Delaware River Basin Commission

Annual Report • 1982

James M. Staples

Contents

Cover photograph by James M. Staples reflects tranquility of the Upper Scenic Delaware as seen from the New York State side near the mouth of the Mongaup River. The National Scenic River system includes 110 miles of the Middle and Upper Delaware, from the Water Gap to Hancock, N.Y.

Delaware River and shoreline landscape within Delaware Water Gap National Recreation Area, with New Jersey in background, are pictured above. On opposite page is sunset scene of water skier enjoying ride on Rancocas Creek, a Delaware tributary in Burlington County, N.J.

Report designed by Odette P. Taft, DRBC graphic artist/illustrator.

Seymour P. Gross

Introduction

This is the twentieth annual report of the Delaware River Basin Commission, whose formation followed quickly the enactment of the interstate-federal compact of 1961 by the legislatures and governors of the four basin states, and the US. Congress and the President.

The Commission is the voice and instrument of the compact's five signatories for water resources planning, development, coordination and protection throughout the 13,000 square-mile valley. Like any government agency, the DRBC responds to the will of the frequently changing administrations that govern the five compact parties and their shifting policies, since they, in turn, democratically respond to changing public philosophies and attitudes.

For example, two decades ago, DRBC was carrying out the wishes and directions of the five member-parties in planning toward construction and operation of a giant reservoir on the main river near the Delaware Water Gap. Today it is obeying their instructions to meet the region's needs by turning to smaller alternatives to that unbuilt project.

Compared to others, the Delaware is a tiny river basin but a heavily utilized one. It helps support the needs of a basin and service area community of millions of people, many of the world's most productive industries and businesses, a variety of farming operations, one of the country's busiest seaports, numerous military installations, and dozens of species of fin and shell fish. As it flows by Philadelphia, it meets the necessities of that fourth largest of American cities, and it also provides about half of the water supply for New York City, situated far outside the basin. It accommodates, in addition, a half-dozen middle-size cities and innumerable smaller communities.

Described are the Commission's policies and decisions for considering all the water needs of an important corner of the nation in an ever-changing social and political environment and the progress being made in carrying them out. This report is made to the people of the region and to their elected representatives in Albany, Dover, Harrisburg, Trenton and Washington.

1982 in Review

Another historic development

Two decades after the four-state Delaware River Basin made some water-management history by bringing the resource under collective and balanced control and restoring interstate comity, another historic development was in the making in 1982 to make the arrangement more effective for meeting present-day conditions.

The Delaware River Basin Compact that the region's four states and United States government enacted in 1961 holds up today as a workable blueprint for managing the basin's resources cooperatively. But the 1954 court-ordered formula under which the states and New York City share Delaware waters has proved inadequate in shortages, so they have recommended a drought-readiness plan to be effected within the compact's framework.

It has long been recognized by DRBC and its signatory parties that the U.S. Supreme Court's 1954 interstate water-sharing decree is obsolete, since it did not envision shortages so severe as that of the 1960s. Also, the 1975 decision not to proceed with the big Tocks Island reservoir plan for the up-river mainstem created the necessity to develop alternative strategies.

The program tentatively recommended in July 1982 to DRBC by the four river states and New York City, the biggest user of Delaware water, included changes in the court's water-sharing formula during droughts and a modest enlargement of the valley's reservoir system as an alternative to Tocks Island. The report is called Interstate Water Management and was prepared by the five parties in their capacities as litigants in the Supreme Court action, which was the primary impetus for DRBC's creation.

The draft interstate management plan was published for public review and comment prior to proposal in final form for DRBC formal consideration in 1983.

The program (described in more detail on page 6) thus represents perhaps the basin's most significant water resource development since the compact and is, also, yet another commitment by the region's major water-using parties to keep the region equipped with up-to-date management tools.

All but a few of the recommendations would be implemented within the framework of the Commission's unchanged compact and without intervention of the Supreme Court, since the litigants may alter the decree by their unanimous consent. The primary vehicle for carrying out the major proposals would be amendment of DRBC's ever-changing comprehensive plan for the basin.

DRBC's single comprehensive plan for the region provides for the cleanup of the lower river, adding storage capacity for all water uses, managing the rich ground water supplies, improving fisheries, protecting against flood damages, conserving water, softening drought impacts, enhancing upper basin streams, protecting parks and recreation values, preserving wetlands, and so on. Compatibility with the comprehensive plan is DRBC's principal criterion for considering the dozens of project-review permit applications it receives, analyzes and acts upon yearly.

New Faces

The Commission gets new representation from New York State in 1983 in Governor Cuomo as its ex officio Member and Commissioner Henry G. Williams of the Environmental Conservation Department as principal Alternate to the governor. In Mr. Williams' absence, Russell C. Mt. Pleasant, associate director for water in the department, will continue to be Alternate from Albany. Mr. Williams was an environmental science and forestry faculty member at Syracuse University until he entered state government in 1969 as a planning official who later became director of the Office of Statewide Strategy and Programs, advising then-Lieutenant Governor Cuomo on all environmental matters.

Governor Thornburgh of Pennsylvania took over DRBC's chairmanship from Governor du Pont of Delaware, and U.S. Interior Secretary Watt became vice chairman, succeeding Governor Thornburgh.

Two of DRBC's senior staff positions changed hands in 1982 following retirement of the officials who had held the posts from the agency's beginning.

Susan M. Weisman, former district manager and program administrator for the Westchester County (N.Y.) Soil and Water Conservation District, succeeded W. Brinton (Buzz) Whitall as secretary to the Commission, and Robert L. Goodell, a member of the DRBC staff since 1963 and its operations branch head from 1965, was appointed chief engineer to replace Herbert A. Howlett.

Assuming Mr. Goodell's operations post was Dr. Richard C. Tortoriello, an environmental engineer specializing in mathematical water quality modeling who has been with DRBC 15 years.

Another valued and long-time DRBC specialist who retired in 1982 is J. W. (Bill) Thursby, whose last assignment with the Commission was head of its environmental unit. Previously, he had held the post of staff economist.

