmental Management Commission were then modified to incorporate federal requirements, thus moving to a single permit system.[410] Delegation of authority to administer federal NPDES permits was received from EPA on October 19, 1975.[411]

Federal legislation required compliance with specific effluent limitations and goals by July 1977 and these had to be written into permits. But, many dischargers were not able to meet the requirements, and special orders by consent were the mechanisms for implementation. If dischargers met the terms of the consent agreement, the state agreed not to initiate enforcement action.[412]

There was also "growing concern over inability of . . . many wastewater treatment works to meet effluent limits based on low stream flow conditions, especially during the

winter months." This precipitated an ever-increasing number of requests for the consideration of seasonal effluent limits. Winston-Salem, Raleigh, and Boone had submitted written requests for the change and there were reportedly "many verbal requests from several industries, particularly the pulp and paper industry." In response, the staff conducted a study to determine the feasibility of such limits. At that time, stream design flows and temperatures for the July–September period were used. They did "not take into consideration increased stream assimilative capacity during (the) rest of the year." It was the staff's opinion that the application of seasonal wasteload allocations could result in substantial economic savings. They were told to "go ahead and see what they come up with."[413]

The concept of seasonal effluent limitations was taken up again by the EMC in July 1979. Public hearings had been held and staff reported "overwhelming" support for the concept. There were calls for "flexibility in setting the seasons or time for applying the variations." Staff viewed this proposal as unworkable and recommended adoption without that provision. That was the version approved by the commission.[414]

The Water and Air Resources Management and Pollution Control Act of 1971 forbade "the discharge of any wastes into a waste disposal system . . . in excess of the capacity of the disposal system . . . or any wastes which the disposal system . . . cannot adequately treat." As might be expected, this resulted in considerable pressure on the Environmental Management Commission to authorize exceptions. But, as a staff member told the commission at its March 1979 meeting, "It [the law] doesn't say unless the Commission says it is alright. . . . It says if you can't treat the waste adequately, don't take it into the system." He went on to say that "a solution to this problem would be a very simple amendment . . . which would allow the Commission to make a decision . . . that under certain circumstances additional waste would be allowed in a system that is not adequate."[415] The law was amended later that year to authorize units of government to accept additional wastes upon a finding by the EMC that they had secured a grant or otherwise secured financing for the construction of adequate wastewater treatment facilities and that the additional waste would not result in any significant degradation of water quality.[416] While the amendment may have seemed reasonable at first glance, it

was to prove troublesome in practice from the standpoint of slippage and delays in compliance that would not have otherwise occurred.

The problems to be experienced with the 1979 legislation authorizing additional wastewater discharges to overtaxed sewerage systems are illustrated by the application from Asheboro in 1980 to permit the town to accept additional wastewater during the period of time necessary to complete an adequate treatment facility. The two conditions associated with EMC approval were that the town had received financing to plan or construct the facility and that the additional wastewater would not significantly affect the quality of receiving waters. The planning process could include almost any level of planning and not necessarily end up with construction of a planned facility. The term "significantly affect" permitted great latitude in decisions regarding resulting pollution during the interim between onset of planning and completed facility.[417] In consideration of the Asheboro application, one commission member said that "he didn't see how approval . . . could be justified when you will be putting one-quarter of a million gallons per day additional sewerage into a system which is already overloaded and the receiving stream [is] designated as water quality limited." Action was deferred but approved at the next meeting on a split vote.[418]

Enforcement

Fish kills continued to be the most visible and poignant evidence for needed enforcement actions. Their significance was all too clear when, in 1974, members of the Environmental Management Commission were told that fish kill reports were not mailed to members "due to being so voluminous."[419]

The question of civil penalties for fish kills was not seriously considered until 1975. While there had been legislative authority to assess civil penalties for water quality violations and oil spills, the practice had been to seek only the recovery of damages and costs of investigations. At the EMC's July 1975 meeting, the director of the Division of Environmental Management asked the commission for clarification of commission policy in this regard. The commission responded by adopting a motion that it "[did] not object to the Director's imposition of civil penalties for fish kills."[420] While that was hardly a

strong endorsement, it did represent a break from the past. This state policy was quite at odds with the federal policy reported to the Environmental Management Commission two years later. The federal policy on civil penalties called for fines to be based on economic benefits from noncompliance and uniformity by industrial category. State-imposed penalties were to be reviewed by an EPA panel and that agency would file suit for additional penalties if the state-assessed penalties did not equal those approved by the panel. EPA delegated its civil penalty authority to North Carolina, which was said to be one of a few states that had administrative authority to assess civil penalties. The staff's viewed the EPA policy as "too litigation oriented" and advised the commission to continue its policy of assessing civil penalties for routine cases and limiting litigation to cases where penalties could not be collected or where serious violations warranted immediate action. One commission member held the view that "EPA should be advised that if they are going to let the State run the program, let them run it; and, if not, to take the program back."[421]

Seemingly intractable industrial wastewater management problems often produced requests for variances of some sort. An example was the pickle industry which was unable to meet chloride standards. The Board of Water and Air Resources had no authority to issue variances in early 1973 and a motion was adopted requesting the Assistant Attorney General and staff to draft legislation to authorize the board to grant variances and to issue temporary permits until the EPA position had been determined and a possible variance procedure established. Both authorizations were granted by comprehensive state legislation later that year.

Lack of needed technology also suggested research and the Water Resources Research Institute responded with a study which led to recommendations on recycling and reuse of brines, reduction of wastes through closer management and better housekeeping, and improved treatment. The study exemplified the role of cooperative research involving state universities, industry, and the state regulatory agency.[422]

The requests for variances were sometimes accompanied by assertions that compliance would impose economic burdens which would lead to plant closures. While the Mead plant at Sylva was closed at the end of 1974 for economic reasons, these were

not claimed to be related to pollution abatement requirements.[423] Later, however, when plans were being made for reopening, the Jackson County Board of Commissioners requested a temporary permit to open with "increased pollution from the mill." It was portrayed as a question of "jobs and economy." An earlier request for a variance had been denied. Staff advised that the "EPA will not look favorably on issuing a variance under the circumstances." However, a motion that the plant should not be reopened until such time as a pollution controls were installed was defeated, and the prospective purchaser was told to request a public hearing on the county's request.[424]

An alternative to issuing a variance from water quality standards was to lower the standards to meet ambient water quality conditions. In 1979, the Environmental Management Commission reduced the dissolved oxygen standard for the lower two and one-half miles of Welch Creek (a tributary of the Roanoke River) from 5 to 0 milligrams per liter, concluding that the cost to the Weyerhaeuser Corporation of meeting the former standard exceeded benefits. This action was later overturned by EPA and the dissolved oxygen standard returned to 5 milligrams per liter.[425] Weyerhaeuser responded by withdrawing its request and agreed to proceed with a project to remove its discharge from Welch Creek and pipe it directly to the Roanoke River.[426]

A routine feature of the Environmental Management Commission's program was the consideration of appeals from violators for the remission of civil penalties imposed by the director of the Division of Environmental Management. Commission policy on remissions was still in the formative stage and uncertain. The two requests considered at the September 1975 meeting were from the Town of Kings Mountain and Broyhill Industries. Staff reported that the Kings Mountain plant had not been operated satisfactorily but that they now had the town's "attention" and recommended that the commission grant the request for remission of the civil penalty. Members expressed apprehension as to the policy implications and one asked, "Is it going to be our policy that we fine a town and then, when it complies, we give back the fine?" Staff responded that "we would hope not" but said there were extenuating circumstances in this case. After debate, with three members voting against, the commission remitted the $500 fine. Broyhill Industries had been fined $250 for failing to immediately notify the

state when it experienced an oil spill. The company explained that it had notified the Lenoir wastewater treatment plant, which treated its wastes, and it was the plant that failed to notify the state. The Broyhill fine was reduced to $50 because of "good faith," but the reporting procedure was deemed improper.[427]

Civil penalties were sometimes imposed but held in obeyance as leverage to gain compliance. An example was serious pollution of the Yadkin River caused by inadequately treated wastes from Winston-Salem. The city was charged with "accepting waste into the treatment system which it does not have the capability of treating and for violating water quality standards a total of 37 times since mid-1976." The discharge permit had been issued by the earlier Board of Water and Air Resources "over staff objections." The commission chairman asked the staff to notify the city that this problem was its number one priority, and "if the city doesn't make it theirs, the Commission will." This followed a discussion when another member observed that the commission "just can't seem to get the city's attention."[428] Early in 1977, Winston-Salem was fined $25,000 for violations of water quality standards for the Yadkin River. This was said to have caught the city's "attention," and the fine was to be imposed only in the case of noncompliance.[429]

Water Quality Planning Under Federal Act

Requirements of the 1972 Amendments to the Federal Water Pollution Control Act dominated state water quality planning. Completion of Section 201 area-wide waste treatment management plans became a routine requirement for federal construction grants. Section 208 required North Carolina to identify areas experiencing substantial water quality problems, designate organizations capable of developing area-wide water quality management plans, and initiate a continuing planning process within one year. Planning was to encompass both point and nonpoint sources of pollution. The governor was asked to identify planning areas and to designate regional planning agencies to carry out the program. These regional agencies were given one year after designation to initiate a continuing area wide waste treatment management planning process consistent with section 201. Federal funds were provided for this activity. Staff reported that the state planned to submit an outline of how it intended to undertake "208" planning, along

with a request for federal 75 percent matching funds by April 1976. A state-wide section 303(e) "continuing planning process . . . to provide water quality plans for all navigable waters" was undertaken. The plans were expected to be completed by mid-1976.[430]

As noted earlier, the Triangle J COG was the first agency in the state to be named by the governor to prepare a 208 area-wide water quality management plan and the first in the nation to be funded by EPA. The plan was completed in 1977 and approved by the Environmental Management Commission early in 1978.[431] The Land-of-Sky Council of Governments plan was completed and approved about one year later. This was followed in mid-1979 by the state's 208 Water Quality Management Plan for the remaining areas. The state-wide plan included plans for agriculture, construction, forestry, mining, on-site waste disposal, urban stormwater, and the two regional plans. While the state plan reported only seven percent of the state's streams as degraded, it acknowledged that "recent biological sampling has indicated that much more than seven percent of the . . . streams are biologically degraded due to pollution caused by muddy water and the discharge of toxics and municipal wastes." Some 22 percent of coastal waters were reported to be closed to shellfishing.

The State 208 Water Quality Management Plan was certified by the governor on May 30, 1979. Five months later, the EPA took early action on the agricultural element "to assure that the State would be eligible for funding under the Rural Clean Water Program authorized by Section 208(j) of the federal act." [432]

In reporting the Statewide 208 Water Quality Management Plan to the EMC the staff referred to the plan as "somewhat unique as it is addressing both point and nonpoint sources of pollution." The planning process was said to have started in June 1976, but it was well into 1977 before the necessary staff was on board because of a hiring freeze and the time required for "extensive negotiations" with other agencies involved in the planning process. Phase I was completed by September 1977, and five areas were selected for "intensive monitoring studies." The draft report was completed in January 1979 and taken to public hearings.[433]

Because of limited resources, only a restricted number of areas could be picked for studies leading up to the state-wide plan. The state was divided into five

physiographic regions, and all of the 128 sub-basins were ranked as to pollution potential. The highest ranking sub-basins were then chosen for detailed study. These were:

Wilmington—urban runoff and septic tanks

Wayne and Lenoir Counties—agriculture and landfills

Union and Anson Counties—agriculture and point sources

Winston-Salem—urban runoff, construction, groundwater, and landfills

Yancey and Avery Counties—silviculture and mining

In addition, there were specific activities directed toward biological monitoring and highway construction. Studies showed approximately seven percent of the streams to be degraded. Sixty-five percent of the erosion and sedimentation was estimated to come from cropland. This would have risen to 80 percent if pasture, farmsteads, and associated roads were included.[434]

The goal of the 208 Planning Section (of the Division of Environmental Management) was to identify actions necessary to restore and protect more than 40,000 miles of streams. Staff identified five general types of water quality problems: (1) oxygen depletion, (2) bacterial contamination, (3) toxic substances, (4) sediment, and (5) nutrient over-enrichment. Many technical questions were said to remain and the state plan was acknowledged to contain compromises.[435]

One of the principal outputs of the 208 program was best management practices (BMPs) for the control of nonpoint sources of pollution. While the staff viewed point source pollution as the state's "biggest water quality concern," it considered nonpoint sources to be a "very significant part of the water quality problem." While money was available for planning, there were no funds for implementation. Thus, the plan focused on voluntary actions for the adoption of the BMPs.[436]

River Basin Water Quality Management Plans

The Neuse River Basin Water Quality Management Plan was approved in August 1974. It was viewed as a policy document and official guide in carrying out the state's water pollution control program. This was followed by the White Oak River Basin Plan a year later. The plans identified sources and types of wastes discharged to streams,

evaluated the adequacy of water pollution control measures, and provided a time frame for corrective action.[437]

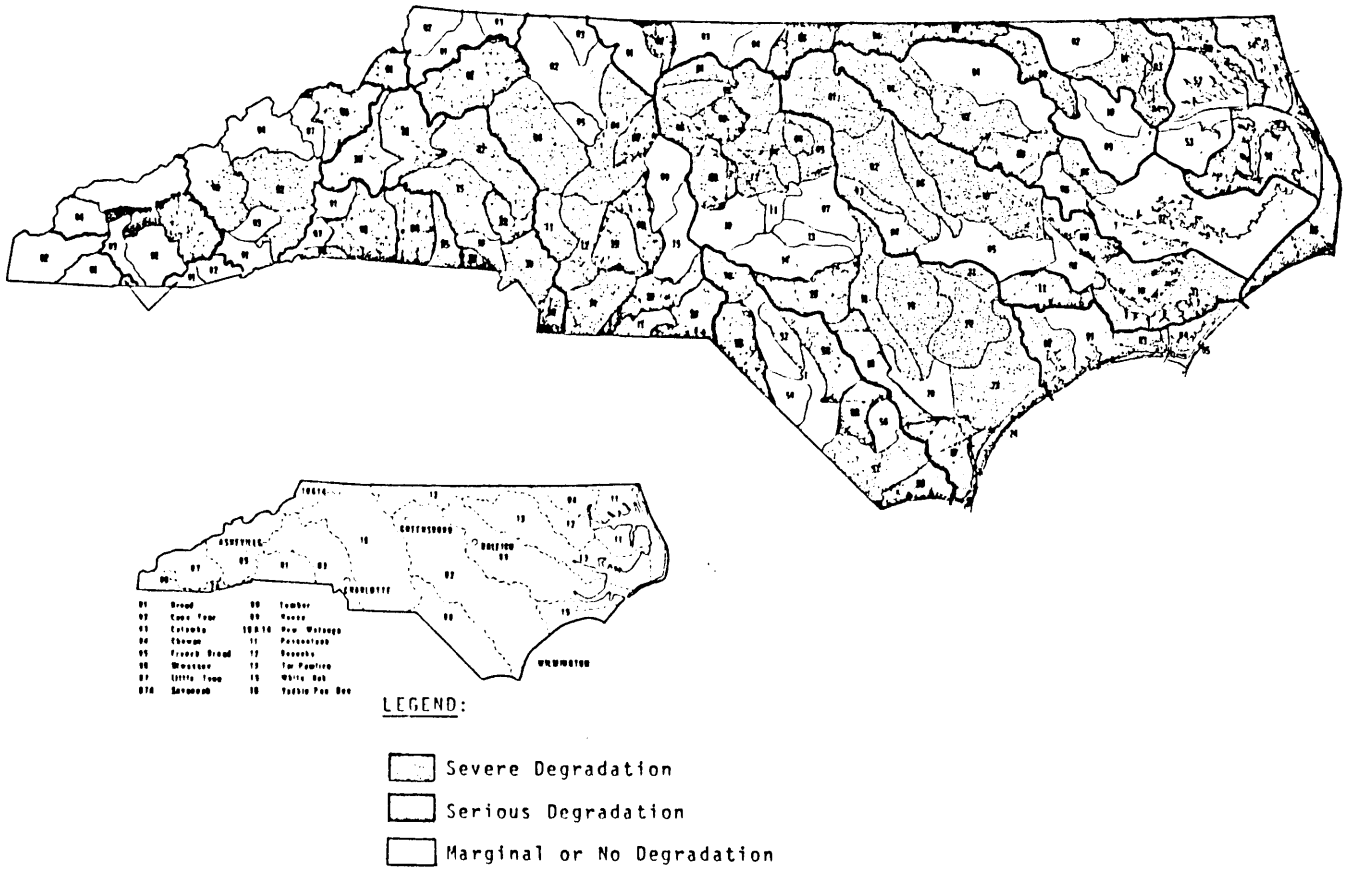
Approval of the Cape Fear River Basin Water Quality Management Plan by the Environmental Management Commission was accompanied by considerable debate as to the imposition of effluent limitations for nitrogen and phosphorus. One member stated that he "thought they should also consider [the two nutrients] down the road." He said, "if communities build plants to meet only dissolved oxygen standards downstream, what happens five or ten years from now when we become concerned about more nutrients in the water and eutrophication?" Continuing, he asked, "Should we be looking at these things now before . . . communities build new plants?" A resolution was approved adopting the Cape Fear Plan, excluding an effluent limitation for phosphorus. However, the commission asked that "cost-effective analyses" for facilities incorporate the cost of reducing phosphorus to 1.0 milligrams per liter in the effluent from all publicly owned wastewater treatment works which treat 100,000 gallons per day or more wastewater. The Roanoke River Basin Plan was also approved at this time.[438]

