

Annual Report • 1969

Delaware River Basin Commission





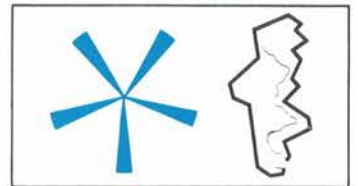
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**Cover**

Protection of the rich environmental qualities of the Delaware Bay area and balanced water-land-wetland development are goals of a proposed Commission study. Cover shows one of a score of picturesque winding marsh-area streams draining into the Bay from Cumberland County. Contrasting scenes in the Bay area are (above) along western shore of Cape May County and (opposite page) Artificial Island in Salem County, where construction of a nuclear power station is under way.

Aerial photography by Leigh Photographs



# Introduction

This is the report on the activities for the year ending June 30, 1969 of the governmental mechanism charged with carrying out the responsibilities for protecting, planning, developing and managing the water resources of the 13,000-square-mile river basin under authority of the Delaware River Basin Compact enacted in 1961.

The signatories to the Compact are the United States Government and the four states in which the basin area is situated — Delaware, Pennsylvania, New York and New Jersey. It is the only full-partnership interstate-federal agreement in the nation for water or any other purpose, and the Commission is the only operating agency with the signatory governors serving as members. The federal member is appointed by the President.

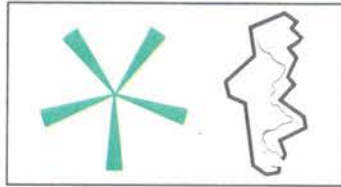
The Commission's jurisdiction covers the full range of water resource management — flood protection, water supply, pollution control, hydroelectric power, recreation, fish and wildlife enhancement and others. Only navigation is excluded.

In the hope that it reflects the wise use of the tools it has been equipped with, the Commission's seventh annual report is presented respectfully to the 7 million persons residing in the valley, and to the Legislative branches of the four signatory states and to the Congress.

# The Commission • 1969



Governor Peterson, Governor Shafer, Governor Rockefeller, Secretary Hickel and Governor Hughes



*Chairman*

**Nelson A. Rockefeller**

*Governor of New York*

*Vice Chairman*

**Richard J. Hughes**

*Governor of New Jersey*

**Russell W. Peterson**

*Governor of Delaware*

**Raymond P. Shafer**

*Governor of Pennsylvania*

**Walter J. Hickel\***

*U. S. Secretary of Interior*

\*U. S. Member appointed by the President  
Governors serve ex officio

## Alternate Members



Mr. Kilborne



Mr. Adams



Mr. Jacobs



Dr. Goddard



Mr. Van Wegen

**R. Stewart Kilborne**  
**H. Mat Adams**  
**Harold L. Jacobs**  
**Maurice K. Goddard**  
**Paul M. Van Wegen**

*New York*  
*New Jersey*  
*Delaware*  
*Pennsylvania*  
*United States*

## Advisors

**Maurice M. Feldman**

*New York*

**Samuel S. Baxter**

*Pennsylvania*

**Col. James A. Johnson**

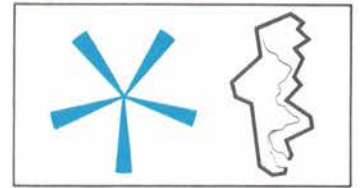
*United States* 2

# The Staff



Mr. Wright (left), Mr. Whitall, Mr. Thompson, Mr. Peeck, Dr. Miller

- James F. Wright** *Executive Director*
- William Miller** *General Counsel*
- W. Brinton Whitall** *Secretary*
- Dawes Thompson** *Public Information Officer*
- Arthur E. Peeck** *Chief Administrative Officer*



# Planning Division



Mr. Howlett

- Herbert A. Howlett** *Chief Engineer*
- J. W. Thursby** *Staff Economist*
- John W. Kelley** *Staff Biologist*
- Ralph Porges, Head** *Water Quality Branch*
- Robert L. Goodell, Head** *Operations Branch*
- Theodore Briganti, Head** *Project Review Branch*
- C. H. J. Hull, Head**
- V. Stevens Hastings, Assistant Head** *Program Planning Branch*



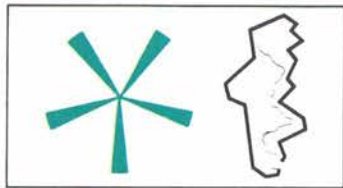
Dr. Kelly, Mr. Thursby



Mr. Goodell, Mr. Porges, Dr. Hull, Dr. Hastings, Mr. Briganti

# 1968-69 • Review

Programs expanded and scope broadened;  
pollution control stepped up; Bay protection  
pursued; "Scenic" Delaware studied



In its seventh year of performance, the Delaware River Basin Commission has sought out and found a deepening role in bringing better balance to the employment of the four-state valley's water resource endowment.

Sharp acceleration and growth were recorded in virtually every phase of the Commission's already extensive water quality activities, and some new ones were added. Efforts aimed at assuring sound future surface and ground water supply management were expanded. Participation in the planning of federal reservoir projects was increased. More research to solve the fisheries problems of the heavily worked river was initiated. Data collection and analysis, basic tools of water management, were stepped up in program after program.

These and other enlarged efforts begun in earlier years contributed heavily to the Commission's 1968-69 production. But they do not tell the other part of the story — that of the broadened scope embarked upon in many aspects of the Commission's multi-purpose resource work.

Experience and the fortuitous absence of a drought or other emergencies have enabled the Commission staff to give more attention to concerns such as long-range preservation and protection of resources. Falling within this class are the protection of the rich estuarine qualities of lower Delaware Bay, preservation of much of the upper Delaware as a scenic river and, in response to persevering conservationists, retention of Sunfish Pond in its natural state.

The past year also has seen the Commission establish or sharply enlarge its involvement — for the first time to this extent — in helping subsections of the four-state, 13,000-square-mile river basin overcome their local water problems.

For example, the Commission has been welcomed into fast-developing areas on both sides of the river to work on disposal of their wastes on a regional basis. It has helped vitalize and in some cases organize small watershed associations for better local water management. It has been called in for planning, consultation or assistance on county water supply matters. And it is being urged to become involved in the severe land use problems facing a mushrooming resort region.

For the first time in its seven reorganizations, the Commission seated two new members. At the annual meeting held in Philadelphia in April, Stewart L. Udall



Mr. Northrop



The late James H. Allen

was succeeded as the United States Member by the new Secretary of the Interior, Walter J. Hickel, and the new Governor of Delaware, Russell W. Peterson, took over his state's seat from the former Chief Executive, Charles W. Terry Jr. The only remaining original 1961 member, Governor Nelson A. Rockefeller of New York, became 1969 Chairman, and Governor Richard J. Hughes of New Jersey followed him as Vice Chairman.

Retirement from federal service in February by Vernon D. Northrop, one-time Philadelphia City Managing Director who had been instrumental in the creation of the Commission, left two of the original five Alternates still serving — H. Mat Adams of New Jersey and Forests and Waters Secretary Maurice K. Goddard of Pennsylvania. Mr. Northrop had served as Secretary Udall's Alternate for seven years.

The new U. S. Alternate is Paul M. Van Wegen of Pennington, N. J., long-time president of the Stony Brook-Millstone Watersheds Association in the Raritan River Basin, a charter director of the Water Resources Association of the Delaware, and a veteran local office holder and advisor on resource matters to volunteer and government organizations.

The death of James H. Allen, for many years director of the Interstate Commission on the Delaware (INCODEL) that was forerunner to the Basin Commission, was memorialized at the annual meeting. As INCODEL director, Mr. Allen had been a key figure in the pollution abatement programs on the Delaware from the 1930s.

Vital advances that will help lead to the upgrading of water quality in the polluted lower Delaware were made this year. They included assignment of specific pound-wasteload allocations to the 91 industrial and municipal dischargers along the estuary, followed by approval of the first groups of abatement schedules under which dischargers set forth specific dates for steps toward compliance.

The Federal Water Pollution Control Administration's evaluation of the Commission's abatement program called the discharger allocations its "most dramatic gain." It added: "This is the only place in the country where such a procedure is being followed. Hopefully, it will provide a model for other regulatory agencies."