Governor Cuomo

Mr. Williams

Miss Weisman

Mr. Goodell

Dr. Tortoriello

Mr. Thursby

Executive Director's Report

Conservation Makes Dollars and Sense

By Gerald M. Hansler

Many areas of the country, even the wet ones, experience water shortages and droughts. The Delaware River Basin is no exception.

In 1954, before the Delaware River Basin Commission was formed, the nation's highest court decreed that waters of the Delaware would be divided in a prescribed fashion, some for export (to New York City and northern New Jersey) and a higher minimum flow for down-basin users (by guaranteeing releases from New York City reservoirs which would increase the Delaware's minimum flow in the Port Jervis area from 175 to 1,750 cubic feet per second). The Supreme Court's division of the "water bucket" was based upon the then-drought of record, which was in the 1930s.

But the drought of the 1960s was much more severe and the Delaware River "water bucket" was considerably smaller than anticipated — which brings up the matter of "how" to assure adequate minimum flows in the river and estuary to protect and enhance the myriad legitimate water uses.

One method would be to erase our present-day population, economic practices and storage capabilities and return the basin to its pre-Colonial status. There are undoubtedly some who would delight in such a return to primitive conditions — provided *they* could stay.

But such land-use dictation would be just a little more unrealistic than mandating zero growth — under which not even a new farmer could be allocated water for irrigation, a depletive use.

Mr. Hansler

How, then, can a proper balance of:

- growth;
- assurance of reliable water supplies and stream flows during dry spells; and
- construction of tolerable new water storage projects

be reconciled?

An honest attempt has been made through DRBC's fully public Level B Study process to assess those factors. And reasonable conclusions resulted. Also, those conclusions have been substantially ratified by the four basin-state governors and the mayor of New York City, representing the five parties to the 1954 court decree, in their "good faith" recommendations.

Water conservation was heralded as a cornerstone in the Level B report. The "good faith" agreement contained seven recommendations dealing with water conservation in one form or another.

Two recommendations dealt with modification or construction of four reservoir projects to increase water-supply and flow-augmentation capacity — i.e., to *conserve* water behind structures, water that would otherwise flow wastefully to the ocean during periods of high river-flow. Yes, conserving water behind a structure can be likened to saving money in the bank for those dry and lean years. However, this doesn't mean that the streams and rivers in the Delaware Basin will all be harnessed by dams. In fact, if all four projects miraculously were completed, 85 percent of the basin's watershed would still remain free-flowing. To put it another way, only an additional three-and-one-half square miles of the basin's 13,000 square miles would be regulated with the completion of these four projects.

Two recommendations dealt with conserving water in existing reservoirs during droughts, so as to delicately balance storage for even drier periods, and to maintain adequate flows in major tributaries, the mainstem and the estuary to assure protection of existing water uses.

The remaining three water-conservation recommendations dealt with:

- a mechanism to trigger "emergency" conservation measures;
- establishment of a policy goal in DRBC's comprehensive plan to achieve a 15 percent reduction in depletive water use during drought emergencies; and
- preparation of drought emergency plans by each basin state which must contain specified water-conservation elements.

Again, it's interesting to note that all seven of these water-conserving recommendations also were covered in DRBC's Level B Study report.

Another — and major — water conservation element of DRBC's 1981 Level B report *not* covered in the 1983 "good faith" document dealt with the practicality of water conservation during normal times. Why waste water before a drought? Such waste would only cause a community's finite surface-water supply to enter any drought at reduced levels, or cause a sensitive well-water supply to continue operation with a much lower-than-acceptable aquifer level. The same applies to self-supplied industrial establishments.

Let's consider self-supplied water users such as industry and agricultural. Conserving water through optimum, not wasteful, use during normal times enhances your raw material supplies at the beginning of a dry spell. *It also saves energy and hence dollars.*

DRBC has conducted over the past two years a study on "industrial water reuse vs. net water loss." Eighty-four major self-supplied industries in the basin were considered — 13 of them in detail. The object was to obtain answers to some major questions during the period 1971-81:

- Has water reuse within these plants increased?
- Has consumptive use per unit of product increased?

Of the 13 plants analyzed in detail, nine showed an increase in water reuse and four stayed the same. The remaining plants in the total of 84 showed no decrease in water reuse.

More important, nine of 13 plants showed a *decrease* in consumptive water use per unit of product manufactured. Three showed an increase, and one remained the same. One petroleum-refining and related-products industry displayed a 76 percent reduction in consumptive water use per unit of product.

A major reason for this drop in consumptive water use is the significant cost decrease that can be achieved by reducing waste heat. And, of course, waste heat means a higher evaporative rate, which means higher water loss. Therefore, industries that have saved dollars by reducing energy needs through decreasing waste heat also have been good citizens by reducing consumptive water losses. Since not all plants within similar industrial categories have embarked upon this dollar/energy/consumptive water-use savings program within the basin, additional and practical water conservation programs are possible.

Similarly, optimum irrigation operations — not wasteful practices — by farmers can be an economic boon and reduce evaporative water losses as well. Why should a farmer pump more water than needed for optimum plant growth? In New Jersey, environmental and agricultural agencies are working with farmers to determine optimum irrigation practices based upon soil type and crops raised.

In summary, water conservation during normal times by residential, commercial, industrial and agricultural users does save dollars and places much less stress on raw-water supplies. In fact, with permanent water-saving programs in place, conservation actually can increase the amount of available water supply during dry periods because of the precedent water savings.

To enhance water conservation goals in the basin, DRBC will establish a water conservation advisory committee composed of signatory party experts, as well as knowledgeable persons from the public spectrum, to assist in the development of water-saving practices in both normal times and drought periods.

"Good Faith" Report

A long-range drought-preparedness plan

A far-reaching program to enable the Delaware River Basin to meet its growing water-use demands and still withstand the effects of future droughts was placed before the region this year by the four river states and New York City.

The program calls for new programs to control salinity intrusion into the estuary and adjacent ground waters along with companion proposals for staged increase of the basin's flow augmentation capability, a drought management formula, tight regulation of additional depletive (mostly evaporative) water losses, several conservation actions, and maintaining the upper basin's cold-water fishery.