Water Quality Problems and Trends

In its fiscal year 1974–1975 Program Plan, submitted to the EPA in late 1974, the Division of Environmental Management reported that the state's primary water quality problems were caused by point source discharges of sewage and industrial wastes. There was an increased awareness that nonpoint pollution from land runoff could result in closures of shellfish growing areas, excessive stream turbidity, and suspended solids. Relatively high concentrations of trace metals in certain waters along with oil and hazardous substances from spills and discharges were acknowledged. There was no mention of synthetic organic chemicals as a generic group of pollutants requiring regulation. Areas of water quality degradation reported in 1975 are shown in Figure 5.[439]

By 1979, the state's Division of Environmental Management reported substantial gains in the control of pollution over the preceding thirty years. While the total quantity of degradable organics (BOD_5) in raw wastes had more than doubled, the waste discharged to streams had been cut in half because of improvements in wastewater

Figure 5. Areas of Water Quality Degradation, 1975



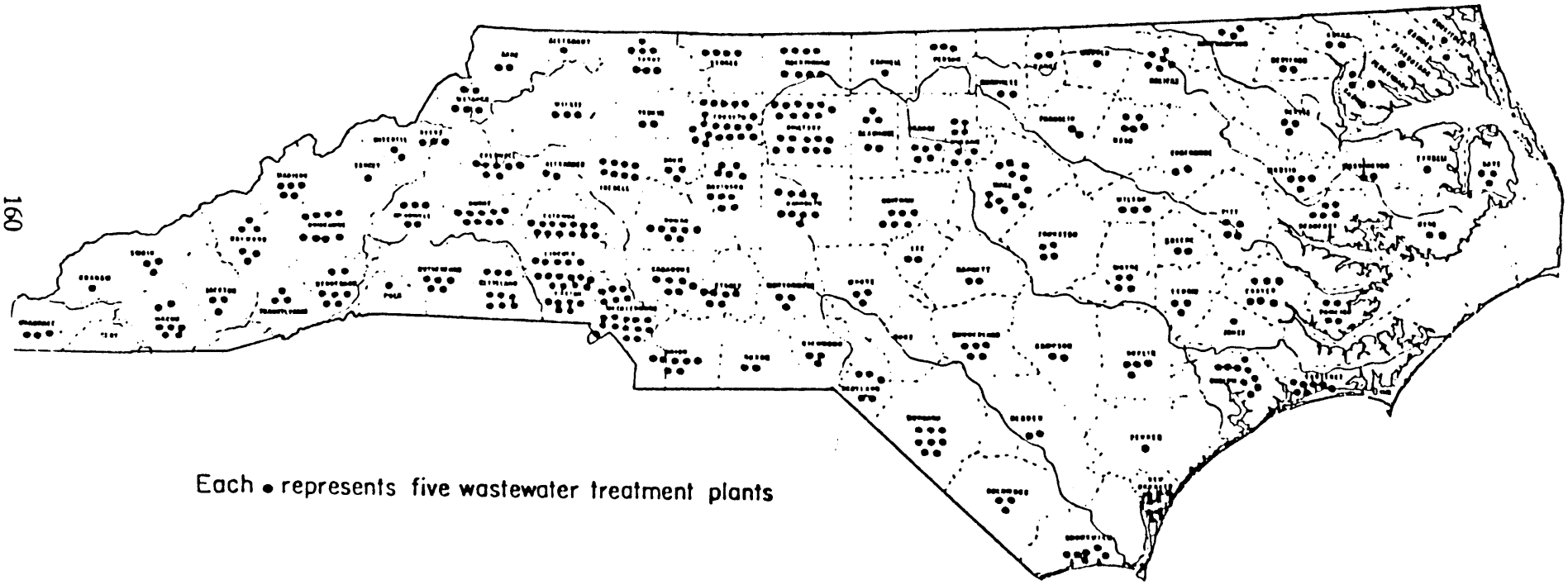
Source: N.C. Division of Environmental Management, 305(b) Report 1975. See footnote 439.

treatment. Thirty years before, one-third of the wastewater discharged was untreated and the remainder received only primary treatment. Virtually all municipalities provided secondary treatment by 1979. Yet, the question of toxic residuals was still largely unanswered. As noted in a staff report: "Countless new products in categories like organic and inorganic chemicals, pesticides, and plastics . . . pose a challenge to designers of treatment facilities and demand special attention from water quality control authorities." Uncertainties as to toxicity, bioaccumulation, and implications for water quality were concerns to be addressed "when a new waste or pollutant is created in an industrial process."[440]

Sixty-five percent of the state's point sources of pollution were located in the Piedmont region where a major portion of the population was located. Most of the developed area lay along ridges rather than the larger streams, and many waste discharges went to small tributaries. Nutrient removal from wastewater discharges was not yet required, and eutrophication of reservoirs along major streams was increasingly recognized as a problem to be dealt with. Then, as more recently, urban sprawl had brought a multitude of small private sewerage systems with their operational and maintenance problems. About 70 percent of the 1,070 waste treatment facilities in violation of discharge permits were located in the Piedmont Region. Point source distribution in North Carolina in 1978 is shown by Figure 6.[441]

Biological monitoring over a period of six months was reported in 1980 to have disclosed severely degraded biological life in urban streams of Charlotte, Asheville, Winston-Salem, and Raleigh. Significant amounts of toxic materials were found in the Haw and Rocky Rivers. Selenium discharged from the ashponds of coal-fired power plants had caused a severe water quality problem in Belews Creek near Winston-Salem. Nutrient-related water quality problems were identified in Kerr and High Rock Lakes and continued in the Chowan River. Early signs of nutrient problems in the Pamlico and Neuse River estuaries were documented. There was concern over potential nutrient problems in the pending Falls of the Neuse and Jordan reservoirs. Bacterial contamination of shellfish growing areas and groundwater was acknowledged, but the extent was unknown.[442]

Figure 6. Point Sources of Pollution, 1978



Source: N.C. Division of Environmental Management, Draft Water Quality Management Plan for Point Sources 1979. See footnote 440.

Research

The fiscal year 1976–77 Program Plan called for research on the relationship between pollution and fish disease and aquatic plant growth in coastal areas. It also cited the need for intensified monitoring of coliform bacteria in coastal waters, continuation of state-wide monitoring of mercury in fish tissue, and research on the effects of large-scale farming on water quality in eastern North Carolina.[443]

In 1977, the Environmental Management Commission asked the Water Resources Research Institute for presentations on nutrient models for the Pamlico River estuary and for assessment of the effects of stream channelization on water quality and bottom land and swamp forest ecosystems.[444] The institute was an active participant in the Chowan River investigations. Since 1972, it had sponsored research on estimation of stream flows, role of aquatic plants in nutrient recycling, algal growth response to changing nutrient levels, seasonal limiting factors, and water quality management models. The research was closely coordinated with state government activities. The Virginia Water Resources Research Center participated in mathematical modeling studies of the upper and lower Chowan River.[445]

There were six coordinated components of the Chowan River studies. These included a stream flow model developed by the U. S. Geological Survey, intensive sampling by the Division of Environmental Management, and four series of university research investigations.[446]

XXI DEMANDS OF THE 1980'S

Each passing year brought increasing intensity and complexity to water pollution control in North Carolina. The 1980's were marked by sharp decreases in federal funding which had grown incrementally since the first federal water pollution control act in 1948. There were more people, more industry, and the need to cope with such newly recognized problems as toxic pollutants and nonpoint source pollution. The 1980's was a challenging decade for the protection and enhancement of water quality in North Carolina.

Retrenchment of the Federal Program

In early 1981, the Environmental Management Commission was advised by the Environmental Protection Agency that "dramatic changes [were] about to happen in Washington, D. C. [relative to] our environmental program." These were said to be on the "downside." The Federal Construction Grants Program was to be trimmed. There was rumor of termination of the area-wide 208 planning program a year earlier than scheduled. Many of the state's planning studies had been funded by that program. The trend seemed "to be a call to the states to take the leadership in environmental programs." The EMC was told that "this is a time of challenge to the Division of Environmental Management in regard to its financial resources."[447]

More Problems With Sediment Control

While the intent of the N. C. Sedimentation Pollution Control Act of 1973 was to provide a basis for regulating sediment pollution arising from construction activity, there were a number of weaknesses in the legislation which became increasingly apparent in the 1980's. These included failure to require erosion control plans in advance of land disturbance, use of the silviculture exception by some developers to avoid regulation under the guise of timber harvest, and other deficiencies. Legislative

amendments in 1988 prohibited land-disturbing activity under the act unless an erosion control plan had been approved in advance by the Sedimentation Control Commission (SCC) or local governments operating under a delegation of authority from the commission. Since there had also been problems in getting compliance from out-of-state operators, the amendments required designation of a North Carolina agent to act on behalf of the developer with respect to compliance with SCC rules.[448]

The General Assembly approved legislation in 1989 which authorized the SCC and local governments to consider the performance history of an applicant submitting an erosion control plan, to provide for minimum setbacks for land-disturbing activity along certain trout waters, and to increase the civil penalties for violations. The earlier maximum civil penalty of $100 per day was increased to $500 per day.[449] Whether the increase was sufficient to bring prompt compliance remains to be demonstrated. The prior maximum was so low as to be considered a cost of doing business and had little deterring effect.

Major advances in environmental programs have, all too often, been launched on the wings of crisis. Sedimentation control was no exception. The September 1988 meeting of the EMC was the occasion for questions about alleged serious pollution of Laurel Creek in the New River Basin and Mitchell River in the Yadkin River Basin by sediment from the "Olde Beau" development in Allegheny County. Mitchell River had been classified as outstanding resource waters (ORW) on July 14, 1988, and its near ruinous pollution from sediment came as bad news, indeed. As mentioned earlier, silviculture activities—including logging—had been exempt under the Sedimentation Pollution Control Act and the initial clearing for the "Old Beau" site was said to be for that purpose.

There was the likelihood that sediment pollution could also be controlled under water pollution control legislation with an appropriate turbidity standard. The staff was asked to bring a recommendation to the EMC for a change in rules with respect to turbidity limits in the cases of sediment violations.[450] A turbidity standard went into effect on October 1, 1989. The much higher ceilings on civil penalties under water pollution

control legislation also argued for a greater role for the EMC with respect to sediment pollution.

Increasing Concern Over Toxics

Toxic substances in wastewater received increasing attention in the 1980's. The earlier water pollution control program tended to focus on conventional pollutants normally associated with domestic sewage and readily degradable organic wastes from industry. In 1980, the staff reported that its program for toxics "fell short of providing adequate control of toxic materials." Permits were being issued for the discharge of industrial effluents that in many cases contained materials the staff did not know about and was unable to control, which might have been more harmful that those constituents limited by permits. Legislative constraints prohibited effluent limitations more restrictive than promulgated by EPA unless needed to protect water quality standards. Staff concluded that "within the limitations imposed by statutory requirements and manpower availability . . . it was addressing the control of toxic materials." The commission adopted a motion requiring staff in its report on proposed reclassifications for water supply use to include information on the composition of upstream industrial wastewater discharges in addition to a determination as to whether these waters met prevailing standards. It also asked for the review of A-II "run of the river" waters to determine whether additional corrective steps needed to be taken.[451]

Excessive levels of mercury in the Abbotts Creek arm of High Rock lake were reported in July 1981. The Mallory Battery Plant of the Duracell Corporation was said to be a "significant contributor." Mercury was found in excess of limits set by ambient water quality standards and in "unacceptable concentrations" in predator fish. Emergency regulations of the Wildlife Resources Commission prohibited commercial fishing and the Division of Health Services issued an advisory for people not to consume fish from those waters. Cleanup operations were launched and enforcement actions considered.[452]

In 1982, the aquatic toxicology effluent testing program of the Division of Environmental Management found a high level of toxicity to test organisms in the effluent from a sock manufacturing plant. Further investigation disclosed a high level of

toxicity associated with the discharge of some hosiery processing effluents. The manufacturer usually received preknitted socks, washed them in various chemical baths and packaged them for distribution. Investigators reported that the frequent use of bacteriostats and fungistats (biocides) may have interfered with the waste treatment process resulting in biocide pass-through to receiving streams. The biocides were applied to the socks as a means of controlling bacterial growth during consumer use. The widespread use of these compounds was cause for alarm. Investigative results clearly established the "extreme toxicity" of products containing organotins as an active ingredient. This led to the conclusion that products containing organotins should not be used in processes which would result in a discharge to wastewater treatment facilities or to receiving waters.[453]

An Interagency Biocide Task Force unanimously voted on March 13, 1984, to recommend "that actions be initiated to prohibit the discharge of organotin compounds in any amount in the waters of North Carolina." The findings in the task force report and earlier DEM report were said to be "alarming." DEM had identified more than 366 biocide products used by industry. EPA had been advised and agreed with state concerns, but was "apprehensive about pursuing an issue so enormous and requiring such extensive efforts to fully address." The task force felt that the most effective procedure was to approach the issue on the basis of the active ingredients contained in biocide products. The EMC adopted the task force recommendations on April 12, 1984.[454]

Toxicity testing of wastewater effluents was initiated on a "significant scale in 1983." Other toxics monitoring had been limited primarily to metals and some organics analysis of fish tissue. Approximately 1400 stream miles were impacted by metals or ammonia toxicity in 1983. Two creeks in the Yadkin River Basin were targeted for fish consumption advisories due to mercury contamination, and two cooling water reservoirs for coal-fired power plants were found to have elevated selenium levels resulting in declining fish populations. No toxic problems were reported with respect to coastal or public water supply waters. It should be noted, however, that very little data on synthetic organic chemicals were being collected at that time.[455]

The discharge of toxic compounds to state waters continued to be "an area of utmost concern and priority." Increased toxics evaluation capabilities reportedly enabled the DEM to more effectively address the toxic properties of wastewater effluents. A mobile bioassay toxicity unit and an effluent screening test procedure had added to the division's monitoring and investigative capacity. Procedures used for establishing water quality permit limitations were to be refined and compliance monitoring was to be directed toward problem facilities as a first priority.[456]

Pulp and Paper Mill Wastes

Pollution of the Pigeon River from pulp and paper mill wastes discharged by the Champion Paper Company at Canton continued to attract attention through the 1980's. A 1980 investigation disclosed that up to 90 percent of the Pigeon River flow was diverted through the mill under low flow conditions. Carried out under an agreement between the states of Tennessee and North Carolina, TVA, and EPA, the study concluded that the Pigeon River was seriously affected by the Champion discharge. The effluent was characterized by high levels of color, dissolved solids, and waste heat resulting in depressed oxygen levels and impacted aquatic life. Potential uses were found to be restricted, particularly with respect to water supply and recreation.[457]

Champion had asked the EMC for a variance from two temperature standards in October 1984. Representatives from the Office of Administrative Hearings and the Attorney General's office took two widely different positions in their advisory comments on the issue. The former stated that "to grant this variance would not comport with North Carolina law; and there is no evidence of serious hardship . . . [but there is] plenty of evidence that . . . [a] variance would violate Federal law." The Attorney General's Office disagreed, saying that "this proposed variance would provide a biotic community typically characterized by diversity with the capacity to sustain itself. This was reported to be the "unanimous evidence of the experts." The company had agreed to reduce color and to maintain dissolved oxygen levels in the Pigeon River. It held that "the proposed variance in conjunction with a special order by consent would provide for

the protection and propagation of a balanced, indigenous species of fish, shellfish, and wildlife in the river."[458]

The spokesman for Champion said that, since 1960, the company had spent over $20 million to develop "one of the finest wastewater treatment plants in the industry." He alleged that the company had done all it could do to clean up the river and "if the temperature variance is approved today, the company is prepared to put in a color treatment plant to remove the color from the river." Within six months of the consent agreement, Champion said it would construct a 100,000 gallon-per-day demonstration unit and would use all "reasonable efforts" to remove at least 75 percent of the color in its effluent. The temperature variance was approved by the commission on a five to four vote.[459]