The Commission began implementing a firm new policy promoting regionalized handling of wastes by launching a \$1.37-million engineering study of one such system and helping to plan others. It also activated an aggressive



Seventh annual reorganization meeting in progress on April 10, 1969 at Philadelphia.

program of cleanup and prevention of oil and other spills, supervised a comprehensive pollution surveillance program throughout the estuary, and readied a massive report on sewerage and water supply problems in the tri-state Tocks Island region.

Both water and shoreside land resources along the still sparsely exploited lower Delaware Bay are being threatened with the same fate as the super-developed upper estuary. Working with other agencies and the Water Resources Association, the Commission has designed a study of biological, water quality and land use problems that hopefully will lead to a strong bay control organization and program. The Commission is searching for financial and academic assistance from foundations and universities for the project.

The beautiful upper Delaware River from Hancock, N.Y., to Matamoras, Pa., is a candidate for inclusion in the new National Scenic and Wild Rivers System. A federal-state-Commission task force has begun an 18-month detailed investigation of the 76-mile river reach for the consideration of Congress and the Executive Branch.

Under the new National Flood Insurance Program, property owners along flood plains are eligible for insurance protection, but only if land use controls are established by states, local communities or other agencies, who must give assurances that permanent land use and control measures will be adopted next year. The Commission notified the program's administrator that the Corps of Engineers, U. S. Geological Survey and the Commission, in our joint flood information program, already have mapped some 250 miles of flood plains in the Delaware Basin, with more in progress. As a result of this work there will be savings of both time and money in developing insurance programs and rates for Delaware Basin communities. It is planned that some of the requirements will be met by the Commission, but others, such as establishment of land use controls on flood plains, must be met by local action.

Public agencies of all varieties are being urged to be alert to means by which their programs can be geared to benefit citizens of low income status. Commission endeavors along this line will, of necessity, be largely indirect, but it is committed to explore prospective

resource activities that could respond to the needs of the poor, perhaps through urban oriented recreation projects.

The Commission's two-year, \$400,000 project of restoration of the wing dams that help make the Lambertville-New Hope area a popular outdoor recreation and tourist attraction was completed early in the report year. Under an agreement made several years ago between former Governor Scranton of Pennsylvania and Governor Hughes, the states provided the funds under which the Commission carried out the project.

Plans for 120 water-related projects submitted by commercial or private organizations, public agencies and others were cleared by the Commission for construction. They were reviewed and in some instances modified to assure that no harmful effects were threatened to water resources. Industrial and public water supplies, including wells, accounted for 94 of the total, which also included 10 sewerage projects and six industrial waste facilities. This was a drop of 65 below 1968, with the principal falloffs occurring in public and private waste projects.

The Commission's general administrative budget supporting 10 basic planning programs for fiscal 1969 totaled \$1,245,083. This amount included \$6,083 of federal grant funds not originally anticipated. The agency's expenditures and encumbrances amounted to \$1,229,391, leaving an unexpended balance of \$15,692, of which \$15,000 was authorized to support the budget for fiscal 1971. The capital expenditure program of \$2,000 toward future water supply obligations was continued.

Special programs and projects financed outside regular appropriations channels cost \$210,906. They included the Tocks Island Fish Research Study, the Tocks Island Region Environmental Study, renovation of the Lambertville-New Hope Wing Dams and the three-year Salem-Gloucester Regional Waste Study. Except for the last of these, all were initiated in prior years.

Audits of the Commission's financial records were completed by an independent firm as required by the Compact, and a grant audit was conducted by the U. S. Department of Interior in connection with the Tocks Island Environmental Study.

There were two vacancies at year-end on the staff of 52 authorized positions.

# Water Quality

The Delaware River Basin community has just worked its way through the fourth consecutive productive year in the gradual, costly, difficult and sometimes frustrating struggle of living down the river's reputation as one of America's dirtiest.

A U. S. Public Health Service report issued in 1966 found the river's overburdened estuary — the 86-mile stretch from below Wilmington to Trenton — to be "a polluted waterway which depresses esthetic values, reduces recreational, sport and commercial fishing, and inhibits municipal and industrial water use."

This important if uncomplimentary document, probably more than anything, represented the turning point for the polluted, oxygen-shy lower Delaware. Its findings of degraded conditions and extensive options for improving them (and surprisingly even for not improving them) startled the three-state area and spurred it into a solemn cleanup commitment.

Within a year, the basin states and federal government, acting through the Delaware River Basin Commission as their regional resource mechanism, broke the ice of inaction. The Commission enacted the most comprehensive water quality standards of any interstate river basin in the nation, keyed to such uses as water supply and public consumption, fisheries enhancement and water-contact recreation.

By 1968, extensive basin regulations translating the 1967 standards into the actual effluent requirements had been adopted. The regulations provided that to meet the standards, current discharge of oxygen-consuming wastes to the estuary must be chopped by two-thirds to 322,000 pounds daily through high secondary treatment, and further divided this total among four estuary zones in accordance with their respective assimilative capacities.

## Action in 1969

The year covered by this report, 1968-1969, added

## Dischargers receive wasteload allotments and submit abatement plans; some appeal; action taken on regionalization, spills

substantially to the progress since 1965. Principally, it brought the issue of the amount of pollutants that may be piped to the river directly to the individual discharger.

As the year commenced, each zone's acceptable load of wastes was again subdivided — this time into each industrial and sewage treatment plant's equitable share of his zone's allowable load. A 10 per cent reserve was withheld for future growth.

The management of each of 91 industrial and sewage treatment plants was formally put on notice that the river's waste consumption capacity was being exceeded and notified of its plant's tentative maximum allowable organic discharge.

This action represents the first such division of an important river's waste assimilative capacity among its waste dischargers.

Several tentative allotments were adjusted at conferences of dischargers with Commission and state personnel prior to the assignment of final allocations. Of the 91 dischargers, 67 (or 74 per cent) ultimately accepted their assigned shares.

Including six appeals later withdrawn, hearings before special Commission-state boards were requested on 24 contested allocations. At year-end, 16 appeals were pending, among them that of the City of Philadelphia, the biggest discharger of all with three giant sewage treatment plants.

## Abatement schedules

In its role of regulatory agency, paydirt for the pollution control program of the Delaware Basin Commission rests, in a large sense, in winning compliance from dischargers with the standards, regulations and load allocations.

For the Delaware Estuary, such progress is reflected in the approval of pollution abatement schedules, which is the



followup step to setting load allocations. In 1968-69 the Commission voted approval of 18 abatement schedules, each comprising a timetable from early engineering to full-observance operation. By early in the forthcoming year, compliance scheduling for most dischargers is expected to be complete.

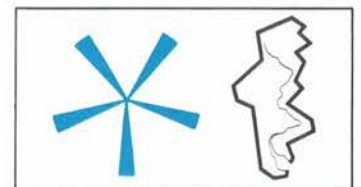
Largest dischargers whose schedules were approved are the City of Wilmington and Sun Oil Co., both slated to be in full compliance in 1973. One municipality, Burlington City, N. J., already is in conformance. Others with sewerage schedules approved are Marcus Hook, Eddystone and Morrisville Boroughs, Darby Creek and Lower Bucks County Joint Authorities, and Bristol Borough and Township, all in Pennsylvania. Schedules also were affirmed for sizeable industrial discharges of Allied Chemical Corp., Gulf Oil Co. and Sinclair Oil Corp.

Of course, the ultimate realization of a pollution control program lies in the measurable improvement of the stream, but attainment of this pleasant result probably must be reserved until the early-to-mid-1970s.

### Regional waste solutions

Promotion of centralized collection, conveyance and treatment systems to serve the waste disposal needs of multiple dischargers within sub-basins or other logical regions in the valley became an official policy obligation of the Commission. Under the policy, the Commission may require regionalized operations where appropriate or itself move in to plan, finance, build and/or operate such systems where local interests are unable or unwilling to act.

Advantages of economy, efficiency and easier pollution control combine to make regionalized operations such as those already functioning in Philadelphia and Wilmington highly desirable. Along the estuary alone, eventual



consolidation of perhaps 100 discharges into up to a dozen plants is viewed as a possibility.

The Commission launched the preliminary engineering phase of a regional system for much of the shoreline of Salem and Gloucester Counties in South Jersey and neared completion of a big sewerage report on the Tocks Island Region Environment Study.