The tentative suggestions were announced in July following four years of negotiations between the four states and New York City, acting as parties to the U.S. Supreme Court decree on interstate sharing of Delaware River waters.

This historic "good faith" process began back in 1978 when DRBC issued an invitation by resolution to the five parties to deliberate with the goal of producing agreements for increasing what have proved to be the basin's inadequate water supplies during droughts.

The Supreme Court's 1954 formula on interstate sharing of Delaware waters had worked well in no-shortage periods, but the region's record drought of the 1960s, worse than any envisioned by the court, proved the decree to be obsolete. And since 1975, when DRBC and the Congress decided to shelve the already long-delayed Tocks Island reservoir, the Commission had been concentrating on developing alternative strategies.

A written commitment by each of the five decree parties' chief executives was received by DRBC early in 1979 to enter the deliberations on the basin's water needs in "good faith," hence the nickname of the negotiations. Signers of the letters were former Governors Carey of New York, Byrne of New Jersey and Shapp of Pennsylvania, along with Governor du Pont and Mayor Koch, each of whom designated a representative to participate in the negotiations.

Following publication of the draft "good faith" report, formally called Interstate Water Management, it was subjected to a round of DRBC-conducted public information meetings, one in each state. These meetings produced extensive comments on the recommendations from citizens, civic and environmental organizations, business and industry representatives and government agencies.

Later in the year, the five designated conferees finecombed the public viewpoints and resumed their talks to refine the report's language.

By year's end, the resulting final text had begun circulating among the mayor of New York City and governors of Delaware, New Jersey, New York and Pennsylvania for the signatures that would formally approve the historic document for submission to DRBC early in 1983.

The "good faith" conferees produced 14 specific recommendations, of which 10 were identical and four similar to proposals that had been made a year earlier, in mid-1981, in the final report of the Delaware Basin Comprehensive (Level B)

Study. That effort, conducted by a special DRBC study team with broad signatory-party and public participation, similarly had resulted from recent institutional changes and hydrologic realities in the basin.

The key element in both the Level B and "good faith" reports is the recommended updating of the salinity standard for protecting water uses and users of surface and ground waters from salt contamination in the Camden-Philadelphia area, which is situated about 100 miles up the estuary from the Atlantic Ocean, and establishment for the first time of a companion sodium standard. Sodium was included due to public health considerations.

Attainment of the salinity and sodium goals would hinge directly on implementing other specific "good faith" proposals. They include permanent guidelines for declaring warnings and emergencies; a standby formula for reducing Delaware water exports to New York City and Northeast Jersey and for cutting downstream releases from the city's three big upper basin reservoirs to conserve storage during shortages; increasing the storage capacity of the basin's network of reservoirs; limiting future water demands through conservation, and controlling depletive losses.

The "Good Faith" Recommendations

- *Adopt revised salinity-control standard and new sodium standard for estuary.*
- *Use 1960s "drought of record" as assumption for water supply planning.*
- *Specify reservoir storage levels as criteria for declaring and ending droughts.*
- *Adopt formula of cutbacks in water exports, streamflow objectives and downstream releases to conserve storage in droughts.*
- *Coordinate operation of basin's other reservoirs to meet water needs and control salinity.*
- *Enlarge Francis E. Walter and Prompton flood-control reservoirs to add storage for water supply and flow augmentation.*
- *Power companies construct Merrill Creek reservoir in New Jersey for cooling water, if found feasible.*
- *Enlarge New York City's Cannonsville reservoir.*
- *New Jersey solve Camden area's ground-water problems.*
- *Test up-river ground-water pumping for flow augmentation.*
- *Keep the unbuilt Tocks Island reservoir in reserve if needed after year 2000.*
- *DRBC adopt program to conserve depletive uses by 15 percent in droughts.*
- *Each state adopt standby conservation plan, also for 15 percent saving.*
- *Establish program to limit future depletive losses unless needed storage is provided.*
- *Extend permanently the successful experiment to improve the up-basin cold-water fishery through reservoir operations.*

The program also is designed to assure protection of the many instream river uses such as recreation and fisheries.

Adoption of an interim salinity standard that would relax the one which has been in effect since the 1960s was proposed. The new guideline would be upgraded in steps to a more protective goal by year 2000 based upon actual enlargement of the basin's storage system and new depletive water uses.

Recent studies show there currently is a small surplus of storage for flow augmentation to hold off salinity incursion. However, as depletive water losses increase, the surplus could be absorbed by the time of the first projected addition of storage capacity in 1986. Then, if depletive losses continue to mount, proposed enlargement of three reservoirs during the 1990s to further increase storage would allow final strengthening of the salinity standard by the turn of the century.

The prospective interstate water-sharing formula sets criteria for declaring and terminating drought warnings and emergencies and for temporarily altering the Supreme Court's interstate water allocations. Elements of the formula would be triggered automatically as storage in the city's three Delaware basin reservoirs dropped to specified levels. During all non-drought periods, the court's apportionment formula would remain in force.

The suggested formula called for reductions of up to 35 percent in the New York City and Northeast Jersey exports of Delaware water. It also called for reductions of up to 37 percent in the river's minimum guaranteed streamflows for the water-rights protection of down-basin areas in New Jersey, Pennsylvania and Delaware. These levels of cutbacks already had been applied successfully in the drought of 1980-81.

The drought-relief plan supports an arrangement for augmenting streamflows from other existing reservoirs to compensate for reductions allowed in New York City's downstream water releases. These are federal and state facilities located in Pennsylvania and also up-river hydroelectric impoundments of the Pennsylvania Power & Light Co. and Orange & Rockland Utilities, Inc.

Suggested for enlargement by the federal government are the existing Francis E. Walter reservoir in the Lehigh valley by 1990 and Prompton in the Lackawaxen valley by 1995, both in Pennsylvania. Enlargement of New York City's Cannonsville reservoir in Delaware County by New York State by 1990 also was urged. To compensate for water losses from electric-generator cooling during droughts, a proposed new power-company impoundment, Merrill Creek in Warren County, New Jersey, is endorsed for completion by 1986, if found environmentally feasible.