A 1985 hearing on the state's intent to issue a permit to Champion for the discharge of 48.5 million gallons per day of treated wastewater to the Pigeon River brought a "significant number of expressions of concern." A special order by consent had been issued a year earlier to address color removal and dissolved oxygen. Under this agreement, Champion "agreed to carry out a program to raise dissolved oxygen to an acceptable level and install state-of-the-art ultrafiltration for color removal." Speakers at the public hearing asserted a need for more stringent effluent and monitoring requirements, more specificity and enforceability relative to color removal and dissolved oxygen, and follow-up studies to document changes in water quality. There was a series of recommendations by the hearing officers. One broke new ground—calling for the "periodic restriction of production based upon river flow." Production had never been restricted in prior permits. In taking this action, the EMC was said to have "sent a message that we are serious about protection of the environment." The commission was "looking for performance" and was "not in the business of doing away with jobs." Other recommendations included a revision of BOD_5 and total suspended solids effluent standards, a reopener clause, increased monitoring and bioassays, toxicity limits, water quality studies by Champion, and the submission of corporate financial data sufficient to satisfy "hardship tests."[460]

Later that year, EPA officially objected to North Carolina's NPDES permit for the Champion discharge and reclaimed authority to issue the permit. This was followed by "intense activity," including court actions by Champion, North Carolina and Tennessee; permit negotiations; meetings, and hearings.[461]

Color was the major barrier to resolution of the conflict between Champion and EPA despite other important issues such as instream dissolved oxygen, toxicity, chloroform, and dioxin. After two public hearings, EPA began to develop a mechanism to balance the benefits of color removal against alleged wide-spread economic impacts that could close the mill. The agency proposed to issue a permit consistent with Champion's technical and economic ability to reduce color in its discharge. Variances from color effluent limitations necessary to comply with color water quality standards were required from North Carolina and Tennessee.[462]

In February 1986, the State of Tennessee filed suit against the EMC with respect to the commission's issuance of a Special Order by Consent (SOC) for Champion.[463] The SOC was rescinded by EPA. Champion shortly thereafter released its report on ultrafiltration for color removal. The company characterized its pilot study as "a tremendous success, averaging greater than 90 percent (color) removal." However, it reported that expansion of the pilot plant to four million-gallon-per-day capacity "may not be sufficient to achieve the required 75 percent reduction of whole mill effluent color." Champion and DEM filed a request in federal court contesting EPA's taking over the permit. "More importantly," the director told the EMC, "they are contesting the broader issue of EPA imposing arbitrarily . . . numerical color standards in the permit.[464]

On January 12, 1988, Champion petitioned the EMC to grant a variance from the state's color standard, as interpreted by EPA in its draft NPDES permit issued on December 1, 1987. The company notified the EMC on March 30, 1988, that given the uncertainties surrounding the Canton Mill's capability to achieve the specified color standard of 50 color units at the Tennessee state line and the "extremely high costs" of achieving that standard, its imposition would result in closure of the mill.[465] A variance from the color standard was requested.[466]

As characterized by the Raleigh *News and Observer*, the company hoped "to win a new lease on life for its Canton mill by getting officials in North Carolina and Tennessee to grant exemptions from water quality standards for the Pigeon River."[467] Champion was asking for a variance that would require them to reduce their color "loading" by 50 percent and prevent color at the state line from exceeding 85 five color units. The variance was approved by the EMC on July 13, 1988,[468] and the EPA permit was issued on July 11, 1989. The permit was the first in the United States to place limits on the discharge of dioxin from a paper mill. Champion developed a plan to reduce production and incorporate oxygen delignification in the pulp digestion process.[469] The socioeconomic effects of the changes, Champion had earlier alleged, would result in closure of the mill. This projection was later changed to the loss of "at least 1000 jobs" and still later to the loss of 300 jobs.[470]

Meanwhile, at the other end of the state, the Weyerhaeuser pulp and paper mill at Plymouth was again on the EMC agenda for its pollution of Welch Creek, a tributary to the Roanoke River. An EMC committee on Welch Creek had been formed in January 1985, and by May there were expressions of concern over the slow resolution of the issue. The committee recommended the DEM proposal for a pipeline and diffuser to the Roanoke River as the alternative of choice. This would remove wastewater from Welch Creek and maintain dissolved oxygen standards in Roanoke River. It was alleged that this alternative would dilute the effluent to a "no effect chronic toxicity" level under low-flow conditions and provide the required mixing at point of discharge. There were to be no wetland impacts beyond existing conditions. At the June 1985 EMC meeting, Weyerhaeuser's request for a 90-day extension of its consent agreement was approved.[471]

Early in 1984, the Federal Paper Board Company at Riegelwood was fined $729,000 for violations of effluent limitations over a period of several years. This, the largest penalty ever imposed by the State of North Carolina, was based on more than 200 violations of limits for biochemical oxygen demand which severely impacted a 37-mile stretch of the Cape Fear River. During the period from 1981 to 1984, the company had been served with 10 notices of violation of permit conditions.[472]

Sweeping Changes in Federal Policy on Industrial Wastes

In June 1979 and again in May 1980, the EPA made "sweeping changes" in the requirements applicable to industrial wastewater dischargers. Most changes pertained to the NPDES permit system. A 1976 consent decree arising from the *Natural Resources Defense Council V. Train* case compelled EPA to address the problem of toxic pollutants discharged by industry. A year later, the Clean Water Act was amended to provide EPA with additional authority to regulate industrial wastewater discharges. Congress adopted best available technology (BAT) and best conventional technology (BCT) effluent limitations. A comprehensive set of new NPDES regulations was adopted in 1979 and consolidated permit regulations in 1980. The latter attempted to consolidate and unify requirements for permit programs. Final BAT guidelines had been promulgated for the timber, iron, and steel, ore mining, and inorganic chemicals. Court challenges led to delays and changes in the regulations. The federal permit program was in a state of "flux" by late 1982, providing little formal guidance to the states.[473]

The 1980 NPDES regulations expanded the list of discharges for which permits would be required to include discharges of contaminated stormwater runoff from industrial sites. EPA was also increasing emphasis on "general permits" which would specify uniform conditions for all discharges of a similar type. Because final BAT and BCT effluent limitations had been issued for only a few industrial categories, permits for most industrial discharges had to be based on best professional judgment (BPJ).[474]

Industrial Waste Pretreatment

The Clean Water Act required EPA to establish pretreatment standards for the discharge of industrial wastes into publicly owned treatment works which could interfere with, pass through, or otherwise be incompatible with treatment processes. It was not until 1977, however, that EPA began to implement a pretreatment program. In June 1978, EPA released general pretreatment regulations. These established a general framework for applying and enforcing standards for industrial wastes discharged into municipal sewer systems.[475]

March 28, 1980, was set by EPA as the deadline for North Carolina to submit proposed pretreatment regulations as a precondition for delegation of authority to the state to administer the program. A proposed program had been submitted a year earlier along with a request for delegation. Only publicly owned systems discharging more than five million gallons per day were affected unless industrial discharges were such as to "warrant control." The proposed regulations, said to be nearly identical to their federal counterparts, were approved two weeks before the deadline expired.[476]

By 1984, only one-half of the communities identified as needing pretreatment programs had met EPA requirements. Many communities actively resisted the program and industries fought the requirements for controlling toxic discharges. A study task force concluded in 1985 that the program was too complex and not well understood, enforcement actions against state and local governments were not strict enough, insufficient resources had been allocated to the program, roles and relationships needed clarification and strengthening, and regulatory changes were required. The strongest message was the need for enforcement.[477] In 1985, the pretreatment of industrial wastes was alleged to be the longest running controversy within the U. S. water pollution control enforcement effort. It had, it was said, become the "Achilles heel" of the Federal Water Pollution Control Act.[478]

The state program required applicable local governments to develop enforcement management systems tailored to each situation. DEM published a manual in 1987 to guide the development of such systems. This included state criteria to determine whether local governments were adequately implementing pretreatment programs and permits, compliance monitoring and inspections, enforcement, and reporting to DEM.[479] A companion report provided guidance on program implementation, monitoring, and reporting requirements.[480]

Pollution Prevention Pays

The concept of pollution prevention at the source through waste minimization, recovery, and utilization has long been viewed as preferable to waste treatment and disposal. Early examples of successful waste minimization were whey recovery from the production of cheese and utilization as a component of other food products, and the

manufacture of vanillin from lignin in pulp and paper wastes. Markets for these products were very limited, however, and the overall impact on the reduction of the wastes involved was very small. The most important factors in limiting growth of the pollution prevention alternative were probably the sheer momentum of the emphasis on waste treatment and lack of economic and regulatory incentives.

A Pollution Prevention Pays program was introduced to North Carolina in 1982 through a state-wide symposium on "Making Pollution Prevention Pay." Business, government, and university leaders met to discuss the concept, share information, and encourage implementation of pollution prevention policy. Inauguration of the program in North Carolina gave visibility and credibility to the potential of pollution prevention as a viable option in the control of water pollution. Old habits are hard to break, however, and the continued support of industrial managers is required if pollution prevention is to reach its full potential as an operating concept.[481]

The North Carolina Pollution Prevention Pays Program was recognized by EPA as the leading state program in the nation. Many North Carolina industries used the concept with $14 million in documented savings reported in 1987. The program focused on three major services: (1) technical assistance, (2) research and education, and (3) financial assistance.[482] In late 1988, EPA funded a two-year pilot project in the form of a Waste Reduction Center within DEM. The center served North Carolina and seven other southeastern states. The purpose of the center was to compile case summaries of waste reduction by industries in the Southeast and provide industry with up-to-date information on waste reduction.[483]

Municipal Waste Treatment Plant Construction

Federal grants for municipal waste treatment plant construction were cut in half under the Reagan Administration in 1981. The North Carolina allocation was reduced from $66.4 million to $38 million in fiscal year 1980 and from $64 million to $48 million in fiscal year 1981.[484]

Amendments to the Federal Water Pollution Control Act in 1981 authorized the appropriation of $2.4 billion for treatment plant construction grants for fiscal years 1982

through 1985 at the federal share of 75 percent. What remained to be seen, however, was what level of funding would actually be appropriated. The administration on the recommendation of its Office of Management and Budget had originally proposed no new funds for 1982. Even with new funds, however, there was little hope that the Federal Water Pollution Control Program would regain the momentum lost during the change in administrations in 1980.[485]

By 1982, it was quite clear that federal construction grants were going to be phased out. The program had been the largest public works effort in the nation's history, pumping more than $35 billion into wastewater treatment facilities. By the end of fiscal year 1983, 38 states were expected to have complete control over their construction grants programs—up from 25 in fiscal year 1982. Major changes in the program at that time were the elimination of grants for planning and design, reduction in federal funding from 75 percent to 55 percent starting October 1, 1984, a requirement that owners certify that facilities would meet operational requirements for one year after construction, and changes in eligibility of certain parts of treatment systems.[486]

A large number of wastewater treatment projects undertaken in North Carolina during the 1970's were funded under the Federal Water Pollution Control Act. The level of assistance is reported to have grown from $18.5 million in 1973 to $110.3 million in 1976. From 1976 through 1982, funding averaged more than $67 million per year. Other federal funding came from the Farmers Home Administration, Department of Housing and Urban Development, and the Economic Development Administration.[487]

Amendments to the Federal Water Pollution Control Act in 1987 required states to use at least 50 percent of fiscal year 1989 and 1990 federal funds for revolving loans. Beyond that period through fiscal year 1994, all federal funds were to be used for the revolving loan program.[488]

In 1984, a one-half of one percent local option sales tax was authorized. This specified that 40 percent of the tax proceeds must be spent for water and sewerage needs. At the same time, legislation which would have authorized a third Clean Water Bond issue was rescinded. All funds appropriated under the Clean Water Bond Act

were committed by the end of 1985. Only recovered funds then remained available.[489] A total of 365 communities were provided assistance under the state Clean Water Bond Acts of 1971 and 1977. More than 100 of those were under regulatory restrictions because of inadequate wastewater treatment.[490]

A Clean Water Loan and Grant Program was authorized by the General Assembly in 1987. With that legislation, the General Assembly recognized a critical need for the state to provide for a low-interest funding source for municipal water and wastewater capital facilities. The need was attributed in large part to the diminished availability of federal loans and grants and elimination of the federal general revenue sharing program. The intent was to create a program to facilitate early construction of needed facilities by establishing a revolving loan fund. It was the further intent to provide grants to local governments for water supply and wastewater treatment facilities. Grants were limited to $500,000 and loans to $3,000,000 for any fiscal year. The interest rate for the loans was to be the same as that for loans under the Federal Water Pollution Control Act.[491] The appropriation for fiscal year 1989 was $19.3 million and for fiscal year 1990 $10 million.[492] Part of the state money was used to match federal funds. This was to address total local government wastewater collection and treatment needs estimated at $1.8 billion.[493]

Common questions associated with the expenditure of public funds for municipal wastewater treatment systems were "are we getting our money's worth?" and "are the receiving waters any cleaner than they were before?" These questions led to studies of before and after effects. A 1984 report of North Carolina studies of eight municipal treatment plants disclosed that the effluent quality improved in every case after the treatment plants were upgraded to meet secondary treatment limits. However, the quality of receiving waters did not always show substantial improvement. When little instream improvement occurred, this was generally attributed to poor upstream water quality. The suggestion was made that potential for improvement in receiving water quality should be a primary issue in the setting of priorities for the funding of wastewater treatment plant improvements.[494]

Septage

The periodic removal and disposal of residual wastes from septic tanks often resulted in clandestine dumping of the "septage" onto the land or into streams with resultant water quality problems. The supervision of septage disposal had long been a problem requiring regulation.

A 1980–1981 study by the Division of the Health Services disclosed that "septage," totaling about 86 million gallons per year was either discharged to sewage treatment plants or applied to land. There were 54 counties which either had no treatment plants or whose plants would not accept septage. Laws and rules were said to be "grossly inadequate." Necessary tools for the management of land disposal sites were not in place. Since one-half of all North Carolina households provided their own method of sewage disposal and half of the wastes pumped from these systems was denied access to wastewater treatment plants, there was need for action. The EMC asked for a list of possible septage treatment locations, a statement of the degree to which the commission could authorize special funding under federal and state grant programs, possible changes in rules and regulation, an investigation of possible EMC regulation of septage dischargers, and an analysis of the feasibility of establishing disposal sites.[495]

Also, in 1981, the General Assembly attempted to clarify interagency responsibilities and rules for septic tank and other ground sewage disposal systems through enactment of the Ground Absorption Sewage Treatment and Disposal Act. The Commission for Health Services was given responsibility for all systems that did not discharge to the land surface or surface waters for which the EMC was to be responsible.[496]

In 1988, the General Assembly adopted an Act to Establish a Septage Management Program in the Department of Human Resources. The act specified that septage could be disposed of only at public or community sewage systems designed to discharge effluent to surface waters and at sites permitted by the Department of Human Resources.[497]

Landfill Leachates

Leachates from solid waste landfills were believed to be a significant source of pollution, but little factual data were yet available in August of 1984 when the Division of Environmental Management initiated a study to better define the problem.