The Commission also undertook preliminary engineering feasibility studies on a similar regional facility on the opposite side of the river for collecting wastes from portions of Delaware County, Pa., south of Philadelphia, and from New Castle County, Del., and treating them near Marcus Hook, below the Delaware-Pennsylvania boundary. Such a facility could be a boon to the area's industrial community. Efforts that may develop in other parts of the estuary region and on the Musconetcong River in Northwest Jersey and on reaches of the Lehigh and Schuylkill Rivers in Pennsylvania also fall within the scope of the regionalization policy.

### Nontidal pollution

The Commission's water quality staff is beginning to direct more attention now to the less severe but often threatening problems of the nontidal regions of the basin.

Aside from working on regional waste promotion in the nontidal problem areas, action is slated on securing abatement schedules from all dischargers on interstate streams — those forming or crossing state boundaries. Basin regulations call for 85 per cent removal of oxygen-absorbing wastes from these effluents, yet few dischargers are in compliance. Continued commercial and residential development of these regions will degrade present good stream quality unless waste treatment practices are improved sharply. Similarly, Commission attention is in store for delinquent dischargers on purely intrastate streams, with state agency cooperation.

# Pollution Spills

## Mop-up and preventive measures taken; petroleum hazards get special attention

One of the vexing and persistent water pollution problems is that of spills — discharges of pollutants from on-shore or ship storage or transfer facilities. In contrast to the conventional waste discharge, neither the time, character nor location of the next sniper-like spill is predictable.

The section of the basin most frequently hit by spills is the heavily industrialized estuary region. And the most commonly spilled substances are petroleum products, which are largely insoluble but not as highly toxic as less often spilled chemical commodities.

Over the past decade there have probably been hundreds of spills. Fewer than 100 were reported to water agencies in that time, but 40 of these were in the past year of increased awareness. Oil spills have ranged from small slicks to nearly a half-million gallons, and the evidence is that virtually all have been accidental.

Spills result from tanker collisions, accidental or deliberate discharges to sewers or storm drains, accidents at industrial installations, mishaps in loading or unloading barges and tankers, accidents involving tank trucks and rail cars, and leaks from oil heating facilities. They hit both main stem and tributaries, contaminate and in some instances shut down municipal or industrial water supplies, damage marinas and other waterfront property, impair fish and wildlife, and hurt boating, fishing and other recreation. Victimized small streams sometimes take years to recover.

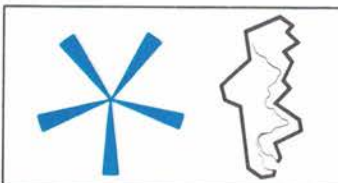
Since its early days, the Commission has used its authority for reviewing proposed projects to enforce anti-spill precautions, including shutting down construction

on a transcontinental petroleum pipeline pending installation of safety devices and materials at stream crossings. Also, the Commission in 1964 established an alerting system to notify downstream users of threatened hazards to their supplies — once employed as a public health alert that raw sewage was being dumped in the river during a regional power blackout.

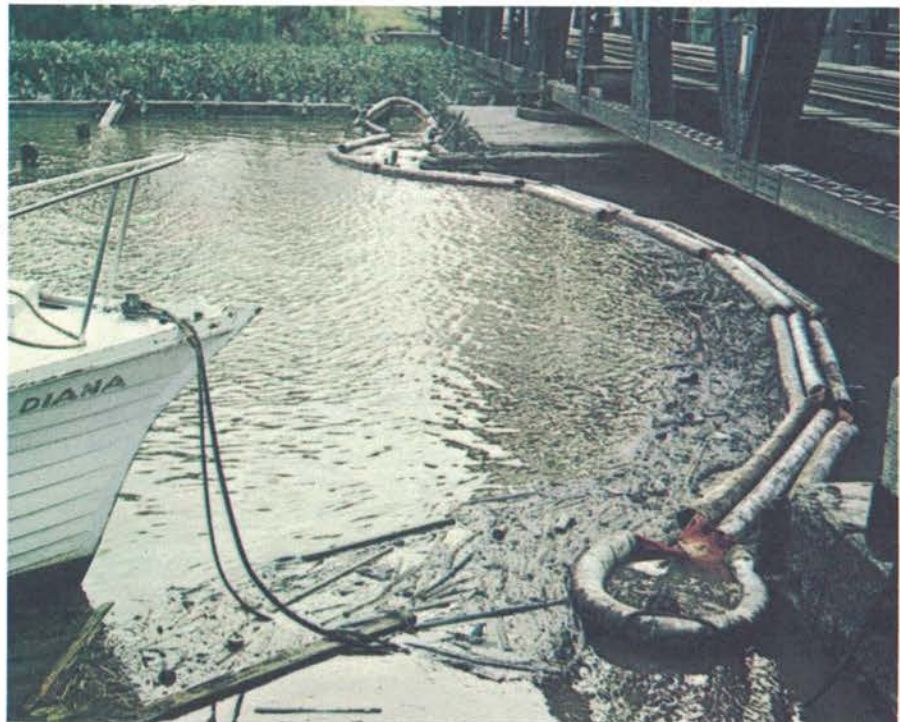
In January 1969, the Commission authorized the staff to provide emergency spill cleanup services, including purchase of absorbent "straw dam" equipment and other materials, hiring of labor, contracting with outside organizations or agencies for abatement services, and recovery of costs from parties responsible for spills.

Additional current and prospective precautionary and remedial provisions include arrangements with agencies for standby emergency cleanup crews; a survey of such potential hazards as sewerage plants without auxiliary power; mapping of all petroleum pipelines in the basin to help in the work of fire and civil defense units as well as water agencies, and formation by the seven basin refineries and others into an industrial Oil Control Coordinating Committee which already has played a key role in helping public agencies keep a Chester Creek oil spill from entering the Delaware.

The Commission and cooperating groups also are promoting storage and other standby facilities to prevent dumping of wastes during emergencies, and encouraging industries and pipeline owners to institute "fail-safe" systems such as emergency shutdowns, diversions, or storage arrangements to keep hazardous materials out of streams.



This was the aftermath of a sizeable oil spill on Chester Creek this summer.



# Tocks Area Protection

## Water-sewerage study toward preserving environmental quality nears conclusion

Finishing touches were in progress as the year ended on a document that will have a heavy impact on the future of the tri-state area around the Tocks Island Reservoir and the Delaware Water Gap National Recreation Area.

The document will be the report of the Tocks Island Region Environmental Study (TIRES), which was begun in 1966 as a cooperative effort coordinated by the Commission and involving state and local agencies in New York, New Jersey and Pennsylvania, the six-county Tocks Island Regional Advisory Council, federal agencies, and a substantial federal grant.

The project is primarily intended to prepare for development of a liquid-waste disposal system capable of preserving the good quality environment of the 1,000-square-mile area as its rapid development continues and even accelerates through the 1970s and afterward. Water supply and solid wastes that affect water resources are other study elements.

The report will recommend one of these five liquid waste disposal alternatives:

- More than 100 relatively small separate sewerage systems; three combinations of subregional collection-treatment systems with highly treated effluent discharged to the Tocks Island Reservoir and below the damsite; or a network of collection and conveyance works with a single treatment plant on the Delaware River downstream of the Tocks Island dam.

With the technical work largely completed and preparation of the final report well under way, the Commission has endeavored to stimulate early consideration in the study region of some of the ramifications it will be wrestling before long.

Final cost estimates are not known yet, but it is a certainty they will be substantial, as they would become in this flourishing region even without the reservoir-park project. The Commission is looking ahead to implementation of the waste-water project in a manner that will not overburden local communities. State and federal grants probably would be available, particularly if there is strict adherence to good regionalization practices as required by Commission policy to assure efficiency and other economies of scale.

The Commission, if it were the implementing agency, might be able to pass along low-cost electrical power, needed in quantity for sewage pumping and treatment, from a hydroelectric project tied to the Tocks Island Reservoir. Also, Commission implementation probably would mean more favorable rates for bonding than otherwise attainable. Savings from interest and other economies would be passed on to localities in the form of lower sewerage charges.

The DRBC is now the only agency with the legal powers to carry out the program. Regardless of the agency designated or the alternative sewerage system selected, effective control of the region's waste waters will necessitate central management.