New Jersey was urged to study potential solutions to the water-supply problems in the Camden metropolitan area, particularly the overpumping of ground water from the Potomac-Raritan-Magothy aquifer system. Alternatives suggested for study are conjunctive use of ground and surface water; pumping of ground water from Cohansey Sands, the uppermost aquifer that underlies most of the Coastal Plain of South Jersey; and tieing into the Philadelphia water system. New Jersey is requested to select the best solution by 1985 and implement it within five years.

Recommended is a DRBC field demonstration of the effectiveness of pumping from ground waters in upper basin alluvial soil areas for additional flow augmentation during droughts. Investigation of this concept also was urged in the Level B Study and in a separate DRBC ground water study (see page 12).

Consideration of the long-planned Hackettstown reservoir on the Musconetcong River in northwestern New Jersey was dropped because New Jersey water officials discovered it to have poor subsurface conditions and are searching for an alternative supply source.

The report stated that the shelved Tocks Island lake project, by far the largest of the federal multi-purpose reservoirs ever proposed for the basin, should be "held in reserve status for development after the year 2000 if needed for water supply." This project for water supply, flood protection, recreation and hydropower was authorized in 1962 by Congress and DRBC for completion by 1975, but was never started due to 1960s' wartime funding delays and environmental controversy.

DRBC adoption of a formal policy under which it would impose mandatory conservation measures during drought emergencies to reduce depletive uses of fresh water by 15 percent was urged in the report. It added that each basin state should prepare drought contingency plans with the same water-saving goal.

The report also called on DRBC to develop a regulatory program to limit additional depletive water losses to the extent that the basin lacks reservoir storage needed to control salinity.

Permanent adoption was recommended of the trial program in effect since 1977 that has enhanced the upper basin's principal streams for cold-water fishing and recreation by altering conservation release operations at New York City's three reservoirs. The upper valley community has welcomed the resulting increased uniformity of flows in the East and West Branches of the Delaware, the Neversink River, and the main Delaware along the New York-Pennsylvania boundary. The changes have been achieved without disrupting the Supreme Court's minimum-flow mandate. The permanent program would be administered by New York State's Department of Environmental Conservation.

The "good faith" conferees as the negotiations concluded were Thomas P. Eichler for Delaware, who was chairman; Eldred Rich for New York State, Dirk C. Hofman for New Jersey, R. Timothy Weston for Pennsylvania, and Joseph T. McGough, Jr., New York City's Environmental Protection Commissioner. Messrs. Eichler, Weston and Hofman also are DRBC Alternate Members. Mr. Rich is a former Alternate. The original good faith chairman was Austin P. Olney, who also preceded Mr. Eichler as Alternate from Delaware.

Since the federal government is not a party to the Supreme Court decree on Delaware water sharing, it participated in the talks only as an observer.

The Commission • 1982


Governor Thornburgh


Mr. Weston

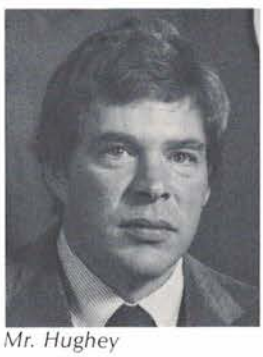

Secretary Watt


Mr. Kanuck


Governor Carey


Mr. Mt. Pleasant


Governor Kean


Mr. Hughey


Governor du Pont


Mr. Eichler

Pennsylvania

Governor Dick Thornburgh
Vice Chairman

R. Timothy Weston
Alternate

William J. Marrazzo
Advisor

United States

Secretary of the Interior
James G. Watt
Member

George J. Kanuck Jr.
Alternate

Lt. Colonel Roger L. Baldwin
Advisor

New York

Governor Hugh L. Carey
Member

Russell C. Mt. Pleasant
Alternate

Joseph T. McGough Jr.
Advisor

New Jersey

Governor Thomas H. Kean
Member

Robert E. Hughey*
Alternate

Delaware

Governor Pierre S. du Pont
Chairman

Thomas P. Eichler
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J. W. Thursby
Head, Environmental Unit

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Chief Administrative Officer

Engineering Division

Robert L. Goodell
Chief Engineer

C. H. J. Hull
Staff Engineer

Branch Heads

Seymour D. Selzer
Planning

Richard C. Tortoriello
Operations

*Dirk C. Hofman serves as Alternate in Mr. Hughey's absence

DELAWARE RIVER BASIN COMMISSION
UNITED STATES OF AMERICA · NEW YORK · NEW JERSEY · PENNSYLVANIA · DELAWARE

Drought:
One ended, another threatened

The 1980-81 drought which plagued the basin and much of the Northeast ended during the spring of 1982, when rains nearly filled New York City's three Delaware Basin reservoirs.

In April, a relieved Delaware River Basin Commission declared a formal end to the shortage that had started with a drought warning declaration in October 1980 and developed into an emergency proclaimed by the four basin-state governors and federal commissioner in January 1981.

DRBC unanimously voted on April 27, 1982 to formally declare the emergency over, based upon an informal agreement to terminate the emergency once combined storage in New York City's three Delaware basin reservoirs reached 40 billion gallons (bg) over the drought warning line and stayed above that level for 30 days.

During that drought period, about 60 bg in savings of the three New York City reservoirs' 271 bg storage was directly attributable to the drought management policies of the Commission. That large saving was brought about by Commission-mandated reductions of Delaware water exports to both New York City and northeastern New Jersey as well as reductions in downstream minimum flow targets.

Yet, by fall of 1982, storage levels plummeted by 160 bg and back into shortage conditions. In a four-month period, an equivalent of only two-and-one-half months' precipitation had fallen on the upper valley.

The Commission's November 13, 1982 formal drought warning was followed by continuing storage declines. July-to-December precipitation in the upper basin normally is about 22 inches, but only 14 inches fell during that period in 1982.

Drought warning actions taken by the Commission included ordering reductions in the 1954 U.S. Supreme Court Decree's allowable out-of-basin diversions and reservoir releases to maintain minimum streamflows for the lower basin. The purpose was to preserve the maximum possible storage in the event the drought deepened, in which case releases from other reservoirs could be arranged also to bolster the river's flows for the lower basin. The Commission also called for volunteer water conservation by the general public.