Leachate samples were taken at 16 landfills to characterize chemical constituents and overall toxicity. Results from 48 hour screening bioassays indicated that leachate from seven of the 16 landfills demonstrated toxicity, with three being extremely toxic. Based on chemical analyses and toxicity tests, three sites were chosen for biological evaluation of receiving streams. Slight instream effects were noted at two of the sites and more marked effects at the third. Sedimentation and urban runoff complicated the assessment. The study concluded that further evaluation of landfill sites was needed to ensure regulatory compliance.[498]

A subsequent study by Borden and Yanoschak analyzed data from 71 municipal sanitary landfills in North Carolina. A total of 322 surface and 411 groundwater quality records were involved. Water quality analyses for inorganic pollutants and heavy metals were performed on 97 percent of the surface water samples. Many inorganic parameter means were reported to show substantially higher values for downstream samples when compared to upstream samples. However, downstream concentrations never approached values reported in the literature for sanitary landfill leachate.[499]

Pollution from Boats and Ships

The question of pollution from boats and ships arose periodically, particularly with regard to effects on shellfish growing areas. The U. S. Coast Guard reported on January 30, 1980, that "no discharge of raw sewage is allowed from vessels in navigable waters of the U. S." Further, "in freshwater lakes and in reservoirs without inlets or outlets for vessels to enter or leave, vessels are prohibited from discharging any wastes. All other waters need Coast Guard approved sanitation devices." The agency was said to be working with manufacturers in the inspection of all new vessels with a capacity of more than six passengers. On existing vessels of this size, the Coast Guard said that it would look for sanitary devices when boarding for safety inspections. Boat operators had

the option of locking and sealing heads in lieu of using approved devices. Violators were subject to fines.[500]

Marine sanitation regulations applied to all merchant ships of all nationalities entering U. S. waters. There were two options as to sanitation devices. One was to treat to reduce the coliform density to 200 per 100 milliliters and suspended solids to 150 milligrams per liter. The other was to store sewage for subsequent pumpout at stations located at Silver Lake at Ocracoke, Beaufort, and Spooners Creek at Morehead City. That left a vast area of the coastal region unserved. The Wildlife Resources Commission reported that it did not have funds to enforce regulation of boats of less than six passengers capacity.[501]

As recently as mid-1990, there was little improvement in the situation. The *Raleigh News and Observer* reported that only 21 of the 104 marinas along North Carolina's coast had pumping stations to service boat toilet holding tanks. Only five percent of the marinas in the state's second busiest port, Morehead City, offered pump outs. Marinas in Wilmington, the state's largest port, offered somewhat better service with five out of 17 providing pumping stations. State and federal officials reportedly assumed the worst about boaters' attitudes toward sewage disposal. As one state official said, "I guess they just throw it in the ocean."[502]

Nonpoint Pollution

A study of the ecological effects of urban runoff released by the Division of Environmental Management in 1982, found the Coastal Plain region to be the most severely impacted. Urban streams in all of the state's cities investigated were found to be in very poor condition. The effects of urban runoff on both Piedmont and coastal streams were found to vary with the size of the city. The quality of urban streams in large cities varied from poor to very poor with some indications of toxic conditions in the smaller cities. Sedimentation and low minimum flows were reported to be the primary stress factors.[503]

The need for additional data on nonpoint pollution prompted North Carolina to participate in the Nationwide Urban Runoff Program funded by EPA. A runoff study in Winston-Salem was one of 28 studies. Along with quantifying urban runoff pollution

loads, each study investigated the effectiveness of best management practices to reduce the urban runoff pollution load. Earlier 208 studies had documented high concentrations of metals, nutrients, microbes, and some toxic pollutants. The purpose of the Winston-Salem study was to investigate the effectiveness of street sweeping as a best management practice. While the study confirmed the high runoff pollutant concentrations found in 208 studies, it did not disclose any improvement of water quality as a result of street sweeping and suggested that "second thoughts should be given to the acquisition and use of street sweepers as a best management practice for water quality protection."[504] This finding was confirmed by four other studies in the EPA program dealing with the same question.[505]

The overall goal of the Nationwide Urban Runoff Program was to develop information that would help to provide a rational basis for determining whether or not urban runoff was causing water quality problems and to propose realistic control operations if this were found to be true. Problems were defined on the basis of the impairment or denial of beneficial uses, violation of water quality standards, and local public perception.[506]

The overall urban runoff study showed urban runoff flows and concentration of pollutants to be quite variable within a particular event and from one event to the next at a given site. Among the overall conclusions were the following:

- Heavy metals were by far the most prevalent priority pollutant found in urban runoff. End-of-pipe concentrations exceeded EPA ambient water quality criteria and drinking water standards in many instances.
- The organic priority pollutants were detected less frequently and at lower concentrations than the heavy metals.
- Coliform bacteria were present at high levels in urban runoff and can be expected to exceed EPA water quality criteria during and immediately after storm events in many surface waters. Analyses and contemporary literature were reported to suggest that fecal coliform may not be the most appropriate indicator organism for identifying potential health risks of stormwater runoff.

- Nutrients were reported to be generally present in urban runoff, but concentrations, in general, did not appear to be high in comparison with other possible sources.
- Oxygen demanding pollutants in urban runoff were found at concentrations approximating those in secondary sewage treatment plant discharges, and both runoff controls as well as advanced waste treatment were thought to be warranted.
- Total suspended solids concentrations in urban runoff were found to be "fairly high" in comparison with treatment plant discharges and runoff controls were recommended where related water quality problems were found to exist.[507]

The federal study concluded that detention basins are capable of providing very effective removal of pollutants in urban runoff. Design and size of the basins relative to urban areas served had a critical influence on performance. Wet basins, which maintain a permanent water pool, were reported to have the greatest performance capabilities. Not unexpectedly, illicit connections of sanitary discharges were identified at some sites, resulting in high bacterial counts and dangers to public health. The location and elimination of such connections were said to offer opportunities for a dramatic improvement in the quality of urban stormwater discharges where such connections exist.[508]

The problem of pollution from stormwater runoff was, by then, well recognized and Congress required EPA to develop regulations setting forth permit application requirements for stormwater discharges. These were published in mid-1985. In a discussion before the EMC, staff said that such regulations "possibly could involve 25–50 thousand discharges, . . . which is 10 to 20 times the number of existing permits." "Clearly," it was said, "stormwater from urban areas is having an impact on urban streams." The permitting procedure for stormwater discharges was viewed as a "real problem."[509]

In April 1989 the Division of Environmental Management released reports on nonpoint assessment and management required under the 1987 Amendments to the

Federal Clean Water Act. The purpose of the assessment was to identify navigable waters degraded by nonpoint source pollution, sources of pollution, the process to be used for the selection of best management practices, and programs to be used for the control of nonpoint source pollution.[510]

According to DEM estimates at that time, nonpoint pollution was the primary source of degradation of freshwater rivers and streams in North Carolina. About 30 percent of the state's streams were said to be degraded. Nonpoint sources reportedly accounted for 92 percent of degradation in streams, 35 percent in lakes and reservoirs, and 68 percent in the estuaries.[511] The most widespread sources in order of importance were reported to be agriculture, urban runoff, and construction. Sediment was reported to be the most widespread cause of degradation.[512]

Slightly more than five percent of the state's estuarine waters were said to be degraded. Nonpoint sources accounted for more than 72 percent of this. Again, agriculture was found to be the most dominant source, followed by septic tanks and urban runoff. The principal causes were said to be nutrients and fecal coliform bacteria.[513]

The DEM nonpoint source management plan included the agriculture and forestry cost share programs (which provide matching funds for BMPs), the water supply watershed protection program, regulation under the sediment control and mining acts, and coastal stormwater regulations. DEM saw public participation as a key component which would be encouraged through workshops, meetings, and other means. The management program stressed the importance of increased federal, state, and local funding if the program is to be successfully implemented.[514]

The North Carolina Nonpoint Program was not approved by EPA until mid-1989 and much of the funding was still pending at the end of the year. While program accomplishments were still somewhat limited, DEM reported significant advances. These included passage of legislation for mandatory nonpoint source pollution control requirements in water supply watersheds, undisturbed buffer zones along trout streams. BMPs for silviculture and increased funding for agriculture, nonpoint source protection

for highest quality waters, expansion of nonpoint-related groundwater program, target watershed management programs, waste reduction and recycling, and wetland protection.

An act in 1989 to Authorize and Direct the Environmental Management Commission to Phase in Stormwater Runoff Rules and Programs was a major step toward control of pollution from nonpoint sources. The EMC was directed to undertake a continuing planning process to develop and adopt a state-wide plan for stormwater rules and their enforcement. The stormwater rules were to be phased in on a priority basis for all sources of water pollution. The EMC was directed to consider standards and BMPs for the protection of the state's water resources in the following order of priority.

1. Shellfish waters
2. Water supply watersheds
3. Outstanding resource water
4. High quality waters, and
5. Other waters where stormwater controls were found to be necessary.[515]

Pollution From Agriculture

As pollution from agriculture grew in importance as a factor in the state's water pollution control program, there was increasing evidence of jurisdictional disputes between the Department of Agriculture and the Division of Environmental Management. The North Carolina Department of Agriculture expressed concern over alleged overlap in authority between its Pesticide Board and the EMC relative to monitoring for pesticide residues in water. Unsuccessful attempts were made to develop a memorandum of agreement affirming that DEM would operate an ambient water quality monitoring network and test for pesticides in that network. It was agreed that the Pesticide Board would prioritize special studies of pesticide problems and have the opportunity to review such studies before initiation. Both agencies were to respond to emergency episodes. The interagency dispute started with a DEM study of pesticide use in apple orchards which prompted observations by the Pesticide Board that "they feel they know better than anyone else" the types of pesticides used, the locations of pesticide use, and where "they are most worried about potential impact on the environment."[516]

An examination of North Carolina Department of Agriculture data for 1989 disclosed nine fish kills allegedly attributable to pesticides. Nearly all involved farm ponds draining treated cropland. Violations of the North CArolina Pesticide Law could be documented in only two cases. There were a total of 172 alleged pesticide violations of all kinds during that period. A review of fish kill data compiled by the Division of Environmental Management presented about the same picture.

The N. C. Cost Share Program to reduce nonpoint pollution from agricultural lands was begun in 1984 as a pilot program with a $2.16 million appropriation from the General Assembly. The voluntary program to adopt best management practices (BMPs) initially involved three nutrient sensitive watersheds in 16 counties designated by the EMC. Its purpose was to install BMPs to reduce the movement of nitrogen and phosphorus from agricultural lands to surface waters. In the fall of 1985, the lieutenant governor, commissioner of agriculture, and secretary of the Department of Natural Resources and Community Development, began to express the need for a state-wide cost share program.[517] The program was expanded to all counties by 1989. More than 10,000 land owners had signed contracts to install BMPs on nearly 700,000 acres of land by 1990.

The program offers state cost sharing of 75 percent of the cost of farm BMPs up to a total of $15,000. It also pays 50 percent of the cost of technical assistance by local governments. Eligible cost-share projects include conservation tillage; diversions; filter strips; field borders; critical area plantings; sediment control structures; sod-based rotations; grassed waterways; strip cropping; terraces; cropland conversion to grass; trees or wildlife plantings; grade-control structures; water-control structures; and animal waste management systems.[518]

A 1986 report of the DEM on pollution from animal wastes disclosed that there were over 70,000 farm operations in the state with livestock. These animals generated up to twelve times the wastes from an equivalent human population. While the majority of the farm animal operations were said to be relatively small with sufficient land areas to adequately assimilate the wastes, the report acknowledged that improperly planned or managed operations did allow wastes to reach surface waters. Regulatory programs

addressing animal operations tended to focus on concentrated feed lots. The report showed that wastes were normally stored in lagoons or other above-ground facilities and that there currently were an estimated 8,000–10,000 of these liquid waste handling facilities state-wide. It was from installations of this kind that discharges most often occurred. The DEM policy was to inspect animal waste facilities only in response to citizen complaints or acknowledged water quality problems. Under this policy, less than two percent of the feed lots would be visited each year. In a number of cases, it took several years to eliminate improper discharges of animal waste. Recommendations at that time included the immediate designation of problem sites as subject to NPDES permit requirements–a foundation for future requirements if the problems persisted.[519]

The EMC adopted a resolution on February 14, 1987, supporting a plan developed by the Agricultural Task Force and N. C. Soil and Water Conservation Commission to expand the Agricultural Cost Share Program incrementally state-wide, based on water quality needs and available funds.[520]

Concerns about Pollution from Peat Mining

Proposed peat mining in the coastal region raised concern over the impact of drainage and discharges on coastal waters. Mining permit applications for five peat mining sites in the coastal region were received for review by DEM in the fall of 1985. Water management plans for each site were requested as a part of that review. The Coastal Federation Inc., a citizens organization, questioned the issuance of NPDES permits in the absence of greater certainty as to the impacts. It suggested that permits not be issued until uncertainties had been resolved. While there was agreement that there were good conceptual guidelines for review of water management plans, there was said to be a greater issue as to whether peat mining was good for North Carolina.[521]

EMC regulations for peat mining were adopted on July 10, 1986. Their purpose was to "adequately protect the State's waters affected by peat mining." They required peat mining projects to develop runoff controls which closely approximated prior, natural conditions.[522]

Nutrient Sensitive Waters

In 1980, the most complex water quality problem was said to be eutrophication. By then, the problem existed in the Pamlico and Neuse River Estuaries as well as the Chowan River. Massive kills of fish and bottom animals occurred in both estuaries due to lack of dissolved oxygen during the summer. There was also mention of the potential for eutrophication in the upstream reservoirs. The nutrient sensitive status of High Rock Lake needed exploration and plans to do the same for Jordan Reservoir were "considered a must."[523]

DEM received funds from the EPA in 1981 to classify publicly owned freshwater lakes according to their trophic state and to establish procedures to restore lake quality where necessary. As a result of associated studies, the newly developed North Carolina trophic state index and lake classification scheme was found to provide a statistically sound and verifiable tool for the assessment of trophic state conditions in North Carolina lakes. Eutrophication was seen to be greatly affected by the presence of high concentrations of suspended sediments, and the control of sediment loads in tributaries was expected to greatly improve water quality. Aquatic weeds like *Hydrilla verticillata* were viewed as a potential threat to all freshwater lakes if not controlled.[524]

The suitability of the nutrient sensitive classifications for Falls of the Neuse and Jordan Reservoirs was still an unresolved issue at the close of 1982.[525] In a related matter pertaining to coastal waters, the staff was authorized to limit or prohibit wastewater discharges to coastal waters affected in this way with the caveat that the staff will have to "come back and address the basin-wide strategy."[526]

Nutrient enrichment of coastal waters and inland lakes and reservoirs had become a significant problem by 1984. A state-wide voluntary program to reduce agricultural phosphorus inputs to eutrophic waters had been implemented and it was believed that a regulatory program to reduce phosphorus inputs to surface waters from municipal point sources was also indicated along with increased participation in the voluntary agricultural program.[527]

A nutrient-sensitive supplemental classification had been approved by the EMC on May 10, 1979, and had been immediately applied to the Chowan River. Nutrient

sensitive waters were defined as waters subject to excessive growths of microscopic or macroscopic vegetation requiring limitations on nutrient inputs. The Chowan River, the first water body to be designated nutrient sensitive, was followed by the Jordan and Falls of the Neuse reservoirs on October 13, 1983; the Lower Neuse River on January 28, 1988, and the Tar-Pamlico River basin on September 14, 1989.[528]

A 1989 status report of investigations of algal blooms from 1984 through 1988 provided no basis for optimism in dealing with eutrophication problems throughout the state. Reported algal blooms had increased yearly from 16 in 1984 to 75 in 1988. The blooms occurred predominantly in Coastal Plain rivers and estuaries and Piedmont ponds, creeks, and rivers. Information derived from the program proved to be useful in resource management at both the state and local levels.[529]

The Phosphate Detergent Ban

Publication of a 1983 report on strategies for municipal point-source control of phosphorus discharged to surface waters concluded that the phosphorus level in treatment plant effluent could be reduced by 80–90 percent through chemical treatment. A phosphorus detergent ban was said to offer "at least a 30–40 percent reduction" (of phosphorus in streams) at no appreciable cost to the consumers. Advantages of a ban were said to be that it could be rescinded at any time, required no initial capital investment, and focused public attention on eutrophication problems. A ban was thought to be appropriate for most of the Piedmont and Coastal Plain and was recommended as a first step in addressing nutrient enrichment problems.[530]

By mid-year, the EMC was told by staff that with a phosphate detergent ban the level of chlorophyll a in the upper portion of Falls of the Neuse Reservoir could be reduced by thirty percent and the two-milligram-per-liter goal met in the lower portion.[531] With no nutrient control, the projections of chlorophyll a were said to be "way above" standards. A phosphate detergent ban was expected to have an impact, but "whether or not it would be noticeable [remained] to be seen." Removal of phosphorus from wastewater effluents through treatment was seen as "the only option that gets us close" to the goal. At this point, the commission adopted a motion "to instruct the Director" that no more permits be issued for discharges into the Falls of the Neuse or Jordan

watersheds and that no more authorizations to construct wastewater treatment plants be issued until completion of studies, public hearings on reclassification, and action by the EMC.[532]

A state-wide "Clean Detergent Act" was first mentioned within the EMC in 1982. Two years later, the commission was informed that the Legislative Study Committee on Water Pollution had unanimously recommended such legislation. The EMC responded by adopting a motion in April 1944 to "go on record" as supporting a Clean Detergent Act." Its resolution urged the General Assembly to enact legislation to require the use of "phosphate-free" laundry detergents. The commission noted that two-thirds of North Carolina's watersheds were becoming nutrient enriched and subject to nuisance conditions from algal growth. In its investigation of sources and available methods to reduce phosphorus levels in North Carolina waters, DEM had concluded that a "significant portion" of the phosphorus being discharged came from laundry detergents. It had found that suitable "phosphate-free" detergents were already available in the state and that use of such detergents would reduce the cost of phosphorus removal at wastewater treatment plants.[533]

The EMC again took up the issue of a phosphate detergent ban at its March 1987 meeting. But, this time, they were counseled by the division director to "wait and see what the effects of the newly adopted strategy toward phosphate removal at the wastewater treatment plant would be." "While there are advantages to [a] ban," he said, "the disadvantages outweigh them," and a phosphate ban would be "premature." Nevertheless, the EMC adopted a resolution in support of a ban which was identical to the one passed in August 1984. This urged the General Assembly "to enact legislation to require the use of phosphate-free detergents beginning six months after passage" of the legislation.[534]

Proposed legislation requiring nonphosphate detergents throughout North Carolina came to a head in 1987 with passage of An Act to Provide for the Sale of Clean Detergents in North Carolina.[535] Legislative action followed public hearings where opposition mounted by the soap and detergent industry found expression through an intensive lobbying campaign. Opponents alleged that the change would adversely impact

the detergent industry, be almost impossible to administer, increase laundering costs and leave the state in the wake of permanently soiled fabrics, and fail to reduce the phosphate content of receiving waters to any meaningful extent. These assertions were not persuasive at the time and were subsequently proven to be inaccurate.