Submission of the study's final report and recommendations by the consultants will precede a review by all appropriate parties, including government officials in the project area, and public hearing on selecting the best proposal for the Commission's Comprehensive Plan.

The reservoir and park are slated for completion in the late 1970s, and some parts of the TIRES region will need new or improved waste disposal facilities by then.

Originally, it was estimated that the three-year study would wind up in Spring 1969, but the deadline has been extended into the new fiscal year.



## Deepwater

### Work starts on Salem-Gloucester regional waste disposal system

The first of what the Commission hopes will be a series of centralized waste collection, conveyance and treatment systems serving sub-regions along the overburdened and polluted Delaware River Estuary went into preliminary engineering before the fiscal year ended.

On June 30, the Commission engaged a prominent consulting firm to perform most of the engineering services in the design of a system that would bring at least 14 sizeable industrial waste and sewage discharging plants in Salem and Gloucester Counties in South Jersey into a single disposal operation.

The \$1.37-million study encompasses financial feasibility as well as technical aspects. Organizational arrangements would be decided upon later, if it is decided the system is to be built.

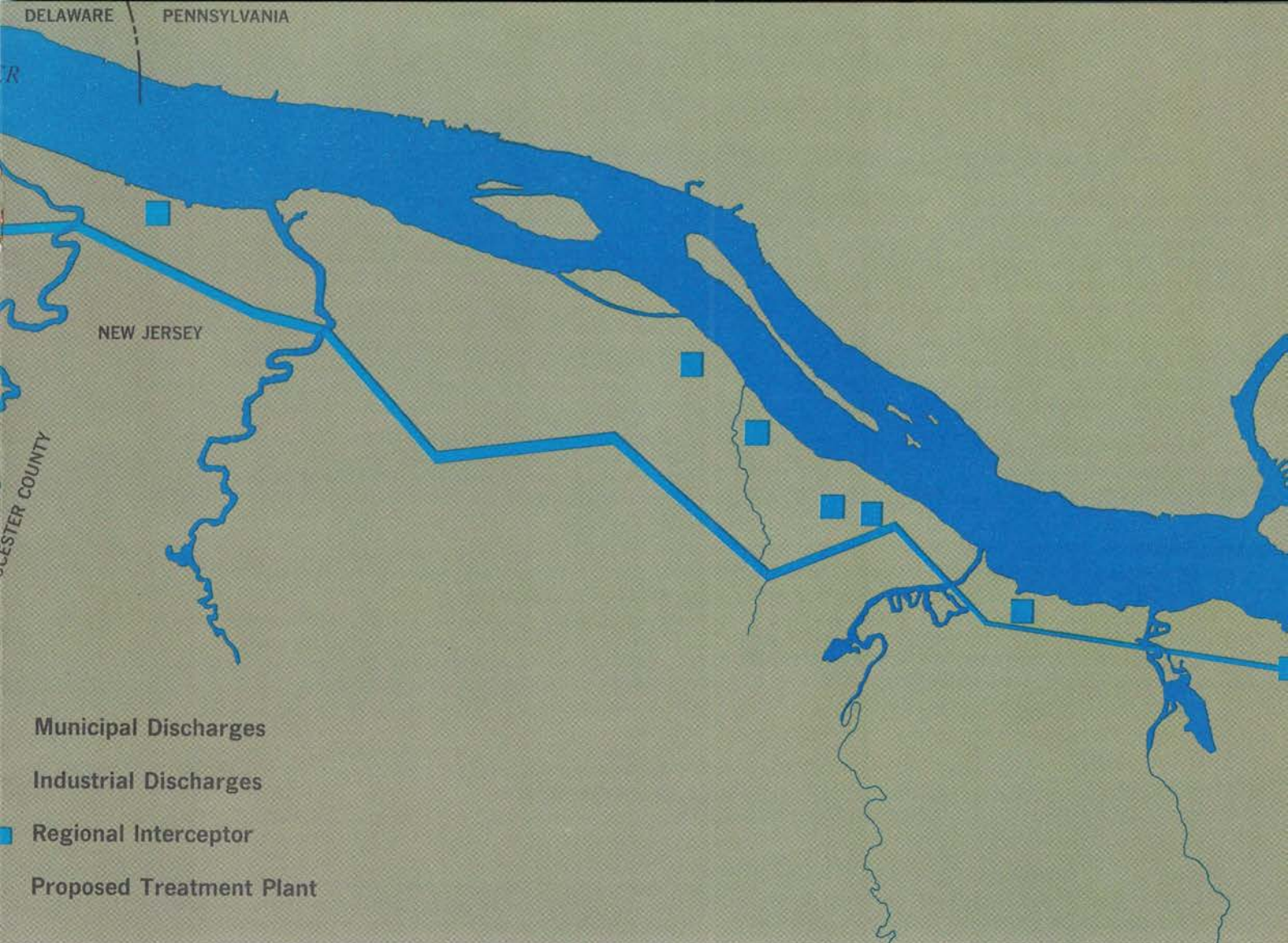
The system could go into operation about 1973. It would comprise a modern high-efficiency waste-water treatment plant near the Delaware Memorial Bridge at Deepwater, Salem County, and a collection network extending about 30 miles along the Delaware from Salem City north to Westville in Gloucester County.

The program implements the Commission's policy enacted this year to promote, and, if necessary, require regionalization in preference to more costly and less efficient single-plant operations now commonplace along the estuary. The New Jersey Health Department supports the program.

The study encompasses these two concurrent and related phases:

- One is development of a comprehensive plan for the municipal-industrial waste collection system and preliminary design of the collection and disposal works.

This work also involves examination of financing and cost-sharing. An interim report 10



Map shows route of 30-mile collection and conveyance network along Salem-Gloucester shoreline in South Jersey and treatment plant at Deepwater. These are principal facilities of proposed regional waste disposal system that has gone into preliminary engineering.

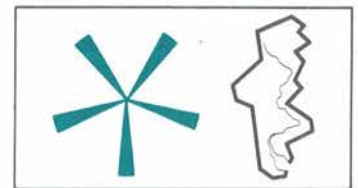
on this phase is due early in 1970. Exploration of comparative advantages in having considerable additional wastes from Gloucester municipalities treated at Deepwater or in the Gloucester County Consolidated Regional system is included. Also under investigation is the need to provide facilities for future development in eastern Salem County.

● The other phase is construction, and operation for three years, of a pilot treatment plant as the prototype for the later big plant. The 50-gallon-a-minute pilot plant project is necessary to develop a chemical-biological treatment process for composite municipal-industrial wastes of wide variety capable of attaining 90 per cent minimum removal of major pollutants. The pilot plant, located on land leased from E. I. duPont deNemours & Co., Inc., also at Deepwater, is to be operating early in 1970. A large federal research grant was made to the Commission toward the pilot plant.

The two-phase study is jointly supported by a research grant of \$646,709 from the Federal Water Pollution Control Administration, a Commission cash contribution of \$75,000, and matching funds totaling \$654,300 from eight industries with 10 plants and from four municipalities. The consulting engineering contract is for \$995,650.

The 12 dischargers sharing in the project cost are duPont, B. F. Goodrich Chemical Co., Hercules, Inc., Houdry Chemical Co., Mobil Oil Corp., Monsanto Co., Shell Chemical Co., Texaco, Inc., Salem City, and the Pennsville Township, Upper Penns Neck Township and Penns Grove Sewerage Authorities.

11 Discharger contributions are in proportion to concentration and volume of wasteloads. With three plants, duPont is the largest participating discharger.



# River Systems Analysis

Work on pollution control, salinity, stream runoff is aided

Comprehensive river management is the science of getting the most benefits from a watershed system for all purposes — water supply, flood protection, generating hydroelectric power and maintaining a combination of good conditions for pollution control, fisheries environment and a variety of forms of recreation.

Adaption of computerized techniques in the planning and operation of a basin's water resources in depth and detail provides large savings of time and manpower. For example, developing a scheme for operating one or a series of reservoirs to maximize all the benefits might take months or longer if calculated by hand, but only minutes once programmed for a computer. Inspection of many alternative methods of operation, once virtually impossible, is now readily performed with computers.

## Basin operations

The development of just such a mathematical model representing major Delaware Basin reservoirs is planned by the Commission. This will be the first step in developing an operations center from which policy makers will get an accurate picture of basin conditions and thus be able to make quick and reliable operating decisions.