The DRBC drought-warning action also provided that the already reduced diversions and streamflows would be further cut if New York City storage were to drop 20 bg or more below the drought warning line. This did occur on December 8 as upstream storage fell to just over a third of capacity, the year's lowest to that date (December 16 was lowest date). Accordingly, export allowances and flow targets were further reduced.

Still deeper cuts would have been mandated if storage had continued to fall to the emergency level, or 40 bg below drought warning. In preparation for this eventuality, the Commission held a public hearing on December 15, required before a drought emergency can be legally proclaimed.

With storage levels still dropping, a late-December upturn from a couple of holiday-season storms prevented what appeared to be an inevitable drop into drought emergency by around New Year's Day.

December is the start of the five-month wet season that customarily replenishes the reservoirs, and the Commission hoped that early-1983 would bring higher-than-normal precipitation through April and be followed by a less arid summer and fall. This would end a string of three consecutive autumns in which storage dropped into or near drought warning.

Despite the late-1982 precipitation and storage deficits, flows entering the tidal portion of the Delaware were adequate enough, although below average, to hold off the "salt front" that must be kept well downstream of the Camden-Philadelphia area to prevent ground water contamination and other water supply problems there. While ground water tables were generally subnormal, they were better than in 1980 and 1981.

The Commission's extensive drought experience has strengthened its ability to handle future drought situations with a wide array of successful management tools. During the 1980-81 drought, arrangements were made by DRBC for auxiliary supplies to be stored in other reservoirs to complement reduced releases by New York City. The others are owned by private utilities, the U.S. Army Corps of Engineers and the Commonwealth of Pennsylvania.

Other actions taken during the 1980-81 drought involved bans on nonessential water uses and a program of voluntary conservation, each of which met with considerable success. In fact, even following that drought, New York City's daily usage remained some 200 million gallons a day (mgd) below pre-drought consumption levels. Post-drought conservation was practiced successfully elsewhere also.

The Commission is confident that lessons learned during these shortages will diminish the impact of future shortages. For example, the 1982 reductions in exports and flow assurances were based on the same formula as that used successfully in the 1980-81 shortage. And it was this formula which became the basis for the one recommended in the Interstate Water Management recommendations of the four basin states and New York City to DRBC.

Droughts, as well as floods, in varying degrees, are inevitable. Though the myriad water conservation practices have proven effective during droughts, the assurance of sufficient water supply storage, even with such practices, is a must.

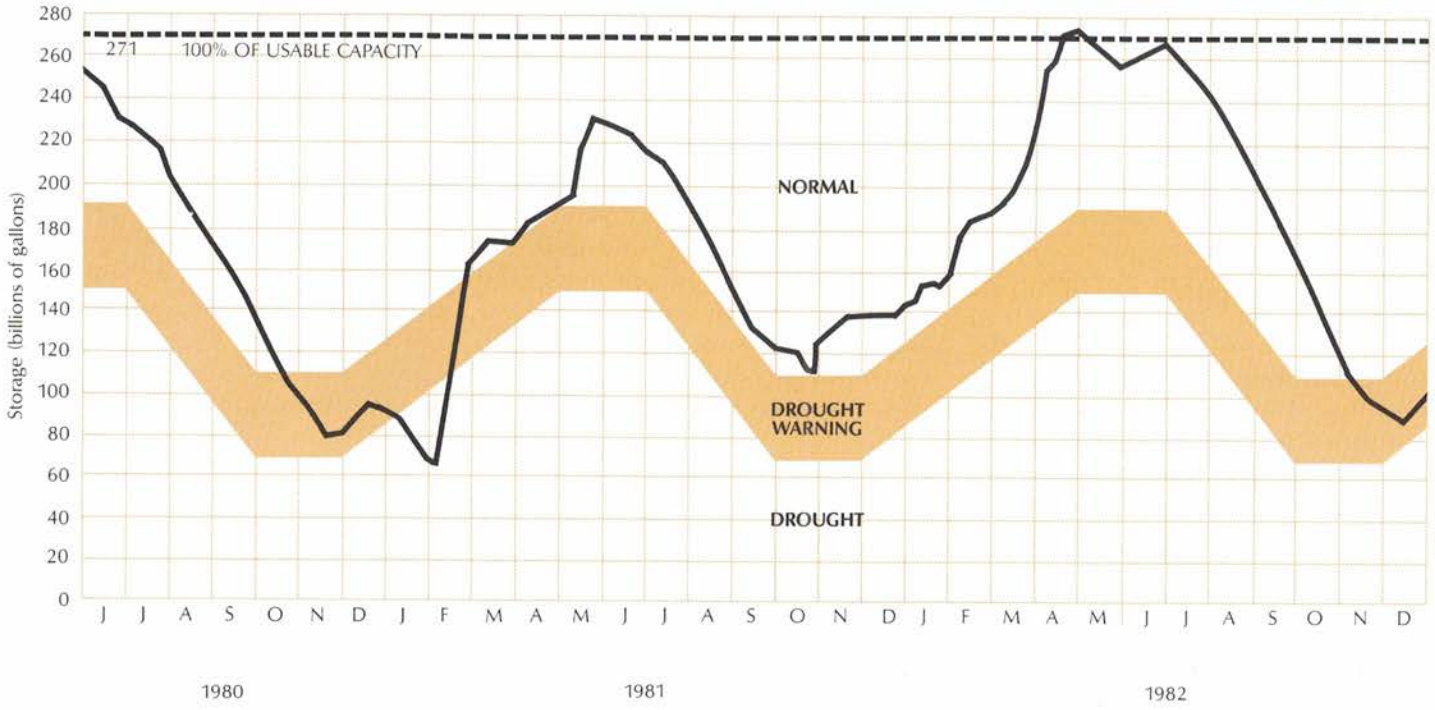


Chart illustrates disturbing three-year pattern of extra-heavy drawdowns during summer-fall dry season in New York City's upper Delaware reservoirs, whose condition is the basin's drought-status criterion. After dropping into warning conditions in 1980, supplies continued to plunge below emergency line early in 1981. The early-1981 recovery was weak, and declining provisions stopped just short of warning level in October. Despite near-overflow waters of mid-1982, storage fell again into drought-warning in November. In normal non-drought years, these supplies drop only to about 180 billion gallons prior to replenishment in the December-to-April wet season.