Studies by DEM before the legislation was enacted concluded that a phosphate detergent ban would remove about one-fourth of the phosphorus in domestic wastewater and about 10–15 percent of the total phosphorus in the Neuse River. Even this conservative assessment proved to underestimate the ultimate effects. A review of data from five major wastewater treatment plants for the year following the change to nonphosphate detergents indicated significant reductions in phosphorus levels. Reductions in influent concentrations for five major wastewater treatment plants ranged from 21 to 25 percent and the decrease in effluent concentrations from 36–52 percent. These findings were interpreted to mean a total reduction of approximately 44 percent with significant reductions in receiving waters. Since the EMC required a reduction in effluent levels of phosphorus to 2 milligrams per liter, the ban held the promise of substantial savings in the cost of phosphate removal. In fact, the findings indicated a potential savings of approximately 45 percent in operating costs for phosphate removal.[536]

Management Plan for the Chowan River

A status report on the Chowan River in 1980 reported that more than 1,000 pounds per day of nitrogen were entering the river form "washoff" at the C. F. Industries plant site. The EMC ordered the plant to prepare an engineering report covering what it intended to do to clean up the site. Extensive studies were undertaken to link Union Camp discharges in Virginia to algal blooms and decline in fishery. The interstate nature of the problem and split federal jurisdiction between two EPA regional offices complicated the matter.[537]

A request was made to the EPA in June 1980 for assignment of an audit team to review the Chowan River Project and "tell us whether we are doing the right things" for the Chowan River cleanup. Governor Hunt met with the two EPA regional administrators involved and an agreement was reached for that agency to supply an airplane to map the region and provide divers to sample sediment in the river bottom.[538]

The Chowan River Management Plan of 1982 disclosed that nonpoint sources were, by far, the largest contributors of the nutrients nitrogen and phosphorus—79 percent and 63 percent respectively. A combination of point and nonpoint control measures was proposed. These included land application systems in lieu of conventional treatment plants for municipal wastes, reductions by industrial sources, and the adoption of agricultural best management practices.[539]

An associated Chowan/Albemarle Action Plan concluded that nutrient inputs to Albemarle Sound from the Chowan River had increased significantly from the early 1970's. While the average flow of the Roanoke River was twice that of the Chowan, concentrations of nutrients were higher in the Chowan. While nutrient levels in the sound were 30–40 percent less than the Chowan River, "substantial" algal growth was found in Albemarle Sound. Yet, massive surface blooms in that large body of water were thought to be unlikely because of physical conditions. The major water quality problem in the river and sound was reported to be the disruption of the food chain because of blue-green algae replacement of normal algal populations. Blue-green algae were not considered to be a suitable food source for small aquatic animals. The Action Plan also concluded that a clear relationship had been established between abundance of the bacterium associated with red-sore disease of fish and excessive nutrient loading. Recommendations were (1) attain a 30–40 percent reduction in total phosphorus and a 15–25 percent reduction in total nitrogen, (2) adopt a phosphate detergent ban within the basin, and (3) develop a strong education program to implement needed BMPs.[540]

Albemarle-Pamlico Estuarine Study

In 1987, the Albemarle-Pamlico estuarine system was designated an estuary of national significance and selected for study under the U. S. Environmental Protection Agency's National Estuary Program. There had been striking changes in this part of the coastal environment. Submerged grasses had largely disappeared and with them an important element of the nursery areas for fish and shellfish. Massive land drainage projects converted wetlands to fields of soybeans and other row crops. With that, came increased turbidity, nutrients, and pesticide residues. Large discharges of freshwater

drainage upset salinity patterns important to immature forms of fish life. Runoff from urban development contaminated shellfish growing areas resulting in still more closures because of increased bacterial levels. Thermal stratification from climatological and hydrologic causes contributed to dissolved oxygen deficits in receiving waters. Fish and shellfish diseases and other factors reduced fishery harvests and marketability.

Clearly, there was a need for a better balance between development and the preservation of a natural estuarine system so important to the well-being of the coastal region. The preservation and enhancement of water quality was an important objective of the Albemarle-Pamlico Estuarine Study. The overall goal of the study was to provide the scientific knowledge and public awareness needed to make national management decisions so that the Albemarle-Pamlico estuarine system could continue to provide the natural resources and recreational opportunities needed for the region's long-term welfare.[541]

Other Coastal Issues

The effects of upland drainage on primary nursery areas in Pamlico Sound was viewed by the state Division of Marine Resources in 1980 as "a chronic problem of great importance to the fisheries industry." About 10 years earlier, the division had begun the identification of areas in the sound which could serve as nursery areas for economically important species of fish and shellfish. A three-year study was undertaken to document the effects of alteration of drainage systems on salinity patterns in the nursery areas and to assess their impact on productivity. Results for Rose Bay in Hyde County showed a distinct difference in salinity patterns but didn't provide a basis for making a "definitive statement" as to the exact impact on the target organism, juvenile brown shrimp. The Division of Coastal Management adopted standards for developing areas of environmental concern (AEC) which specifically addressed agricultural drainage into primary nursery areas. Resource agencies were asked to stress the value and fragile nature of the small estuaries and to encourage development of adjacent lands in such a way as to minimize its adverse effects.[542]

Two ocean outfall sewers were now proposed, one in Dare County and one on Bogue Banks. Studies were delayed, however, and staff reported that, "It looks like the

cost of the outfalls may be so high that they may never come about." It was at this time that the EPA completed a draft environmental impact statement (EIS) to determine whether the federal construction grants program constituted a significant environmental impact on the barrier islands. During the review period the agency deferred action on construction grants to most barrier island communities. President Carter had initiated a policy to protect the barrier islands and the EPA "had a responsibility not to make investments . . . inconsistent with President's policy." The EMC adopted a motion to notify the EPA that the construction grants program should not be suspended during an interim period because it would "significantly detract from our efforts in pollution control and adversely affect the locality involved." It also questioned the validity of any generic EIS in an area of that "scope and variety."[543]

A study of bacterial contamination of SA (shellfish growing) waters in four tidal creeks of New Hanover County confirmed the assumption "that as higher concentrations of septic tanks are installed in coastal watersheds, greater levels of fecal and total coliform bacteria are recorded during both wet and dry weather," resulting in violations of water quality standards. Other contributing factors were found to be land clearing, increased runoff from impervious areas, and contamination from domestic animals and birds. Between 300,000 and 400,000 acres of shellfish growing areas had been closed.[544]

On a number of occasions, the Coastal Resources Commission (CRC) and the Marine Fisheries Commission (MFC) asked the EMC to consider greater protection of coastal waters. The CRC held a series of round-table discussions to address the issues. While DEM said that it recognized the water quality problems associated with coastal development, its limited resources had kept the division from fully addressing the issues. The Special Projects Unit of DEM was then working on several reports which focused specifically on the issues involved. The matter was referred to a new EMC Committee on Coastal Water Quality which was asked to work with the attorney general's office to review the commission's authority in this regard.[545]

In March 1985, DEM told the EMC that SA coastal waters were being increasingly impacted by stormwater runoff. It was viewed as a rapidly developing issue. Regulatory options were seen as detention ponds with treatment, pumping of stormwater

away from SA waters, and limits on impervious ground cover. An interagency task force was created to assure "that water quality issues are discussed freely among . . . [the] regulatory commissions involved."[546]

Both point and nonpoint sources of pollution reportedly contributed to degraded water quality in shellfish growing areas. Regulations of the EMC prohibited the discharge of any sewage into SA waters. Dischargers existing prior to the classification of SA waters were prohibited from expanding their facilities. Industrial wastewater discharges were prohibited where they were not treated to the satisfaction of the EMC. In 1985, there was a comprehensive state program to regulate point source discharges to SA waters, but no program had yet been established to regulate nonpoint discharges. "Significant levels of contaminants" were attributed to several nonpoint sources in the coastal areas. There was recognition that, as coastal development continued, urban runoff would increasingly affect water quality. High density development with large areas of impervious cover was expected to produce larger runoff volumes and associated pollution. Discharge of wastewaters from boats was also a matter of concern. Failure of septic tanks and package sewage treatment plants led to the closure of shellfish waters in several areas. Mitigation measures were said to be needed if coastal shellfish resources were to be protected. Two options for stormwater management were suggested for consideration:

1. compliance with general stormwater guidelines or goals, with no prescription of specific technology to be used; and
2. compliance with specific technical guidelines developed by an inter-agency working group.

Options were also proposed for management of marinas and on-site sewage systems.[547],[548]

An intercommission task force was created in 1985 to consider proposals from EMC and CRC for the regulation of coastal stormwater runoff. The EMC was advised by the DEM director to await action by CRC before moving itself. The latter commission's regulations applied only to designated areas of environmental concern. It had overall jurisdiction over coastal development, while the EMC was responsible for

water quality. Since the two concerns could not be separated, there was an overlap of responsibility where water was concerned.[549]

The EMC debated proposed coastal stormwater regulations at its September 1986 meeting. They proved to be highly controversial and there was a tie vote. The main issues were the distance back from shoreline to be required for development, redevelopment coverage, sunsetting, and additional studies. After a temporary tabling, the measures were reconsidered, and the September 11, 1986, version was adopted with some changes. They were to cover all major development activity involving one acre or more from class SA waters landward to a distance of 575 feet.[550]

At its next meeting in October, the commission adopted a resolution which recognized stormwater runoff as a "significant source of pollution to coastal waters." The regulations were "to protect coastal waters from improper development." Further evaluations were needed to identify waters with significant shellfish resources and to cope with the technical and scientific uncertainties as to the extent and type of stormwater controls needed. The commission requested that "adequate support" be provided through the governor's office and in the General Assembly for the scientific studies needed to accurately locate and classify coastal waters and the types of controls needed.[551]

A report of the hearing officer on proposed options for coastal stormwater regulations was presented at the October 1987 meeting of the EMC. In 1986, the commission adopted rules which required new development in a limited zone of 575 feet around class SA waters to control stormwater runoff. Developers could comply by either limiting density or by completely controlling a 4.5", 24-hour storm. Those regulations applied only to development which required either a Coastal Area Management Act (CAMA) major development permit or an erosion/sediment control plan. Both the design storm and areal coverage were quite controversial.

In May 1987, DEM had presented a new proposal applicable to stormwater controls for development activity in the 20 CAMA coastal counties. This was designed to protect shellfish waters and coastal water quality in general. While the proposed controls were more moderate than previous rules, they covered a significantly greater

area. The "overwhelming majority" of comments at public hearings were against the proposed rules, which were seen as a relaxation of the previous rules. However, staff recommendations to expand the area covered to all 20 CAMA counties, to reduce the design storm to 1.5" for SA waters and 1" for other waters, and to resist the reclassification of SA waters to a lower class unless supported by use attainability studies were adopted.[552]

The commission was told by staff that stringent controls were justified for certain exceptional waters and it recommended that only the low development density option (the other option being structural stormwater runoff controls) be allowed in highly productive/high quality waters. Use of the new outstanding resource waters (ORW) classification was seen as a means to this end. Wet detention basins would not be allowed adjacent to SA waters. Porous pavement was considered to be an "innovative system" until its effectiveness had been demonstrated.[553]

Governor James G. Martin announced a set of coastal initiatives in December 1987. These included increased protection of ecologically fragile and environmentally significant coastal areas, promotion of the marine waterway system, and stimulation of waterfront investment. The first of these objectives was to be addressed through the designation of areas of environmental concern, the state's Natural Heritage Program, and ORW classification to be discussed later. Waters nominated by the EMC for study and public hearings were to receive immediate protection under state stormwater regulations which allowed only low density development on adjacent lands. Immediately following public hearings and ORW designation, a "tailor made" protection package went into effect. This included a prohibition of most point source discharges and stormwater regulation.[554] The ORW classification played a major role in the protection of coastal waters.

A year later, Governor Martin wrote the EMC asking for temporary rules designed to prevent recurrence of recent instances of deposition of medical and other wastes on North Carolina beaches. He asked the EMC to adopt a policy "that medical and other potentially dangerous substances will not be tolerated on the shores or in the territorial waters of this State." A resolution was immediately adopted to broaden the

definition of wastes and receiving waters to encompass problems of this type.[555] The 1988 dumping of medical wastes on the North Carolina coast led to new legislation a year later prohibiting such discharges. Violations were to be subject to substantial civil and criminal penalties.[556]

The incremental approval of permits for development in areas of environmental concern under the Coastal Area Management Act gave little attention to the cumulative effects on water quality. This was particularly important with respect to the control of nonpoint pollution from stormwater runoff. In 1989, the General Assembly attempted to rectify this deficiency by its approval of An Act to Require that Cumulative Impact Be Considered Prior to Issuing CAMA permits. Among other things, this legislation required the Coastal Resources Commission and the Environmental Management Commission to "act on all permits so as to prevent violation of water quality standards due to the cumulative effects of permit decisions."[557]

The same year, state legislation authorized the Coastal Resources Commission to designate primary nursery areas (PNA) and outstanding resource waters as areas of environmental concern. Public notice, opportunity for public comment, and agency review were then required for all development within such areas.[558]

Primary Nursery Areas

The Marine Fisheries and Coastal Resources commissions had asked the EMC in November 1984 to consider a primary nursery area classification and DEM was examining criteria to protect the areas by late 1984. This was reported to be the staff's "first start at coastal water protection." No PNA classification was ever adopted by the EMC, and protection was reportedly afforded through the ORW designation.[559]

Sampling by the Division of Marine Fisheries indicated that more than 75 species used the primary nursery areas. These accounted for more than 90 percent of commercial landings in recent years. Brown shrimp was the species most abundant, commercially important, and sensitive to environmental conditions and was thus used as an indicator species. Impacts to the primary nursery areas came from altered salinity regimes, pollution, and habitat destruction. The proposed standards closely paralleled

those of other tidewater classifications with the addition of standards for salinity in response to the issue of freshwater intrusion and the use of narrative standards for juvenile fish species.[560]

Neuse River

The Neuse River system continued to receive a great deal of attention into the early 1980's. The second largest river basin lying entirely within state boundaries, it encompasses a drainage area of more than 6,200 square miles from its source near Durham to the Pamlico Sound. Since 1971, there had been reports of a "dark substance" attached to nets and boats in the lower Neuse River, with the most notable occurring during the summer of 1978. The material was found to be a bloom of green filamentous algae which trapped diatoms (minute planktonic algae). The blooms were viewed as an indication of nutrient enrichment problems in the Neuse River.[561]

The Division of Environmental Management initiated an intensive ambient monitoring program in 1978 which disclosed substantial algal populations from Kinston downstream to Oriental. University research sponsored by the Water Resources Research Institute investigated factors regulating nuisance blue-green algal potentials in the lower Neuse River, the impact of pulp and paper mill effluent, and the sources and fate of nitrogen and phosphorus. In 1981, the General Assembly appropriated $100,000 for the institute to expand research on water quality problems in the lower Neuse River and the White Oak River. Water quality monitoring was continued by the Division of Environmental Management. Summer levels of chlorophyll a—an indicator of algal biomass—were found to have doubled since the early 1930's.[562]

The General Assembly enacted legislation[563] in 1983 appropriating funds for the development of a water quality management plan for the Neuse River Basin and creating a legislative commission to review water pollution problems and oversee the development of the plan, which was to be submitted by May 1, 1986. The final report was to specify

- actions necessary to reduce algal growth to acceptable levels,
- impact of discharges on water quality in the lower basin,
- steps to control harmful contributions,

- feasibility of a phosphate detergent ban in the Neuse River Basin,
- effect of such a ban on basin wide phosphorus contributions, and
- determination of the ecological health of the Neuse River with regard to water quality.

Falls of the Neuse and Jordan Reservoirs

Legislative interest in a Neuse River Basin Water Quality Management Plan was not lost on the EMC, which recognized that the Falls of the Neuse Reservoir (source of Raleigh water supply) "must be protected to prevent pollution." The commission held the view that "the entire Neuse River Basin must have nutrient controls to restore and maintain the health of the river."[564] A public hearing on the proposed reclassification of the Falls of the Neuse and Jordan Reservoirs as sources of public water supply, for recreation, and as nutrient-nutrient sensitive waters was held in August 1983. The hearing created a great deal of interest and there was extensive public participation. Only parts of the reservoirs were to be classified "A-II" for public water supply. DEM staff advised that the waters to be used for public supply would be provided adequate protection by classification at points of withdrawal only. While this limited action might have provided sufficient guidance for state actions, it led to later problems with respect to local government land use decisions, which were guided by the actual classification at the land-water interface in their areas of jurisdiction.[565]

There was broad support at the public hearing for nutrient-sensitive classifications for the entire watersheds of the Falls of the Neuse and Jordan reservoirs. The implementation strategy included immediate notification of all wastewater dischargers that further restrictions on nutrient discharges might be necessary. Nutrient controls in the Falls of the Neuse watershed were to be coordinated with basin-wide management of the Neuse River. Staff was to report back to the EMC in one year on progress.[566]

There was some apprehension on the part of several members of the EMC as to the suitability of Jordan Reservoir as a source of public water supply because of the number of wastewater discharges throughout its principal tributaries and the alleged inadequacy of A-II standards to protect the water supply with respect to toxic chemicals.