The Commission already is applying computerized techniques in the planning and operation of several phases of its resource work.

## Data collection

Under Commission contract, the State of Delaware is collecting and analyzing water samples in the Delaware Estuary below Trenton for information on 32 pollution indicators such as dissolved oxygen, acidity, bacteria, toxics and radioactivity. The material is processed for storage in a computer system in Washington for retrieval in various forms, thus permitting rapid analysis and inspection of river quality by the Commission staff.

The first mathematical modeling of a river was performed in the early 1960s on the Delaware by a federal water pollution study group whose systems operations have since been turned over to and used by the Commission. This model, showing the cause-effect relationship of waste discharges on stream oxygen content, contributed greatly to the Commission's pollution control program and now helps in the solution of day-to-day problems arising in that effort.

Another area of current use is in regionalization of waste collection and treatment. The model makes it possible to determine the effects a given regional treatment plant would have on river quality and to compare these effects with a nonregional waste system. Also under computerized investigation is the location of the most desirable sites for regional waste plants along the estuary.

By using the same model in slightly modified form, the Commission is able to develop a profile of the chloride or salinity concentrations in the estuary. This provides the Commission a method of determining relationships between fresh water inflow from nontidal sources and salt water concentrations at given points in the lower Delaware. This information is important, among other things, to work involving the shellfish industry that is so sensitive to chloride changes.

Computerization is used further in storing and analyzing masses of information collected on 40 years of natural streamflows for making predictions needed to regulate streams.

# Watershed Action

New program urges local interest; six groups form

With rising public interest in environmental affairs, community action on water resources at the local level is enjoying a sharp upswing in the Delaware valley, where the whole idea of organized volunteer watershed endeavor was pioneered a quarter-century ago.

Responding to this current concern, and hoping to stimulate even more, the Commission this year established a new program on local and regional watershed management to assist in forming and strengthening watershed associations and help them prepare and carry out their plans, in turn aiding Commission programs.

The Commission program was devised largely as a result of recommendations and prodding by the Water Resources Association, itself a watershed association in many respects whose scope of interest covers the entire Delaware Basin and which has been an ally of the Basin Commission in many efforts. Also instrumental in promoting the Commission program was the Mid-Atlantic Council of Watershed Associations, formerly the Delaware River Watersheds Association.

Eight Delaware Basin watershed groups have been waging vigorous programs without interruption for years, including the highly successful Brandywine, Red Clay, Wissahickon and Neshaminy Associations.

In 1969, six new organizations were formed or in the process, most of them with Basin Commission encouragement and assistance. Flooding in the summer of 1969 on many Delaware tributaries was instrumental in the new concern.

The new groups add substantially to the portion of the 13,000-square-mile Delaware Basin covered by organized local conservation activity.

Twelve other associations have been inactive for some years and will be a target of Commission efforts to revive interest. Some of these went dormant after successful completion of short-range programs, thereby failing to capitalize on their organized status for additional gains.

In contrast to the inactive groups, the surviving organizations have profited from concern, leadership, program objectives, volunteers, public relations and financing.

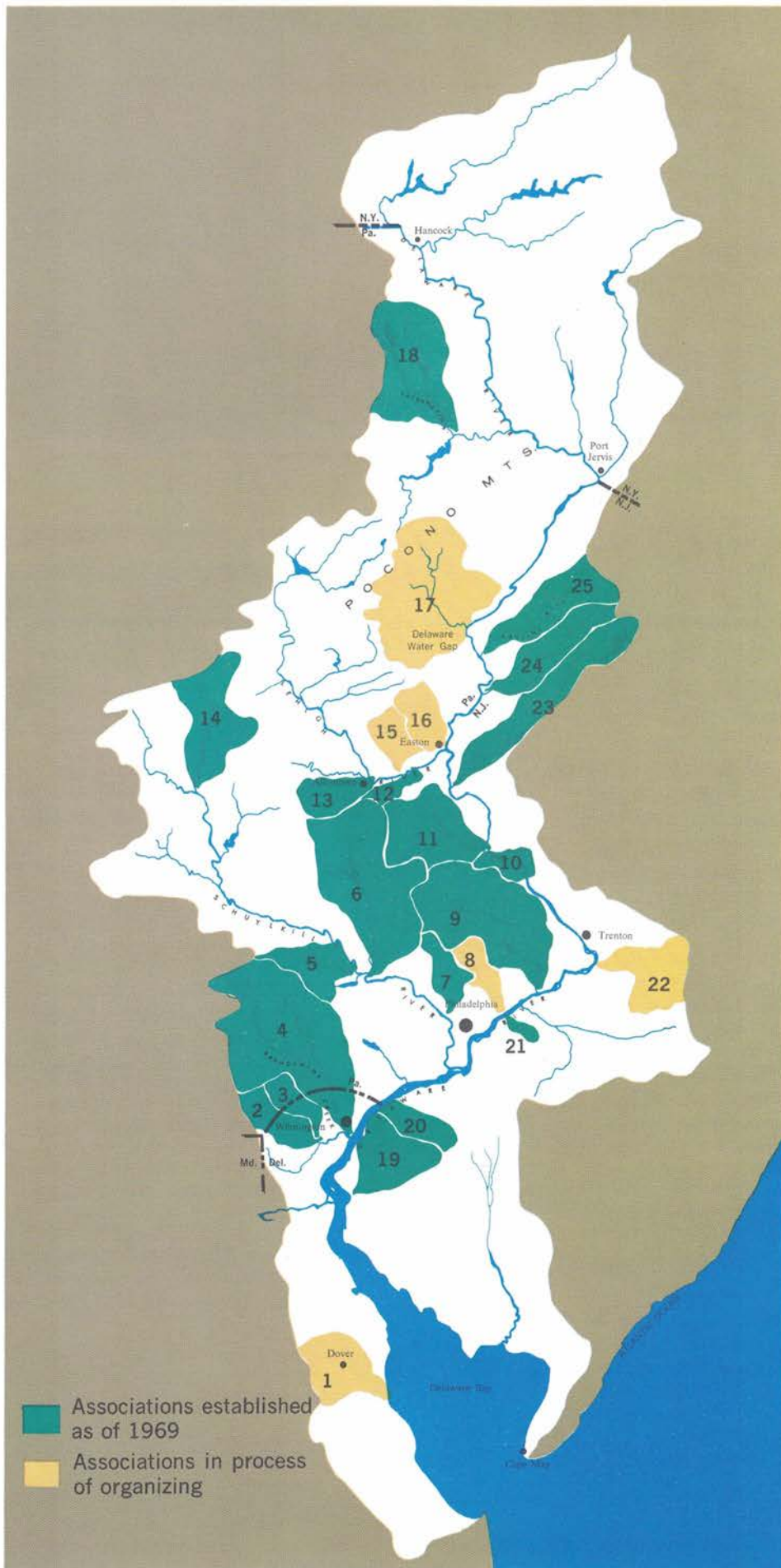
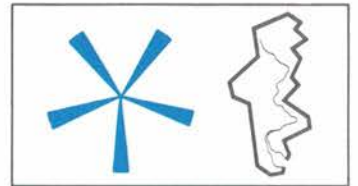
Watershed groups range in size from the eight-square-mile area covered by the Pompeston Creek Watershed Association in Burlington County, New Jersey, to the basinwide Water Resources Association.

A recent Delaware innovation has been the formation of single groups of several watersheds too small for effective separate action. These include the Natural Resources Association in Bucks County, comprising nine small basins, and the Green Valleys Association in Chester and Berks Counties, with four small drainage areas. Both groups are in Pennsylvania.

It all started back in 1945 when the "father" of the watershed approach, Clayton M. Hoff, established the Delaware Basin's and nation's first watershed group — the Brandywine Valley Association. That group has fostered many reforms in pollution and flood control, land treatment and open space preservation. It also instituted sound management for forest, fish and wildlife conservation and spearheaded creation of a state water pollution control agency in Delaware and a Soil Conservation District in Chester County, Pennsylvania.

Organized on the concept that water resources can best be managed within the natural boundaries drained by a stream or system of streams, the watershed association is a private community action organization of people who live where the problems are. Supported primarily by dues, it works to educate the citizens in conserving resources and stimulating desirable federal, state and local programs.