Ground Water Study Completed

A newly recommended program could mean a cleaner and more dependable supply for the millions of residents, farms, industries, institutions and others in the Delaware River Basin who get their water from the ground rather than surface sources.

The program was presented in the final report of a special three-year investigation on ground-water problems that was published in December. A high-priority item on the 1983 agenda of the commissioners will be to begin implementing the plan after soliciting broad public response on initial elements selected for consideration.

The investigation and recommendations grew out of the Commission's commitment to protect the region's rich ground-water resources from depletion and deterioration through a basinwide management program.

The study was launched in 1979 largely with funding by the U.S. Water Resources Council and matching by DRBC, the three lower-basin states of Delaware, New Jersey and Pennsylvania, and the National Park Service, which administers the scenic and recreational river program for the uppermost 110 miles of the Delaware.

The recommendations are all subject to review by the commissioners as well as the public at hearings to be scheduled before being considered for adoption. They include setting standards governing large withdrawals and large inter-watershed transfers of water; establishing uniform permitting and regulatory procedures for sizeable withdrawals; monitoring the subsurface resource; and collecting extensive data throughout the basin.

The suggested program already has been subjected to one round of public scrutiny through availability of all study documents at 15 repositories around the region and information meetings held in each basin state prior to drafting of the final report.

The report pulled together and built upon the findings of three separate detailed consultants' investigations of the two dissimilar geological sections of the basin — the ground water-rich Atlantic Coastal Plain and the less prolific Appalachian Highlands. The Coastal Plain includes agricultural South Jersey and Delaware in the lower basin and constituted one study area (Study Area I). The Appalachian Highlands is found north and west of the fall line, and includes the 40-mile wide Triassic formation that takes in most of Montgomery and Bucks counties in Pennsylvania and Hunterdon and upper Mercer counties in New Jersey, comprising most of another study area (Study Area II). The third area studied (Study Area III), also in the Appalachian Highlands, was the mountainous upper basin in the Pocono, Kittatinny and Catskill mountain ranges. Area III differs from Area II in that it contains extensive deposits of glacial outwash in stream valleys. Separate backup reports were prepared for each of the areas investigated.

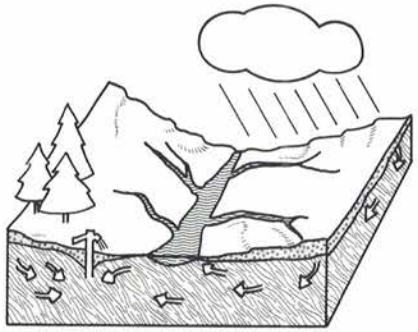


Illustration from cover of new report illustrates interaction of precipitation and ground and surface waters.

The final report singles out ground water trouble areas in southeastern Pennsylvania, the Camden metropolitan area in New Jersey, and northern Delaware for special program attention and for more investigation.

The southeastern Pennsylvania problems of the Triassic formation are located primarily in Bucks, Montgomery and Chester counties. According to the report, they stem from a combination of overuse of ground water in the growing Philadelphia suburbs, inter-watershed transfers of ground water, and the poor water-retention qualities of the red-shale subsurface.

Under a cooperative program authorized by the Commission's enabling law and begun in 1980 with the Commonwealth of Pennsylvania, DRBC already has designated this Triassic region as a ground-water "protected area" and instituted a regulatory program to secure users against incursions from large new wells.

To deal with problems in the southeastern Pennsylvania ground-water protected area, the new study offered guidelines

for regulating large withdrawals and large evaporative uses, and for limiting large water transfers between local watersheds. The guidelines are suggested to apply also to other parts of the four-state basin that suffer from similar ground-water stresses. As in the existing protected area, harmed owners of pre-existing wells would be assured a continued water supply.

The report notes that water pumped from well fields is the major source of public water supply in Camden, Gloucester, and Burlington Counties, which comprise the South Jersey problem area. It is drawn from the Potomac-Raritan-Magothy (P-R-M) aquifer, which in turn receives about one-half of its recharge from the Delaware River. The P-R-M aquifer must be protected from river salt-water infiltration for public health, taste and other reasons, and also from man-made contaminants.

The principal Camden area problem cited is ground-water overpumping, which has created a number of water quality stresses. These include movement of contaminants from waste disposal sites toward pumping centers; possible inducement of sodium chlorides in water from the tidal Delaware River into the P-R-M aquifer; and acceleration of the movement of deep salt water in the P-R-M aquifer towards the Camden well fields.

The report urges that New Jersey undertake a study of potential solutions including conjunctive use of ground and surface water, pumping from the Cohansey Sands aquifer in the Coastal Plain; and tieing in with the Philadelphia water supply system. The study also recommends that the selected solution, or combination of solutions, be implemented by 1990. The river states and New York City urged this too, in their Interstate Water Management report.

The study also cited a large "cone of depression" near Wilmington that indicates extra-heavy withdrawals from the P-R-M aquifer beneath the Coastal Plain in Delaware as well as South Jersey. Delaware was asked in the report to continue hydrogeologic investigations to determine if brackish-water infiltration from the Delaware River and migration of deep salt water pose a threat to future ground-water supplies in New Castle County, as concluded by the consultant.

Another major recommendation was that DRBC determine the technical and economic viability of low-flow augmentation pumped from ground waters located in thick sand and gravel formations, known as glacial outwash deposits, in the northern third of the 13,000-square-mile river basin. These formations are good for ground-water storage. Water pumped from these sand and gravel deposits, as with water stored in existing and proposed water-supply reservoirs, could be discharged down-river during droughts. This would help prevent high concentrations of saline ocean water from intruding as far upstream as the well fields located in Camden County. The viability study also would cover environmental impacts.