A motion was adopted on October 13, 1983, to reclassify the reservoir as a source of public water supply with the restriction that before any water could be allocated, its adequacy for that purpose must be reviewed by the EMC in light of information available at that time. As a "qualified" A-II classification, it would offer protection with respect to future wastewater discharges, while recognizing the unanswered question about water quality. A motion was adopted to forbid allocation before one year at which time staff was to report on water quality.[567]

The commission asked the staff to intensify its efforts to identify and control toxic wastes discharged to the tributaries of both reservoirs. Efforts were to include

- characterization of toxic compounds in point source discharges with modification of NPDES discharge permits where indicated,
- development of a program for a continuing review and updating of water quality standards for toxic chemicals,
- continuation and expansion of bioassay program and related enforcement actions, and
- intensification of effluent and ambient monitoring for toxic chemicals.[568]

Earlier in 1983, the secretary of the Department of Natural Resources and Community Development had formed an advisory committee of local officials responsible for watershed protection in the Falls of the Neuse and Jordan watersheds to encourage inter-governmental discussions leading to uniform land use controls to prevent further deterioration of water quality from nonpoint sources of pollution. Considerable progress was made in the initial stages, but the procedure was dropped by the subsequent administration.

Local government officials appeared before the EMC from late 1983 to early 1985 to discuss their proposed actions to protect water quality in the two reservoirs. Durham set a goal of 35 percent reduction in phosphorus discharged through a voluntary curtailment of the use of phosphorus detergents, best possible wastewater treatment through existing facilities, and a county-wide sediment control program.[569]

The Orange Water and Sewer Authority proposed watershed protection through county land use regulation, a "stringent" county erosion and sediment control ordinance,

a limit on "objectionable" discharges, water quality evaluation, and the cultivation of public awareness of public responsibility for maintaining water quality.[570] Orange County, itself, proposed limiting or prohibiting land use which would generate pollutants and measures to minimize the movement of pollutants to Jordan Reservoir. Regulatory tools were to include land-use planning and zoning, stormwater management, and best management practices for agricultural lands.[571]

Wake County proposed phosphorus removal, agricultural BMPs, adoption of a sediment control ordinance, restriction of industrial land use, and limitation of commercial development to "small neighborhood types." It proposed a minimum residential lot size of 40,000 square feet. Developers were to be urged to include swales, buffer strips, sediment traps, and other stormwater control devices. The County Planning Board was to consider amendments to subdivision regulations to add "some teeth" to urging and persuasion. County spokesmen felt "very strongly" that there would have to be some requirement that would cut across jurisdictional lines.[572]

Raleigh attempted to incorporate state guidelines for watershed protection into the city's land use plan. Its proposed watershed plan included no additional nonresidential zoning within the Falls of the Neuse watershed, restriction of residential density and impervious surface areas, tributary buffer strips, on-site controls of the first one-half inch of stormwater runoff, new zoning regulations prohibiting urban uses in sensitive areas, minimal land use for freeways and interchanges, and discouragement of wastewater discharges except where pumped from the watershed through the city's sewer system. Raleigh's mayor stressed the importance of state guidance in assuring adequate and consistent actions by local governments.[573]

By early 1985, the City of Cary had developed a plan to use Jordan Reservoir as a source of water supply. A formal application for allocation of water for this purpose was expected before the end of the year. There were several interrelated problems yet to be resolved. The earlier reclassification to A-II had been conditional pending water quality studies by the Division of Environmental Management. Related monitoring had been underway for a little over a year and a report was to be presented at the February 1985 EMC meeting.[574]

At the commission's request for full disclosure of chemicals discharged to Jordan Reservoir, DEM reported that it had made a mass mailing to all dischargers asking them for full disclosure of compounds used in the manufacturing process or which could otherwise find their way into the discharges. Similar letters were sent to municipalities asking for their review of toxic substances discharged by industries to municipal sewer systems.[575] The 1985 report on toxic substances discharged to the Jordan Reservoir watershed concluded that water quality had improved throughout the basin since the 1960's along with the upgrading of wastewater treatment facilities. However, standards for heavy metals were still exceeded in tributary waters. A number of stream segments continued to have poor biological ratings. In contrast to the streams, heavy metal standards had rarely been exceeded in the reservoir. Research sponsored by the Water Resources Research Institute identified several synthetic organic chemicals in the Haw River at low concentrations. These were thought to be of both agricultural and industrial origin. The chemicals were not found in Jordan Reservoir itself. Clearly, more data were needed on toxics in point, nonpoint, and illicit discharges to sources of public water supplies and their health effects. The report concluded that continued work needed to be done with respect to development and enforcement of toxic limits for direct discharges; minimization of toxic inputs to municipal sewer systems; and additional bioassay, biological, and ambient monitoring; and expansion of both urban and agricultural nonpoint source control programs.[576]

Local governments in the Falls of the Neuse and Jordan reservoirs watersheds routinely reported to the EMC on actions taken to control nonpoint source pollution. But, these actions varied from jurisdiction to jurisdiction, and there was a clear need for state leadership beyond that of convener and facilitator. As Dr. Raymond Burby, Professor of City and Regional Planning, UNC-CH, told the commission, "The key to watershed management is that no single party is in charge. State government needs to take the lead to bring everyone involved to the table."[577]

Wastewater discharges to Falls of the Neuse Reservoir through Knap of Reed's Creek from the Butner sewerage system, operated by the Umstead State Hospital, were of major concern. The treatment plant effluent from Butner had been shown to be

acutely toxic at times. Synthetic organic chemical (SOC) scans for EPA priority pollutants identified 13 SOCs from Durham's Northside Wastewater Treatment Plant, but most were said to be below levels of concern for aquatic or human health after mixing in the receiving stream and Falls of the Neuse Reservoir. Nonpoint sources appeared to be important potential sources of toxicants. Urban runoff was found to contribute more than 90 percent of the lead, 85 percent of the zinc, and 62 percent of the copper entering the watershed. No estimates could be made of SOCs in urban runoff because of lack of data. Streams in the Falls of the Neuse watershed were reported to be in good or good-fair biological condition except for Ellerbe Creek below Durham and Knap of Reeds Creek below Butner. The levels of metals in both streams frequently exceeded water quality standards. Water quality data for the reservoir, itself, was reported to "clearly indicate" that it was suitable for use as a source of water supply. Nevertheless, the report concluded that water quality concerns remained and that programs to control toxicants needed to be continued and strengthened.[578]

A related report the same year concluded that nutrient enrichment of Falls of the Neuse Reservoir was a primary concern. In fact, the data were said to indicate that this was one of the most eutrophic lakes in North Carolina.[579]

With respect to the Jordan Reservoir, DEM staff reported that municipal and industrial point sources of wastewater discharges had responded to the earlier request for "full disclosure" of toxic substances used in manufacturing processes or otherwise available for discharge to the watershed. None or very low levels of SOCs were reported in effluents entering the New Hope River arm of the reservoir. Additional measures had been taken or proposed by DEM to increase its knowledge of toxicants in the basin. The New Hope arm of the reservoir where water was to be withdrawn for public water supply was reported to be comparable to Falls of the Neuse Reservoir with respect to point and nonpoint toxicant sources.[580]

The EMC adopted a resolution on October 9, 1986, expressing its intent to adopt regulations covering the allocation of waters from Jordan Reservoir "as soon as possible." The commission had reached the conclusion that the reservoir had been "intensively studied and monitored" and that its review of existing water quality data had not

identified any water quality parameters which would limit its use as a water supply source, nor had it found the quality to differ significantly from other sources presently used in North Carolina.[581] The initial allocation from the Jordan Reservoir for Cary and Apex was approved in 1988 despite allegations by one EMC member that, among other things, the water was of questionable quality and there was a lack of watershed protection guidelines.[582]

Major Revisions to Water Quality Standards

In November 1984, the commission adopted major revisions to its water quality standards. At that time, three issues remained unresolved. These were the design flow for toxic substances, classification for outstanding resource waters, and the removal of the remaining exceptions for fecal coliform bacteria and dissolved oxygen.[583]

Earlier standards provided for several design flows as the basis for waste load allocation to protect ambient water quality standards. Prior to 1977, the minimum seven-day average stream flow with a 10-year recurrence interval (7Q10) was used for all pollutants. In 1977, the design flow for toxics was increased to the minimum 30-day average flow with a recurrence interval of once every two years. This meant less dilution for toxic substances than prior to 1977. A proposal to reverse the previous decision and return the toxics design flow to 7Q10 was approved in mid-1985. [584] The change was called "a critical element of the state-wide toxics [control] program." Studies had shown that the larger 30Q2 standard "could allow concentrations of toxics to periodically reach acute toxic levels for periods of four days or longer." All other states in the Southeast used the 7Q10 flow, which fell in the middle of the EPA proposed range.[585]

In further response to a requirement under the Federal Water Pollution Control Act that states review and revise water quality standards every three years, the EMC appointed an *ad hoc* advisory committee in December 1988. The committee represented business and industry, environmental/conservation groups, academic community, and local governments.[586] Its report was presented to the EMC the following February and approved for public hearings.[587] Revisions to existing water quality standards were adopted in July 1989[588] and became effective on October 1 of that year. These changes represented the first time the state had adopted standards to protect human health from

the consumption of contaminated fish tissue and included 15 specific numeric standards for carcinogens. The advisory committee was lauded by the EMC as an "outstanding example of how individuals representing divergent points of view can come together and work with the State to develop a set of balanced, effective recommendations to address a complex problem."[589]

Water Supply Watershed Protection

Increased interest in the classification of surface waters for use as sources of public water supply was evidenced by the proceedings leading to the reclassification of Falls of the Neuse and Jordan Reservoirs and Asheville's request, in mid-1984, for use of the French Broad River for this purpose. The hearing officer reported to the EMC that the French Broad River was suitable as a raw water source based on the *current EMC* regulations as well as *past and present policy* (emphasis added). This action was endorsed by the Division of Health Services. But, as the hearing officer reported, "the discharges upstream . . . are potential sources of toxic chemicals. Insufficient information [was] currently available to fully evaluate these sources and potential impact." Because of this, the hearing officer offered no recommendations. The action taken by the commission was to adopt the A-II classification, but to ask the staff to request full disclosure by the principal upstream dischargers. There were 60 wastewater discharges upstream, of which six were classified as "major."[590]

The staff reported that it had a "rough plan" for identification of toxic chemicals which it also intended to use in other watersheds. This included notification of all dischargers of the classification and a request for full disclosure of toxic chemicals which could potentially reach the A-II waters. It also included a request for dischargers to contact suppliers and obtain information on chemical composition of proprietary compounds. The division was to expand monitoring requirements, encourage dischargers to develop spill and treatment failure programs, and contact local government officials so staff could provide guidance with respect to any future industrial development in the watershed.[591] It is interesting to note that a subsequent effort by the City of Asheville to approve a bond issue for use of the French Broad River as a source of supply was

defeated by voters who shared concern about use of this questionable source of supply. Opposition groups asserted that there were better sources available.

The deficiencies of the A-II classification with respect to toxic chemicals were becoming more and more apparent. Limited budget and personnel were seen by DEM as constraints on fully answering the toxic chemical question could be addressed. The division director told EMC in 1984 that "the question of controlling toxics is a very expensive and resource-intensive activity. We have run out of resources . . . to carry out these activities in the way we should."[592]

The EMC was briefed January 10, 1985, on a proposal for the revision of water supply classifications. The A-I and A-II classifications, then in effect, offered no inducement for the control of nonpoint pollution and failed to give adequate attention to the identification and control of toxic chemicals. The EMC Water Quality Committee and staff found that local land use regulation for the control of nonpoint sources of pollution would be complementary to the state control of point sources; state action to classify waters according to risk would be meaningless without nonpoint source control; and that proposed revisions would permit the state to advocate, support, and assist local initiatives for the development and protection of safe water supplies.[593]

The committee recommended an intermediate classification between A-I and A-II where limited nontoxic discharges would be allowed. The third classification was to be similar to the A-II with enhanced control of toxics. A public hearing was authorized at its January 1985 meeting to seek public comment on the proposed A-I, A-II, and A-III classifications. The new water supply classifications, now known as WS-I, WS-II, and WS-III, were approved by the EMC on December 12, 1985.[594] They were defined according to the amount and types of point sources regulated by the state and requirements for local governments to adopt the land use control needed to control nonpoint sources of pollution. All waters previously classified A-I became WS-I. Since then, four additional watersheds have been reclassified WS-I from A-II. The WS-I waters were described as undisturbed and uninhabited or predominantly undeveloped. All other waters formerly classified A-II became WS-III. Reclassification of WS-III waters to WS-II was to be initiated at the request of local governments. This entailed a

detailed watershed protection evaluation by the state and development of the necessary local land use controls under state guidelines.[595]

The first and only WS-II classification was approved in October 1989. Big Alamance Creek in the Cape Fear River Basin was the stream involved.[596] Questions were raised at the time as to whether the land use controls proposed by one of the three counties involved met the state guidelines. Of the 157 communities using surface water supplies, 42 watersheds had the potential for the higher WS-I classification.[597]

The General Assembly acted in 1989 to require the EMC to adopt new rules establishing water supply watershed classifications and minimum requirements for the protection of surface water supplies.[598] This responded to mounting public concern for the protection of sources of public water supply in the face of escalating pressures on such watersheds from development. Considerable initiative for the legislation came from the Triangle J Council of Governments' Water Resources Committee under the chairmanship of Raleigh Mayor Avery Upchurch. The legislation also gave new life to a historic interest in water supply watershed protection—long the centerpiece of water pollution control. It provided for a cooperative program for water supply watershed protection to be administered by local governments within a framework of state minimum standards. In the event of failure of local governments to adopt and adequately manage such programs, responsibility was to be assumed by the EMC. The reduction of agricultural nonpoint source discharges was to be accomplished primarily through the N.C. Agriculture Cost Share Program. The EMC was directed to develop and adopt a system of water supply watershed classifications and management requirements. It was authorized to designate critical water supply watersheds and impose management requirements more strict than the minimum state-wide requirements. Appropriate classifications were to be assigned to all water supply watersheds in the state with applicable minimum protective standards. This extended to sources of future water supplies or improved protection of existing supplies. Provision was made for state assumption of responsibility for local programs in the event of local failure to adopt and administer a program. State grants to local governments for water supply watershed protection programs were authorized.[599]

Closely related legislation to provide for the development of a state water supply plan and for local water supply plans was also enacted in 1989.[600] Each unit of local government that provides public water services was asked to prepare a local water supply plan with technical assistance from the state. The language, however, limited such plans to readily available information and to the extent that technical assistance proved to be available. Local plans were to be revised at least once every five years. The local plans were to be submitted to the state, but there was no mention of approval authority. A state water plan, including data from local plans, was also to be prepared. It was to assess technical assistance needs and compatibility and identify potential conflicts among local programs. No time frame was given for completing the initial plans.