# Watershed Associations in the Delaware River Basin



Associations established as of 1969  
 Associations in process of organizing

- 1 St. Jones River Basin
- 2 White Clay
- 3 Red Clay Valley
- 4 Brandywine Valley
- 5 Green Valleys
- 6 Perkiomen Valley
- 7 Wissahickon Valley
- 8 Pennypack Creek
- 9 Neshaminy Valley
- 10 Natural Resources
- 11 Tohickon Valley
- 12 Saucon Creek
- 13 Little Lehigh
- 14 Little Schuylkill
- 15 Monocacy Creek
- 16 Bushkill
- 17 Brodhead Valley
- 18 Lackawaxen River
- 19 Salem River
- 20 Oldmans Creek
- 21 Pompton Creek
- 22 Crosswicks Creek
- 23 Musconetcong River
- 24 Pequest River
- 25 Paulins Kill River
- 26 Water Resources Association (basinwide)



Corps of Engineers photograph shows final construction under way at Beltzville Reservoir in Lehigh Valley. Beyond spillway in foreground is the main dam structure.

## Major Reservoirs

Advances were registered this year on several major facilities that help comprise the physical projects portion of the comprehensive plan of the Commission, whose coordinating role is to assure basinwide balance of resource uses.

### Tocks Island Reservoir and Park

The biggest and best known Delaware Basin project, the combined Tocks Island Reservoir and Delaware Water Gap National Recreation Area, progressed but at the decelerated rate imposed by the federal financial squeeze.

Preconstruction work by the Corps of Engineers continued toward the start of building the dam in the fall of 1970, with completion still scheduled in the late-1970s. The dam will be far enough along two years ahead of completion to provide flood protection. The reservoir also will contain extensive water supply. Most of next year's funds for the project will be spent on land purchases, although planning for utilities and cemetery relocations will proceed also. The new alignment for relocating Rt. 209 in Pennsylvania was completed.

By year-end, about 20 per cent of the 72,000 acres of property needed for the reservoir and recreation area projects had been acquired. This represented purchase for \$16 million of nearly 2,500 properties, of which only 181 went to condemnation.

In the National Recreation Area, three overlook areas on the Pennsylvania side of the Water Gap and a visitor information and some picnic and boat launching facilities in New Jersey were completed. Work on facilities for swimmers, picnickers, hunters and nature fans was in progress at Hidden Lake and Slatford Creek in Pennsylvania.

### Pumped storage power

The efforts of three New Jersey utilities to win federal and Commission authorization to expand their existing pumped storage electrical generating system on Kittatinny Ridge near the Tocks Island dam were still unresolved.

In October 1968, the Commission, favoring the utility plan, added pumped storage to Tocks Island's project purposes in its comprehensive plan. In the same action, the

## Tocks Island dam and park advance; Beltzville nears completion; States move on Pa., N.J. projects

Commission imposed a series of conditions preserving Sunfish Pond for its scenic and recreation values, requiring underground installation of penstocks and transmission lines and preserving the area's natural characteristics during and after construction. Subsequently, the utilities deeded Sunfish Pond back to New Jersey.

The U. S. Senate voted the pumped storage authorization for the federal project, but the House had not acted by late in the session. Still pending also is Commission action on the utilities' project review application. One of the issues before the Congress was disposition of preference-rate power — the equivalent to a smaller block of energy that would be generated through the dam if the federal government were to install a conventional power plant.

### Beltzville and Blue Marsh

Construction of the dam for Beltzville Reservoir, located on a Lehigh River tributary in the Poconos, was speeding toward completion by Summer 1970.

Preconstruction planning of Blue Marsh Reservoir, to be built six miles northwest of Reading in the Schuylkill River valley, was concluded. Most of next year's funds are earmarked for land acquisition. Construction contracts could be awarded in Fall 1970. Like Tocks Island, these are both multiple-purpose Corps projects.

### State projects

Pennsylvania proceeded with the acquisition of the Evansburg Reservoir site in Montgomery County, to be developed for recreation and future water supply needs. This action, in effect, preserved an important reservoir site in a fast-growing suburban area. In upper Bucks County, construction was begun on a reservoir on Tohickon Creek in Nockamixon State Park, scheduled for completion late in 1970, to provide water supply and recreation.

Although construction is not yet scheduled on Hackettstown Reservoir on the Musconetcong River in Northwest Jersey, the state had acquired about a fourth of the needed 9,260 acres.





## River Conditions

Unlike so many of the previous years since the Commission's creation in 1961, 1968-69 was a comparatively normal and uneventful one in terms of hydrology and condition of the Delaware River system.

Notwithstanding some low ground water readings late in the report year and a couple of heavy rainstorms, there was no flooding to speak of prior to July 1, and nothing approaching drought conditions.

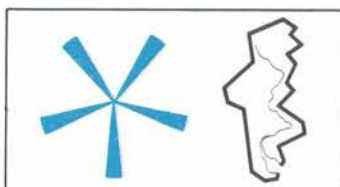
Precipitation, normally about 44 inches a year, fell off by up to 17 inches, or four months' rainfall equivalent, in some locations in the lower basin, but was only three inches below normal in the upper basin areas where the big reservoirs are located. Consequently, the year ended as it began, with reservoirs at near-overflow. In fact, they did spill in April and May.

Streamflows at key measuring points in the upper and lower basin approached normal for the year, although an early-1969 dry spell dropped Delaware flows to new lows 40 per cent off the norm for early-March.

Spring thaws and precipitation brought quick improvement to the surface water situation, but ground water, having gone through the normal decline in the fall and early winter, still had not fully recovered by year-end. However, the prolonged rains of late-July completely replenished the water table.

For the pollution-laden lower river, the picture for the year was routinely bad — with severe oxygen depletion in the warm months. The annual shad run did occur before the pollution block set in, and it was a rather good year upstream, at least in terms of recent history, for the popular spring fish.

Behaving normally, the salt front of 250 parts chloride per million, which is the recognized drinking water maximum, moved upstream to within two miles of Philadelphia International Airport in March. This was higher than usual, but far from threatening any problems at Philadelphia's water intake as it did during the 1960s drought.



# Fish Research

The Commission launched a research project in June aimed at reviving the long-suffering oyster industry in Delaware Bay.

The project is a four-year program under which the University of Delaware is applying a successful Japanese production technique in the hope that it will work in Delaware Bay. The University will do much of the work under the \$100,000 Commission contract at its Lewes shellfish laboratory.

Japan has become a major oyster producer in the last quarter-century by growing the shellfish suspended in water rather than resting on bottom. Previously, Japanese oyster production had dropped off sharply, as it has in the United States, where annual crops are running about 50 per cent what they were a half-century ago.

The Delaware oyster industry has been threatened with extinction as annual production has fallen to only 34,000 pounds in recent years from 4.2 million pounds in the 1950s.

Much of the drop has been blamed on a predatory snail known as the oyster drill. Scientists who designed the research project feel that by taking oysters off the bay bottom, where the snails live, they can eliminate this problem.

In the off-bottom system, young oysters lodge themselves on strings of shell or other suitable material suspended from rafts in the bay water.

Aside from placing the shellfish out of reach of the oyster drill, the off-bottom system uses the full vertical depth of water, as opposed to only the bottom area. This is especially efficient since there is also a shortage of good bottom growing space.

The research also includes control of marine organisms that compete with the oyster for food and growing space, an intensive study of oyster growth, and the evaluation of its market value. Other factors include a study of the local economics of the off-bottom method and location of good new growing sites in the bay.

If the project is fruitful, the knowledge gained will be turned over to commercial growers in the hope that they will employ it to increase production.

In Japan, more than 90 per cent of the oyster crop is produced by off-bottom means.

An oyster research project conducted by the U. S. Bureau of Commercial Fisheries in Massachusetts has indicated that this method is twice as fast and far more productive than conventional techniques.

The oyster project is a major phase of the 10-year comprehensive research program of fishery protection and enhancement adopted by the Commission two years ago.

## Tocks Island fishery

As the year ended, a special team of biologists was bringing to a close its three-year study on how water-level fluctuations in the Tocks Island Reservoir would affect fish spawning if a proposed pumped storage electric generating station is built near the dam.