The report cited problems, primarily drying up of streams, caused by the transfer of withdrawn ground water between local watersheds. It suggested that DRBC and the states delineate

Some Facts on Ground and Surface Water

The new water report begins by citing these often-overlooked facts on the interdependence of ground and surface waters:

- *The ground and surface water resources are interrelated and act as a unit.*
- *Ground water maintains streamflows between periods of precipitation and constitutes a major portion of the flow of perennial streams.*
- *When ground water is withdrawn and not returned, streamflows are reduced.*
- *Water that is consumed (or depleted) at any location in the basin, or exported, diminishes the quantity — and may affect the quality — of fresh water for other uses at other locations.*
- *As fresh surface flows are reduced, ocean water invades farther into tidal water bodies.*

surface-watershed units in the basin for managing both surface and ground-water withdrawals as an interrelated resource. It said a permit should be required for any sizeable water transfer between watersheds, and also for any large depletive, or evaporative, use.

The study suggested that DRBC reconsider a long-standing policy that promotes regional water-supply and sewerage systems that cross watershed boundaries because, like the other water transfers, they result in water loss for local streams and aquifers.

The report, based largely upon scientific exploration by consulting firms for the lower, central and upper basin study areas, suggests that DRBC assume primarily an umbrella-type role in which it would set policy, standards and criteria, and also streamline its permitting function. The report said the states should take the lead in registering wells and issuing ground-water permits that would serve local, state and interstate needs.

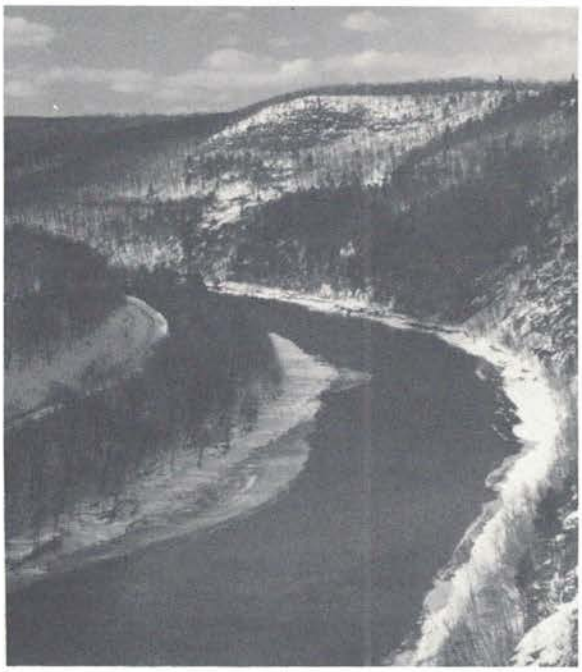
The report also suggests standards and criteria for uniform regulatory functions among the states in the basin. These would cover water-withdrawal reviews and permits along with registration of wells, and would apply to large developers and industries as well as public and private purveyors of water supply.

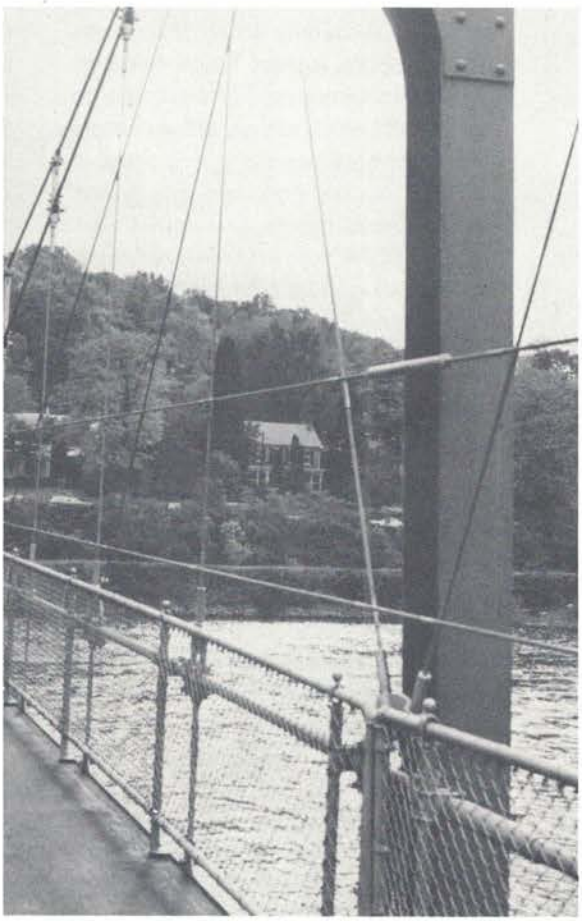
Wells for individual residences and small groups of homes do not draw volumes large enough to fall under the suggested regulatory program.

From the study's inception in 1979, it was guided by a steering committee that supplied continuous review and advice on all aspects of the effort and also provided public participation throughout. Following the Commission's acceptance of the final report in December, the steering group was renamed the ground water advisory committee and retained to assist in the implementation phase. In addition to one member named by each commissioner to represent the five signatory parties, six public members served on the committee, of which David C. Yaeck, executive director of the Chester County (Pa.) Water Resources

Mr. Featherstone

Authority, was chairman. Jeffrey P. Featherstone became project director early in 1982, succeeding retired DRBC Chief Engineer Herbert A. Howlett, who took special interest in the project.





Photos by James M. Staples.

Top picture is of winter scene in beautiful Hawk's Nest section of Upper Delaware that separates Catskill Mountains in New York State, on right, from Pennsylvania's Poconos, a few miles upstream of the Tri-State Rock. Bottom view is of the Delaware and pedestrian suspension bridge that links Lumberville, Pa., in background, with Bull's Island State Park in Hunterdon County, N.J.

Upper Basin Activities

Scenic and Recreational Rivers

DRBC staff is coordinating with the National Park Service in the resumption of work to develop a new general management plan for the Middle Delaware National Scenic and Recreational River and Delaware Water Gap National Recreation Area. With the official commitment of the Tocks Island reservoir to a reserve status after the year 2000 by the "good faith" agreement and a 10-year planning horizon for the park management plan, ways are being sought to accommodate short and long term proper development and utilization of the National Park within these restrictions. The new management plan will be developed to provide a firm planning and development foundation for the National Park Service without the reserve status on Tocks Island reservoir being a major impediment. The new management plan, scheduled for completion by fall, 1983, will also become an item for DRBC action to revise its own comprehensive plan regarding the National Park and reservoir.