Outstanding Resource Waters

The Clean Water Act specified that the quality of outstanding "national resource waters" should be protected, and the EPA periodically recommended that North Carolina adopt classifications and standards to protect waters of outstanding state or national recreational or ecological significance under the federal antidegradation policy. A proposal for a supplemental outstanding resource water classification was approved on December 12, 1985. After hearings at which the EMC was asked to acknowledge the "overwhelming support" for the ORW concept and to endorse staff efforts toward its adoption and implementation. The ORW classification became effective on January 1, 1986.[601]

Outstanding resource waters were defined as waters of exceptional quality which possessed one or more of the following outstanding resource values:

- outstanding fish habitat and fisheries
- unusually high level of water-based recreation
- previous special designations such as wild and scenic rivers designation which did not provide water quality protection
- important component of state or national park or forest
- special ecological or scientific significance[602]

In acting on the first ORW classification requests, a few EMC members expressed the feeling that they needed more detailed criteria than presented in

regulations at that time. This was viewed by some persons as a delaying tactic. At the commission's January 1986 meeting, Department of Natural Resources and Community Development officials expressed their hope for more rapid progress in the ORW classification process for coastal waters.[603] The South Toe River in Yancey County was classified ORW on May 1, 1987—the first in the state. It was followed by the Roosevelt Natural Area in the White Oak River Basin. The staff was directed "to continue appropriate studies and investigations in the southern coastal area to determine suitability for ORW classification," and "to develop . . . further guidance in the form of objective criteria." A committee was established to address the meaning of ORW designation, nature of the protection, and identification of specific criteria for designations.[604]

Responsibility for the identification of coastal waters for ORW classification was divided between the Division of Environmental Management and Division of Marine Fisheries. The former was to identify high quality waters and the latter was to document other resource values such as fisheries and recreation. DEM staff was instructed to bring a list of the best shellfish resource, primary nursery areas, and submerged vegetation for nomination as ORW waters to the September 1988 meeting.[605]

Secretary of Natural Resources and Community Development Thomas Rhodes told the EMC at its September meeting that the department had developed a list of waters eligible for ORW designation. The proposed "protection package" was to involve the Coastal Resources, Marine Fisheries, and Sedimentation Control commissions as well as the Environmental Management Commission. It was ironic that the next ORW designation was for the Mitchell River in the Yadkin-Pee Dee River Basin which was later to be so disastrously impacted by sediment from land development.[606]

In December 1988 the EMC specified that ORW management schemes must declare that there be no new wastewater discharges or expansion of existing discharges and that development must provide control for a one-inch storm.[607]

In September 1989, the Environmental Management Commission was advised that Governor Martin considered outstanding resource waters classifications in the coastal region "to be a crucial component of his Coastal Initiative. The governor pledged "all

available powers of his office" for implementation. He said that support for ORW classifications at the coast "was strong and the time for action was now." The commission then approved the ORW classifications for the following coastal waters:

Alligator River Area

Core Sound including S. E. Pamlico Sound and Back Bay Sound

Western Bogue Sound and Bear Island Area

Swanquarter Bay and Juniper Bay Area

Stump Sound Area

Topsail Sound and Middle Sound Area

Masonboro Sound Area

While Lockwoods Folly River was not recommended because of water quality problems, the governor requested that a water quality management plan be developed for the river which would provide an ORW level of protection. Federal and state agencies with any responsibility for coastal waters were advised of the ORW designations and asked to provide the commission their plans to assist in the protection of ORW waters.[608] By mid 1990, the EMC had approved nine additional ORW classifications for a total of 25 throughout the state.[609]

High Quality Waters

One of the important products of the 1989 triennial review of water quality standards was a new supplemental high quality water (HQW) classification to further implement state and federal antidegradation policies. This new classification was designed to protect high quality waters which did not meet the natural resource criteria of the ORW classification. Prior to that time, the quality of all waters could be reduced to the level of quality set by the ambient standards for the primary classifications. Discharge permits could be issued until the absorptive capacity of receiving waters prescribed by the ambient water quality standards had been fully utilized. The new high quality water classification was to prevent such degradation unless degradation was found necessary to accommodate important social and economic development. Thus, under the new classification, the quality of designated waters would be maintained unless justification to the contrary could be provided.[610]

High quality waters were defined as waters of excellent quality based on biological and physical/chemical characteristics, native and special trout waters, primary nursery areas, critical habitat areas, and all WS-I, WS-II and SA waters. The designation was effective October 1, 1989. The first body of water to be classified HQW was Alarka Creek in the Little Tennessee and Savannah River drainage basins on July 1, 1990. Additional designations in the Hiwassee, Little Tennessee, Savannah, French Broad, Watauga, New, Catawba, Yadkin-Pee Dee, Lumber, Cape Fear, White Oak, Neuse, Tar-Pamlico, and Pasquotank River Basins were approved the following month.[611]

The HQW classification offered more room for negotiation than the ORW because of the provision that allowed some degradation with respect to social and economic development needs. Alarka Creek was originally nominated as outstanding resource waters. This was met with considerable local resistance because of its perceived impact on land values and development. After an investment group backed off from a land development project and ensuing opposition from county officials, the creek was classified HQW.[612]

Permits

In 1980, EPA changed its NPDES permit regulations to expand the list of discharges for which permits may be required. It also specified that certain discharges from separate storm sewers must be permitted, including all stormwater discharges in urban areas and any discharges of contaminated stormwater runoff from industrial sites. Because final best available treatment (BAT) and best conventional treatment (BCT) effluent limitations had been issued for only a few industrial categories, permits for most industrial discharges had to be based on best professional judgment (BPJ).[613]

The U.S. Court of Appeals vacated the 1980 regulations pertaining to permits for discharges from storm sewers and remanded the regulations to EPA for reconsideration. No further action was taken until enactment of the Water Quality Act amendments of 1987. These made major changes in the Clean Water Act's regulation of stormwater discharges. A large number of stormwater dischargers were relieved of an immediate obligation to obtain NPDES permits unless contributing to existing water quality

problems. The final regulations were promulgated in November 1990.[614] They required NPDES permits for stormwater discharge for all urban areas with populations of 100,000 and over. This included Charlotte, Durham, Greensboro, Raleigh, Winston-Salem, and Cumberland County. Eleven industrial groupings were also required to submit permit applications.[615]

The stage seemed to be set in 1984 for a greater emphasis on water quality-based controls and a greater role for biomonitoring. There seemed to be general agreement that something more than technology-based effluent guidelines would be needed. Estimates indicated that 20 percent of the nation's industrial plants with BAT-based permits were in violation of state water quality standards.[616]

The question of discharge of large waste loads to small streams as a policy issue had been around for a long time. In July 1985, DEM staff reviewed waste load allocations to Crabtree Creek in the Neuse River Basin, and asked the EMC to consider the question in that context. The creek had a 7Q10 (10-year recurrence interval) at Cary of only 0.3 cubic feet per second. Yet, Cary was requesting authorization to expand its Northside Treatment Plant discharging to the creek from 4 to 16 million gallons per day. Upstream, the town of Morrisville was planning an expansion from 0.2 to 5.5 million gallons per day. The 7Q10 there was zero. The issue was referred to the commission's Water Quality Committee for study.[617]

The review and issuance of discharge and nondischarge permits was a very demanding task, and the $100 permit fee was totally inadequate to meet the costs of administration. In February 1989 the EMC asked the General Assembly to authorize permit processing fees of $400 to $10,000, depending upon the costs involved. There had been a 42 percent increase in NPDES discharge permits issued between 1985 and 1986. An 11 percent increase in nondischarge permits was experienced over the same period.[618] Legislation to increase the permit fee was introduced shortly thereafter.[619] Enactment soon followed. The new ceilings were $400 for processing permit applications and up to $1500 per year for administration and compliance monitoring of individual permits. Total fee payments for any single facility could not exceed $7500 per year. The

resulting funds were to be used to eliminate the backlog of applications, improve permit quality and compliance, and decrease processing time.[620]

The General Assembly also approved legislation in 1987 to authorize the EMC to consider the financial capability and performance history of applicants for wastewater discharge permits prior to granting the permits. The act specified that the EMC "shall act on all permits so as to prevent so far as reasonably possible . . . any significant increase in pollution . . . from any new or enlarged source." There was nothing here about decreasing pollution. This was in sharp contrast to another provision pertaining to air pollution which said that the EMC "shall act upon all applications for permits so as to effectuate the purpose of this section, by reducing air pollution and preventing, so far as reasonably possible, any increased pollution."[621]

In 1989, an effort was made to improve coordination with local governments and public participation in the issuance of permits. Increased attention was to be given to publication of announcements of state intent to issue permits, and no action was to be taken on new nonmunicipal domestic wastewater discharge permits until local governments of jurisdiction had certified as to compatibility with local ordinances.[622]

Innovative permitting of wastewater discharges emphasizing waste minimization was brought to the forefront under the state's Pollution Prevention Pays Program. Probably one of the best examples was an NPDES permit issued to Texasgulf, Inc. for its phosphate mining and processing plant at Aurora in 1990. This was said to be the largest single contributor of phosphorus to the Pamlico River. The permit involved the construction of a $30 million wastewater recycling system to reduce the company's phosphorus discharge by 90 percent and fluoride by 75 percent. The system would direct the vast majority of the contaminated water into reservoirs where it would be kept until needed in manufacturing. A particularly unique feature was the participation of three environmental groups with company and state officials in drafting the permit. All participants hailed the permit as a major advance for pollution control in North Carolina.[623]

Moratoriums on Wastewater Discharges

An item of some controversy among members of the Environmental Management Commission in the early 1980's was a provision of state law[624] which prohibited the discharge of wastes to sewage disposal systems in excess of the capacity of the system to adequately treat those wastes. This authorized DEM to declare a moratorium on permits for new or enlarged discharges where treatment plants were already operating at full capacity. The moratorium idea was not popular with local governments wishing to attract new industry or other economic activity. Consequently, the law was changed[625] to authorize units of local government to accept additional wastes beyond treatment plant capacity if they had made provision for plant expansion and the additional waste would "not result in any significant degradation" in the quality of receiving waters. The debate centered on interpretation of the legislative language. Would mere application for a federal or state grant meet the financing criterion, even though long delays and uncertainty were involved? What was meant by "significant deterioration" if receiving waters were already badly polluted and the additional wastes could only extend the affected length of stream?

By mid-1982, the EMC was confronted with mounting numbers of requests for relief from moratoriums on new sewer connections or community acceptance of increased wastewater discharges in the face of inadequate treatment facilities. Some members expressed concern over the pattern of events and asked for a more definitive policy and guidelines for the staff. The central thrust of a proposed policy was that the state and local governments shared responsibility for the protection of water quality and that if the state were to approve increased discharges, local governments had a collateral responsibility to take steps to ameliorate the adverse effects on receiving waters. Such steps could include water conservation, reduction of inflow and infiltration to sewer systems, pretreatment of industrial wastes, and improved operation. All applicants were to demonstrate that they were operating wastewater treatment plants to the satisfaction of the commission and had implemented acceptable controls over the discharge of wastes into municipal sewer systems. Guidelines were suggested for the interpretation of "significant degradation." Special orders by consent were to include "best operation" of

wastewater treatment plants, and control of industrial wastes discharged to municipal sewer systems. The guidelines were adopted as a policy guide for staff who made these determination subject to review by the commission.[626]

There was a decrease in moratoriums from 118 in 1984 to 68 in 1989. Special order by consent authorizing local governments under a moratorium to accept additional wastes beyond treatment plant capacity averaged 40 per year over the period 1979 through 1989.[627]

Enforcement

Fish kills still provided the most dramatic evidence of noncompliance with water pollution control regulations as illustrated by the illegal discharge of four to six million gallons of spent yeast to the Yadkin River in late spring 1981. The episode killed more than 100,000 fish and brought prompt enforcement action.[628]

The goal of the EMC continued to be to encourage voluntary compliance. The role of civil penalties was to deter violations. Before such a penalty was assessed, efforts were made to secure compliance through site visits, discussions, and notices of violation. The fines were a last resort. The EMC delegated authority for the imposition of civil penalties to the director of the Division of Environmental Management. Violators could pay the fine, ask for an administrative hearing when there was disagreement as to the facts, or seek remission of penalties from the EMC.[629]

Despite progress in many areas, there were still examples of prolonged enforcement actions. These ranged from pulp mills at the coast and in the mountains to Piedmont communities like Butner and Rocky Mount. Stormwater or groundwater infiltration into sewers in these two communities increased wastewater volume so much that the treatment plants frequently had to let wastewater pass by untreated, with serious effects on receiving waters. As noted under "Moratoriums," exceptions were often made and expanding sewer systems only added to the problem. The Rocky Mount sewage treatment plant was unable to meet demands from the date of its construction in 1982 because of groundwater infiltration and increasing connections to the system.

The long-standing problem of Neuse River pollution from Raleigh's wastewater discharge again came to a head in early 1980, when city officials appeared before the EMC to plead for remission of a $25,000 civil penalty for violations of effluent limitations. The city did not contest the facts but argued that the fine was excessive. Staff opposed remission because the fine represented less than half of the money the city saved by not complying and the magnitude and number of "violations would have supported a substantially larger penalty." Violations involved the dumping of 723 tons of sludge in excess of authorized amounts. Sludge was said to line stream banks up to a mile downstream. The city pleaded equipment failure. The two Raleigh members of the commission were asked by the chairman for comments. They opposed remission on the basis of, as one put it, a "miserable record of abuse of the Neuse River." He felt that "the City of Raleigh ought to set an example." The other Raleigh member first questioned city officials if there was a problem with funding and when told there was not, said "that to remit the fine would be to say to the other cities and industries in North Carolina, 'Just sit it out and everything will be alright.'" The fine was sustained by a split vote of nine to three.[630]

The NPDES permit was the key to enforcement of the Clean Water Act. More than a decade after the 1972 amendments, the program still suffered from problems that prevented it from meeting its potential for effective water pollution control. In November 1980, the Government Accounting Office (GAO) reported that the enormous investment in wastewater treatment facilities since passage of the 1972 act had not produced plants that performed as expected. Three years later, GAO reported continued noncompliance and attributed the problem to inadequate enforcement action by the EPA. Two policy memoranda from EPA in 1982 directed their regional offices to settle enforcement cases in a nonconfrontational manner (voluntary compliance) and stated that the regulated community must be dealt with on a presumption of good faith. GAO expressed concern that dischargers had little incentive to operate treatment plants in accordance with their permits because meaningful enforcement was unlikely.[631]

EMC actions on remission requests were frequently viewed as inconsistent and too soft on violators. That was demoralizing to the DEM staff and brought expressions

of dissatisfaction from environmental and other public interest groups. The situation deteriorated to such an extent that the commission chairman felt it necessary on February 12, 1987, to ask another member to assume the chair so that he could more freely address the subject. He told the body that "he was in favor of assessing the complete penalty" for each remission case before the EMC at that time. He said that in his opinion, there was a lack of consistency in the manner in which the Commission acted in assessing the civil penalties.[632]

This was followed in July by a statement from the Secretary of the Department of Natural Resources and Community Development that "there appeared to be a trend . . . toward forgiving the violators." He suggested that the EMC would prefer to assess the civil penalties (rather than the Department). Staff expressed the "concern that word of the remissions would get out across the State." The staff clearly needed the commission's backing on enforcement actions or "they were wasting their resources bringing the enforcement cases to the Commission." The commission chairman then said, "The Commission must uphold the laws and regulations of the State." It "should not send discouraging signals to the staff and there is need for consistency in granting remissions of civil penalties." He saw a pattern developing wherein "a violator is sent notices of violations and they are ignored repeatedly," but when the violator is assessed a penalty, steps are taken to bring the facility into compliance. As might be expected, this showing of top level leadership reversed the trend of favorable actions on five remission requests, and denial of such requests—except under the most extenuating circumstances—ostensibly became the rule of the day.[633]

Special orders by consent (SOCs) had long been used to establish mutually acceptable schedules for bringing municipalities into compliance with water pollution control regulations. Yet, many had not been able to make sufficient progress to meet the July 1, 1988, deadline set by the Clean Water Act. During the noncompliance period, offenders had only to comply with less stringent effluent limitations. Since SOCs could not extend compliance dates beyond the federal 1988 deadline, municipal dischargers were required to either be in compliance by that date or operate under a judicial order which would allow additional time. It was anticipated in July 1987 that 35

communities would require court-sanctioned judicial orders. Staff planned to have the necessary draft orders in the hands of the state superior court within "the next few months."[634]

The use of Special Orders by Consent tended to give a more favorable impression of overall compliance than justified by the actual quality of affected waters. There could be legal compliance with the SOC but not with ambient water quality standards. Clearly, there was a need for greater public awareness and participation in the process. In 1989 the General Assembly enacted legislation to provide for public notice of proposed SOCs and for public meetings concerning such orders if the EMC determined there was a significant interest. This was expected to open up the process to public review and response.[635]

A 1987 Act to Establish Penalties for Failure to Remove Prohibited Discharges authorized civil penalties up to $5,000 for the intentional or negligent discharge of hazardous substances by any person who permits the discharge of oil, fails to report, or fails to comply with orders issued by the EMC. Every act or omission which caused, aided, or abetted a violation was to be a separate violation.[636] A related Act to Establish Penalties for Prohibited Discharges authorized fines of $15,000 per day, up to a total or $200,000, for the willful or negligent violation of classifications, standards, or limitations pertaining to the prohibited discharges of radiological, chemical, or biological warfare agents.[637]

Water Quality Planning and Trends

The Clean Water Act required each state to have a continuing planning process (CPP) which described the processes and procedures used in water quality planning. The first CPP for North Carolina was approved February 14, 1973. The most recent plan was submitted to EPA in 1985. The purpose of the 1985 plan was to explain how North Carolina managed its water pollution control program.[638]

Many changes had occurred in the state's Water Pollution Control Program since earlier submissions—the last being in 1976. The completion of area-wide planning (208 program) had brought increased attention to nonpoint source pollution. The trend was reinforced by progress that had been made with point sources through federal and state

construction grants and loans programs. Aggressive new programs in the fields of pollution prevention, nutrient sensitive waters, and toxic substances had advanced the overall program. There had also been negative changes in the form of reduced federal funding and cessation of 208 area-wide planning grants.[639] A de-emphasis on river basin planning was evidenced by the demise of the Federal Water Resources Council and the loss of funds for this purpose under the Reagan Administration.