Although the final conclusions were still to be made and the report to be written, the tests conducted

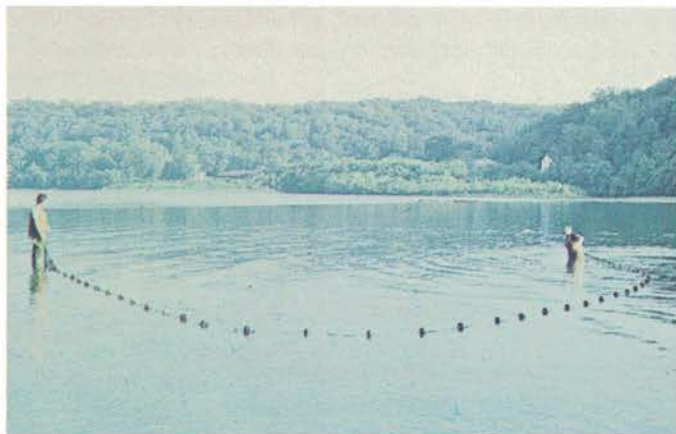
## Oyster and shad revival sought; Tocks Island study nears conclusion

indicated no particular negative effects on spawning by nest building or non-nesting species.

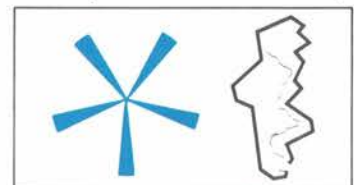
### Shad

The special federal-state study of shad problems in the Delaware, begun in 1968, was expanded in 1969 and, fortunately, the fish cooperated. The team of scientists had a productive season collecting new biological knowledge on the popular spring migrating fish, which ran up the Delaware to spawn in greater numbers than in the previous year. Among the concerns to be examined next will be migrating habits of juvenile shad and the effect of the pollution block in the Philadelphia-Chester area on fish movements.

The project's long-term goal is to find ways to reestablish anadromous fishes wherever possible in their former habitats in a river beset with the ecological disruptions from urban-industrial concentration.



Biologists working on fish research projects are shown (above) readying strings of shells and card-like squares to be suspended in water as part of oyster program and (below) netting shad for analysis in anadromous fish study.



# Water Supply

Projections of the growth in both population and economic development of the region served by the Delaware are staggering. For example, the population of the basin is expected to about double in 50 years while industrial output is increasing perhaps tenfold.

In looking ahead to the development and management of the valley's resources in preparation for meeting water supply demands by expanding future generations, the Commission and cooperating agencies must be equipped with the fullest possible knowledge of the available resources.

Actually, the basin's water supply is a combination of its surface and ground waters. Important work toward furthering understanding of both of these sources was conducted during the year by the Commission.

## Reservoir yield reappraisal

In the Delaware's record six-year drought that ended late in 1966, nature shorted the basin the equivalent of more than a full year's precipitation, normally 44 inches. In the wake of the drought, apprehensions about the adequacy of existing and planned water supply facilities in the basin induced the Commission to reappraise the valley's long-term water supply resources.

The water supply reassessment, in progress for the past two years, includes reanalysis of the capability of the reservoir systems of New York City and North Jersey; a study of the yield potential of major reservoirs not yet in operation; and a reevaluation of future water demands. Chaired by a Commission staff member, the study group also includes officials of top federal and state water agencies and appropriate local governments.

Study of the New York City system is a key part of the project, since water collected in three upper Delaware reservoirs is shipped out of the basin to furnish nearly half the city's entire consumption. This entitlement is established in a U. S. Supreme Court decree that also protects the downstream water rights of New Jersey, Pennsylvania and Delaware by way of mandatory downstream releases from New York.

Early results show that the drought-period yield from New York City's entire supply system, including non-Delaware sources, dropped 28 per cent below the previous norm. But the water crop from the city's biggest supplier of all, the Delaware, was down the worst, 40 per cent.

Among the completed work is a probability analysis of the allowable yield of New York City's Delaware reservoirs. It shows, for example, that if the Supreme Court's basic provisions for releases downstream and diversions out-of-basin were to be maintained under drought conditions, the reservoirs would go empty an average of once every 20 years.

17 Similar studies have been completed on the drought's effect on North Jersey's system and the capability of

## Ground and surface resources investigated in face of expanding population, industrial growth and in wake of 1960s drought

facilities projected under the Commission's master plan to help that area.

Work now in progress includes an analysis of future water supply demands in the basin and outside service area (including Northeast Jersey and New York City), and additional studies using synthetic hydrology to place the recent drought in proper perspective.

On completion of these factual studies, the Commission will be in a position to consider any revision of its Comprehensive Plan necessary to adjust to latest supply-demand knowledge.

## Ground water study

One of the richest natural resources in the basin is its underground water. So abundant is it, in fact, that in an average year about 40 per cent of the flow in the Delaware comes from the ground rather than direct precipitation runoff, and that this proportion may rise to 75 per cent in the plant growing season of a dry year. If the rains and snows that supply both stream runoff and ground water recharge were to halt abruptly, underground supplies would keep the Delaware from drying up for several months. A rough estimate of the water lying beneath the land surface of the Delaware Basin is up to 15 trillion gallons, or five times the average annual flow of the Delaware at Trenton.

Camden and many smaller communities rely upon ground rather than surface water for their supplies, yet comparatively little is known of either the extent of the use of this resource or the quantities available. Good information is available on the whereabouts of subsurface water, but no complete inventory essential to intelligent management has been taken. Unlike more easily measurable surface waters, facts are elusive on the invisible resource lying in and moving through the geological formations that constitute the earth's crust.

In a move to fill in the subsurface information void, the Commission engaged the services of a leading ground water hydrologist who has mapped out a series of prospective ground water investigations and programs to help ease the job of protecting and managing the resource.

The recommendations, now under review by water experts of the basin states and federal agencies, will become the basis for the valley's long-range ground water program. The suggested program includes:

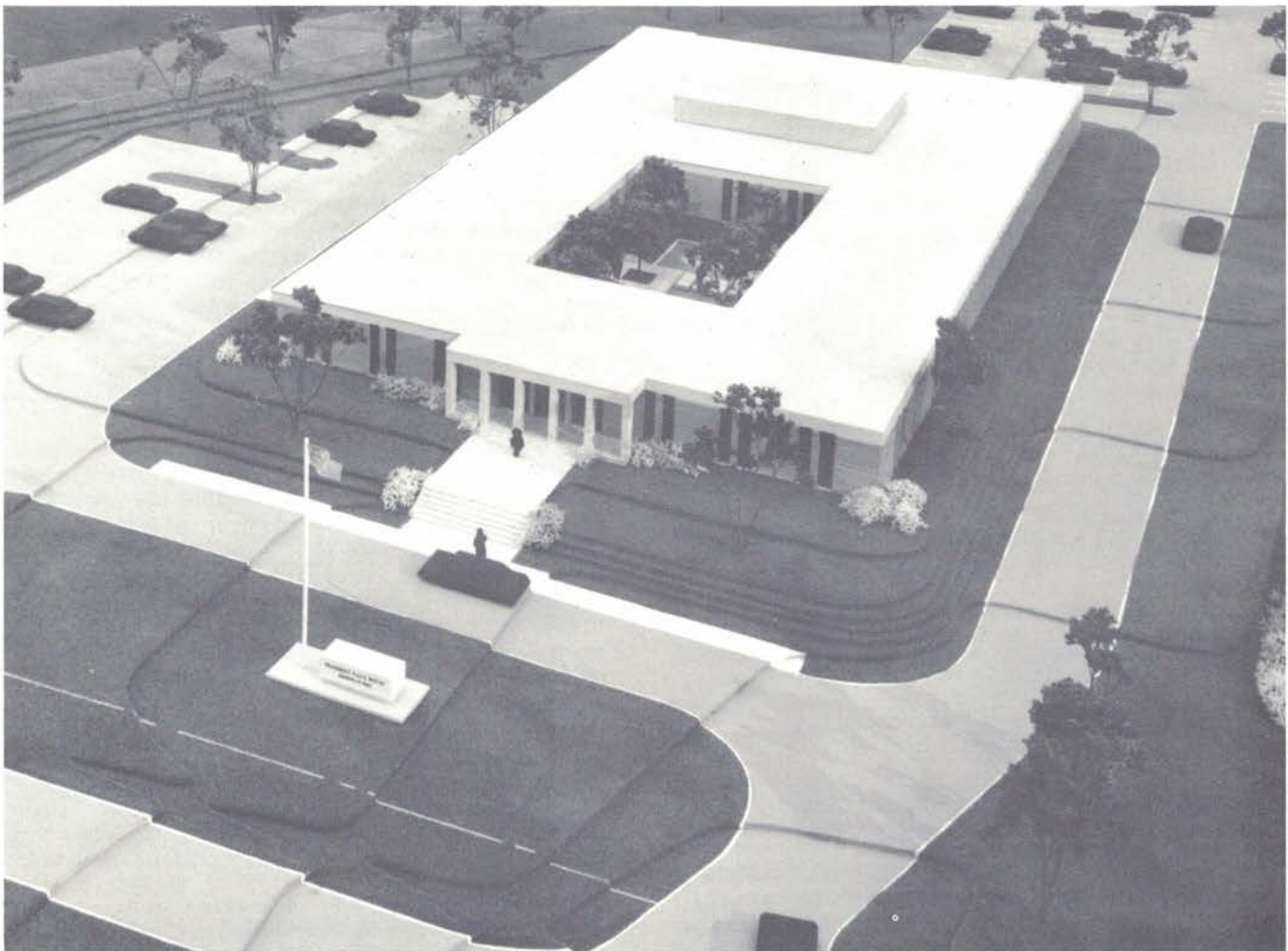
Investigation of quantities available and costs of developing water from each of 16 major aquifers, or underground reservoirs.

Continuing the programs to collect information on present water use, quality of ground water, records of wells, and of time fluctuation of water levels.

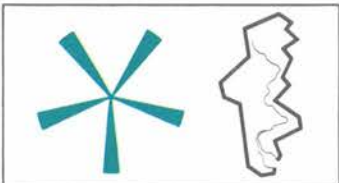
Identification of existing and potential sources of aquifer contamination.

Investigation of possible use of subsurface supplies to increase low flows of surface streams.

## DRBC Headquarters



The Commission is scheduled to move into its new headquarters by late-1970. Photograph of architect's model shows the building under construction off West Upper Ferry Rd., Ewing Township, near Trenton. It will be located on property donated by the State of New Jersey adjacent to State Police headquarters and situated a short distance from the Delaware River itself. The 25,000 square-foot, one-story building will bring the staff of water resource specialists and supporting personnel under one roof for the first time in several years. The \$985,000 facility also will house pollution control facilities, mathematical systems equipment and other technical facilities employed in multi-purpose water resources management.



# Financial Summary

## Budgetary

1969 REVENUES		By Organization	1969 EXPENDITURES	
Budgeted	Received		Appropriations	Expended
Delaware 59,300	59,300		Directorate 160,258	196,675
New Jersey 276,900*	276,900*		Administrative Division 124,104	134,116
New York 235,900	235,900		Planning Division 960,721	898,600
Pennsylvania 281,900*	281,900*		TOTAL 1,245,083	1,229,391
U. S. 154,000	154,000			
FWPCA Grant 235,983	235,983	<b>By Program</b>		
Miscellaneous 3,100	4,123	WATER SUPPLY	55,000	62,299
Working Reserve 0	0	WATER DEMAND	26,000	24,345
TOTAL 1,247,083	1,248,106	RECREATION	68,000	102,182
1,023**		POWER	43,000	36,216
1,248,106		PROJECT REVIEW	140,000	103,179
		WATER QUALITY	552,083	560,591
		COMPREHENSIVE PLAN	219,000	203,368
		FLOOD LOSS	23,000	23,625
		BASIN OPERATION	45,000	83,261
		SMALL WATERSHEDS	24,000	30,325
		TOTAL	1,245,083	1,229,391
		Capital Program	2,000	2,000
		Excess Appropriations over Expenditures		15,692**
		GRAND TOTAL	1,247,083	1,247,083

\* Includes \$1000 appropriation for Capital Budget

\*\* Unencumbered balance allocated as follows:  
(1) To support Fiscal 1971 Budget — 15,000  
(2) Transferred to Working Reserve — 1,715

The records of the Commission are independently audited each year as required by the Compact.

## Non-Budgetary

	Funds Available	Expenditures	Unexpended Dedicated Allotment
Tocks Island Region Environmental Study	101,429	76,458	24,971
Wing Dam	202,967	102,229	100,738
Tocks Island Fish Research	85,566	32,219	53,347
Deepwater Regional Study	693	0	693
TOTAL	390,655	210,906	179,749



## Scenic River

### Upper Delaware is proposed for natural preservation as part of National Rivers System

To fishermen, canoeists, sightseers and other outdoorsmen, one of the beauties of nature in this section of the country is the upper Delaware. Particularly popular is the 76-mile stretch from Port Jervis to Hancock that forms the only common water boundary between New York and Pennsylvania.

Aside from offering perhaps the best white water canoeing in the mid-Atlantic region and good fishing for bass, trout, shad and walleye in pollution-free waters, the upper Delaware presents scenic splendor happily devoid generally of commercial and honky-tonk development and housing subdivision.

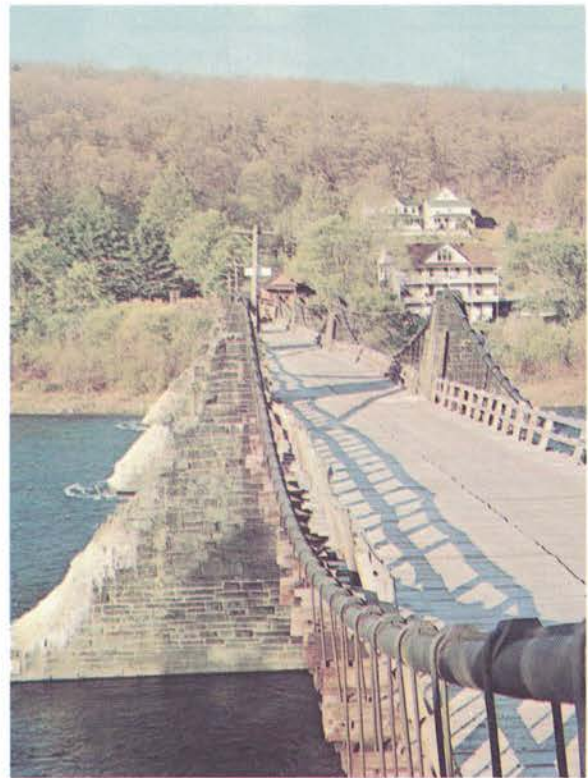
In June 1969, an interagency task force initiated a study of the Hancock-to-Matamoras section of the Delaware for permanent natural preservation as part of the Scenic and Wild Rivers System established by Congress some months earlier.

The Delaware is one of only a half-dozen Eastern streams under study and the only one within reasonable traveling distance of the Philadelphia-New York metropolitan area.

If inclusion is recommended by the study team and accepted by Congress and the President, the federal government will preserve the natural environment through waterfront land easements or acquisition.

Full description of the river stretch and details on economy, present and future population, recreation resources, ecology, water quality, present uses of the river, land ownership and water rights patterns, access by highways and other means, fisheries and local history will be included in the report to be made to Washington by December 1970.

Recommendations on a proposed recreation plan for the river, landscape control, land acquisition and easement boundaries and policies, management jurisdiction, and general preservation are to be made by the study group, which comprises the federal Bureau of Outdoor Recreation and of Sport Fisheries and Wildlife, the U. S. Forest and Park Services, the Delaware River Basin Commission and the States of New York and Pennsylvania.

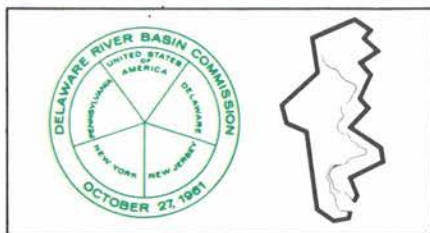




**On the Scenic River**

Three views of varying seasonal and historical attractions illustrate values of the upper Delaware. Seen on opposite page are (top) a typical unspoiled reach of the stream and (bottom) the historic Roebling bridge linking Lackawaxen, Pa., in foreground, with Minisink Ford, N.Y., built in 1847 to carry the Delaware-Hudson Canal across the river. (Above) This is how the area looked last winter.

Photographs by James M. Staples



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