The Division of Environmental Management's program plan for the period October 1, 1983, through September 3, 1984, disclosed that pollution from point source discharges of wastewater continued to be a significant cause of water quality degradation. There was to be a continued focus on several degraded stream segments to improve water quality and to evaluate and document the improvements to demonstrate that the expenditure of pollution abatement funds resulted in tangible water quality improvement.[640]

The plan reported that portions of coastal waters were being threatened by eutrophication, organic pollution, freshwater intrusion, and bacterial contamination. Special efforts were to be directed toward the development of management strategies to protect and enhance coastal waters. Inland, continued attention was to be given to eutrophication of Falls of the Neuse and Jordan reservoirs, which were viewed as important water resources for central North Carolina. An intensive effort to evaluate the occurrence of Hydrilla and other "aquatic weeds" and the best methods of control was to continue.[641]

A review of water quality monitoring data from 75 ambient stations in 1983 showed excellent quality at 13 sites, good quality at 13, good to fair quality at 29, fair quality at 25, and poor quality at 5. The classifications were based on taxa richness criteria and field observations. Trend analysis was possible at 40 of the 75 sites on the basis of biological information. While trends were positive at only seven sites, no negative trends in biological integrity were discernible. Sediment chemistry data suggested potential contamination at several stations. The Catawba River at South Belmont had elevated sediment concentrations of mercury, arsenic, chromium, and copper. Other sites with elevated sediment metal concentrations were the Cape Fear

River at Lillington and Kelly, the Neuse River at Clayton and Kinston, Uwharrie River near Uwharrie, the Rocky River near Norwood, Sugar Creek near Fort Mill, S. C., the Pee Dee River near Rockingham, and the Northeast Cape Fear River at Castle Hayne.[642]

Substantial state progress in meeting the goals of the Clean Water Act during 1982 and 1983 was reported in 1984. Nearly all freshwaters and tidal saltwaters had been classified to meet the fishable/swimmable goals of the act. Approximately 80 percent of streams, rivers, and lakes were said to be meeting water quality standards for their designated use. About 85 percent of the two million acres of tidal saltwater estuaries were open for shellfishing. However, coastal waters were believed to be seriously threatened by extended conversion of natural forests to agriculture and silviculture and by the extensive real estate development along coastal waters.[643]

Biological monitoring at 94 of the state's 346 ambient monitoring stations during two summer months in 1983 did not give as favorable results as the water quality index, which was based upon routinely analyzed parameters. Bioclassification results were reported as follows:

Bioclassification	Percent of stations
Excellent	5
Good	14
Good-Fair	40
Fair	31
Poor	10

A positive trend in water quality was indicated at six stations and a negative trend was suggested at three stations.[644]

North Carolina's first state-wide assessment of surface water quality was released in 1985. It was intended to serve as the basis for review and improvement of the state Water Quality Management Plan and as a source of information on water quality in North Carolina for the public. It was the first to bring together the Division of Environmental Management data base with those of other state agencies. Stream segments were characterized by their biological condition as well as their traditional

physical and chemical state. Overall, the water quality in most streams was said to be good. Many streams had not yet been impacted by man's activities. But others had been degraded to an unacceptable degree. A graphical summary of conditions in each river basin is presented in Figure 7.[645]

The report "Water Quality Progress in North Carolina in 1986 and 1987" updated the 1985 state-wide water quality assessment. Of North Carolina's 37,000 miles of fresh water streams, nearly 61 percent were reported to fully support designated uses. See Figure 8. Approximately 25 percent of the streams partially supported and five percent did not support such uses. The remainder was not evaluated. River basins in the mountains tended to have the highest proportion of use-supporting streams because of less development in that region. Nonpoint sources accounted for 92 percent of stream impairment, and agriculture was cited as the principal source, with sediment the major pollutant.[646]

Lakes and reservoirs fared well in the assessment with 96 percent of the total surface area said to fully support designated uses. Coal-fired power plant discharges to two reservoirs (Hyco and Belews) were collectively the major cause of use nonattainment because of excessive selenium levels.[647]

Estuaries and sounds fared better than streams and somewhat worse than lakes and reservoirs, with 93 percent of the coastal area fully supporting designated uses. Major sources of impact were agriculture and municipal wastewater treatment plants.[648]

At the end of 1987, there were 2,606 active point source discharges of reported wastewater in the state. Of these, 120 were classified major municipal wastewater treatment plants and 94 as major industrial. New or expanded programs to reduce the impact of point sources included toxicity reduction, permit fees, an emergency operating fund, general permits, nutrient removal requirements, and expanded toxicant monitoring. The agenda to control these sources included expanded coastal stormwater management, watershed protection, the agricultural cost-sharing programs. and new monitoring and planning efforts.[649]

Biological data collected at 77 locations in 1988 indicated positive changes in water quality over earlier years: about 64 percent of the sites were given an Excellent or

Good classification. Fifteen locations were assessed as fair or poor. Sampling sites were located so as to assess overall basin quality. The findings are summarized by river basin in Table 6.[650]

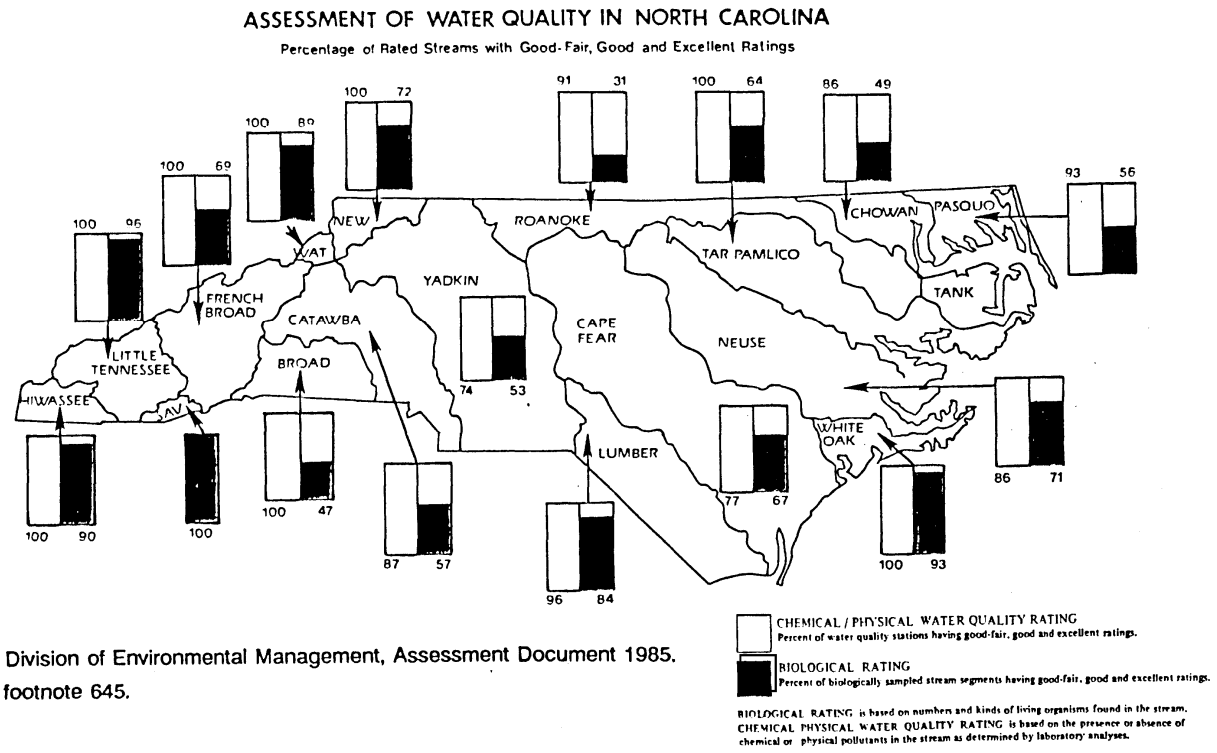
Table 6 Bioclassification of Representative Sites–1988

REGION	TOTAL NUMBER	EXCELLENT	GOOD	GOOD/ FAIR	FAIR	POOR
MOUNTAINS						
French Broad	9	2	3	2	-	2
Hiwassee	2	1	1	-	-	-
Little Tennessee	3	1	1	-	1	-
New-Watauga	4	3	-	1	-	
Savannah	1	1	-	-	-	-
Total	19	8	5	3	1	2
MOUNTAIN-PIEDMONT						
Broad	2	1	-	-	1	-
Catawba	9	1	3	2	2	1
Yadkin-Pee Dee	8	3	3	1	1	-
Total	19	5	6	3	4	1
PIEDMONT-COASTAL						
Cape Fear	11	1	4	3	3	-
Neuse	7	-	4	1	1	1
Roanoke	3	-	3	-	-	-
Tar-Pamlico	4	-	2	1	1	-
Total	25	1	13	5	5	1
COASTAL (+SANDHILLS)						
Chowan	1	-	1	-	-	-
Lumber	4	3	1	-	-	-
White Oak	1	-	1	-	-	-
Total	6	3	3	-	-	-

Source: N.C. Division of Environmental Management 1989. See footnote 650

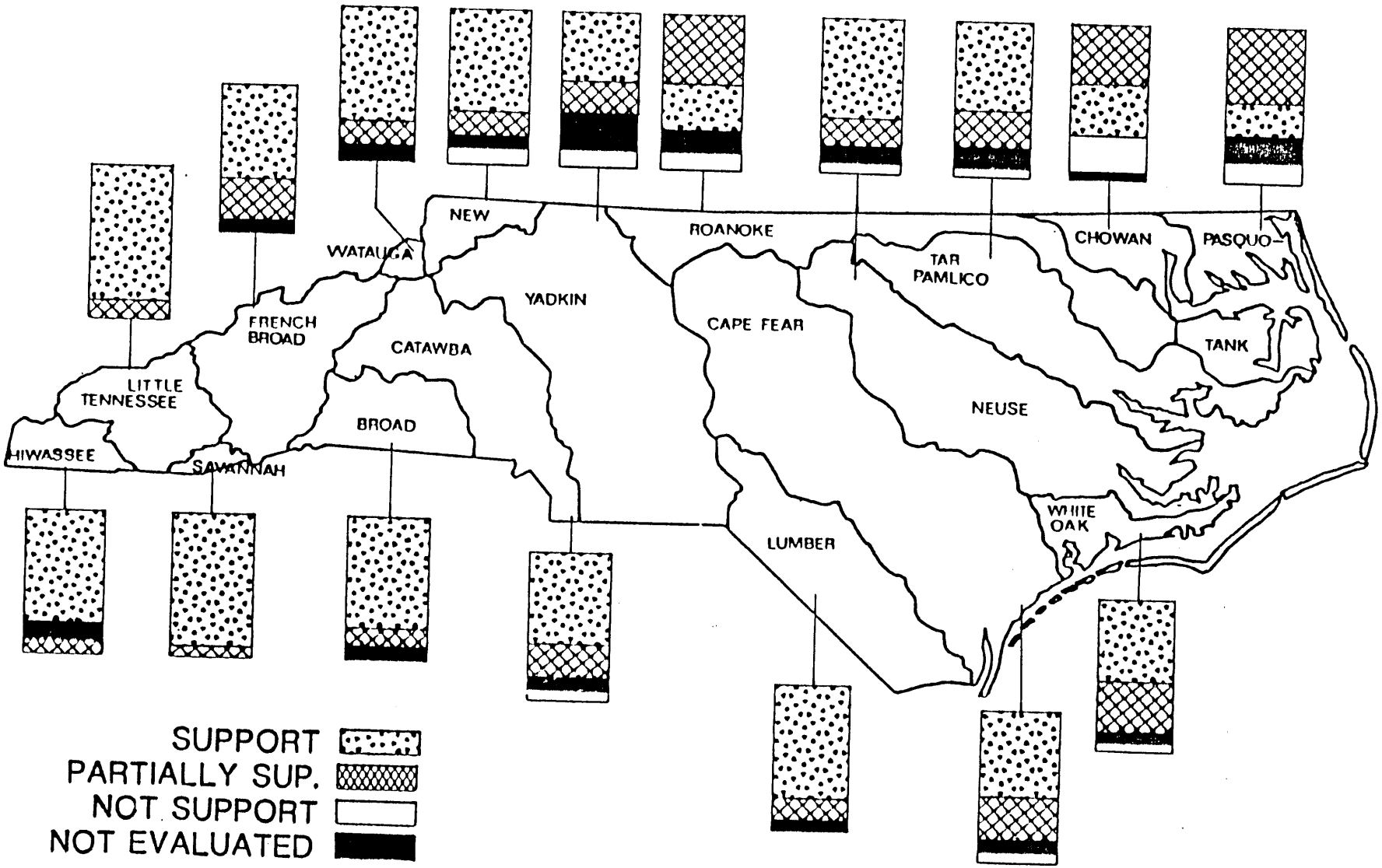
In its water quality management plan for fiscal year 1988, the Division of Environmental Management emphasized the reduction of the backlog in processing NPDES permits, control of toxic substances, control of nonpoint source pollution, greater efficiency in monitoring, timely completion of compliance inspections, revision of

Figure 7. Assessment of Water Quality, 1985



Source: N.C. Division of Environmental Management, Assessment Document 1985. See footnote 645.

Figure 8. Percentage of Stream Miles Supporting Designated Uses, 1986-87



Source: N.C. Division of Environmental Management, Water Quality Progress in North Carolina 1986-1987. See footnote 646.

state water quality standards, and staff training. An improved means for measuring the effectiveness of the state's water pollution control program was also on the agenda. The construction grants program planned to continue to place a high priority on projects needed to bring publicly owned wastewater treatment works into full compliance with water pollution control regulations.[651]

Research

Research and studies by state agencies, universities, and industry have been important components of the state surface water quality program. The need for greater understanding of the phenomena involved in maintaining water quality in an era marked by a rapidly growing and changing society and sharp reductions in appropriations, could hardly be overemphasized. Costs will continue to rise as funds available for water quality management fall, creating increasing demand for more efficient and effective mechanisms for maintaining water quality in the years ahead.

The Water Resources Research Institute has been an important source of new information during its 25-year lifetime. Of its 248 research reports published through 1989, the vast majority have addressed water quality problems ranging from eutrophication to monitoring. Its research priorities for 1989–90 programs were water supply, waste management, surface water quality and groundwater. High among its research objectives during that period were assessment of threats from synthetic organic chemicals, wastewater treatment and disposal of waste residuals, and impacts from stormwater runoff on streams and coastal waters. Special attention was being given to toxic substances and the potential threat to drinking water from agricultural chemicals.[652]

A New Home in State Government

The sharing of responsibility for water pollution control by the Division of Environmental Management within the Department of Natural Resources and Community Development and the Division of Health Resources in the Department of Human Resources continued to be a problem for the regulated community. At its February 1988 meeting, the Environmental Management Commission adopted a

resolution that "supports the concept of combining all environmental and environmental health programs along with natural resources program into a single state agency."[653]

Continuing interest in multiagency involvement in water quality and other environmental programs led Governor Martin to propose consolidation of environmental programs into a new department. This was formalized by the General Assembly in 1989 through an Act to Create a Department of Environment, Health, and Natural Resources.[654] An important feature of this legislation with respect to water supply and water pollution control was to bring environmental management and environmental health together under "one roof," with the expectation that duplication and overlap might thereby be diminished. The divisions and their principal policy making bodies, the Environmental Management and Health Services commissions, remained separated, however. Experience and time will be needed to demonstrate the efficacy of this, the latest of a long series of reorganizations.[655]

Epilogue

Many unsung heroes labored hard and long to move North Carolina to the forefront of state water pollution control programs. It is due to their efforts that North Carolinians can now enjoy the use of clean streams throughout much of the state. Yet, a great deal of work remains to be done to cope with problems inherited from the past and new challenges of the future associated with a mounting population, economic growth, and technological change.

Resources to cope with stream pollution have sharply diminished in recent years. Yet, the problems grow more complex. New industrial technology must encompass waste management as a part of the production process. Pollution prevention must become a priority component of industrial waste management. All levels of government must insist that water quality protection and enhancement be an integral part of all planning and actions. Costly remedial actions can be avoided if water quality management assumes its rightful place in the hierarchy of private and public planning.

A great deal of the difficulty faced in the past had its roots in a lack of understanding of what lies behind the protection of water quality. This calls for vastly more education at all levels. Not the least important educational tool is the firm, prompt, and impartial enforcement of water pollution control laws and regulations.

The road ahead will be as demanding as the road behind, and the state's commitment to clean streams must continue.

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