The intergovernmental cooperative planning effort to develop the management plan and an institutional structure for the Upper Delaware National Scenic and Recreational River continued to involve DRBC's staff in detailed planning activities with the National Park Service. Also participating were all levels of government in Orange, Sullivan and Delaware counties of New York and the Empire State's Department of Environmental Conservation, and Pike and Wayne counties of Pennsylvania and the Commonwealth's Environmental Resources Department, as well as other local, state and federal interests. During the year, as early drafts of the management plan were developed for public review, DRBC provided technical information and support for interstate concerns of New York and Pennsylvania in matters relating to water quality, flow management and environmental protection in the upper river. The Upper Delaware Clearinghouse, an interstate, intercounty planning group expected to evolve into the technical assistance group proposed in the draft management plan, was reactivated and includes DRBC staff participation.

Water Quality Investigations

The annual summer limnological investigations that DRBC has been conducting since 1969 respond to varying needs of the upper basin area, including determination of the nature, extent, and cause of water quality problems, particularly in interstate waters. The summer program's findings contributed to DRBC's water management operations, including its recent focus on impacts from upstream reservoir releases as well as water quality management in the two segments of the National Scenic Rivers system. In 1982 the program's primary objective was the assessment of water quality in the Middle Scenic River that runs through the Delaware Water Gap National Recreation Area. A similar study had been conducted in 1981 for the Upper Scenic River from Hancock, N.Y., to Port Jervis, N.Y. The Middle River's quality was found to be generally good, with problems in some areas from both point and non-point pollution sources. Biological monitoring was continued on the East and West branches of the river in Delaware County, N.Y., as well as the mainstem. Biological stress observed during 1981 in the Delaware at Lordville, N.Y., was absent in 1982.

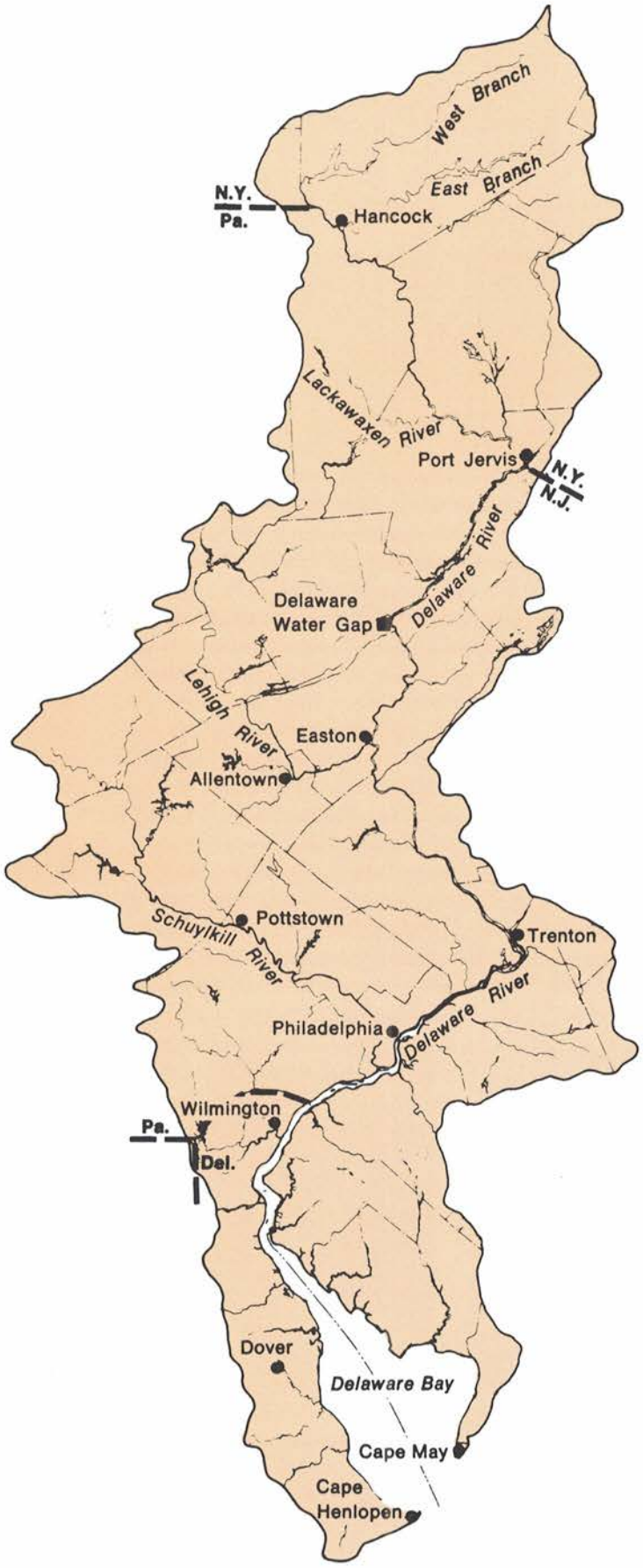
Icejam Study Sought

In February of 1981, the Delaware River Basin was beginning to recover from its worst drought since the 1960s. But an extra-wet Presidents' Month was far too wet for Matamoras, Pa., and Port Jervis, N.Y., which are separated by the narrow Delaware as it passes the Tri-State Rock. A cold winter had left the river jammed with great chunks of ice that uncontrollably crunched and devastated shoreline property in its path as the river rose following torrential rains. Cooperating with Mayor Arthur E. Gray of Port Jervis and other community leaders on both sides of the river, DRBC coordinated and arranged a May 1982 meeting in Port Jervis of citizens and local officials with representatives of federal, state and municipal agencies to discuss possible means of averting a recurrence. Ironically, an early-1982 repeat of the local disaster had been threatened due to similar circumstances, but fortuitously did not materialize. The Army Corps of Engineers said it was willing to study the problem if a congressional appropriation, on which a decision was still pending at year-end, were forthcoming. A resolution endorsing the federal effort won unanimous approval of DRBC's members, and general support of the study was voiced by the agencies. However, some skepticism persisted concerning the practical feasibility of harnessing the river under such circumstances. The river's crest after the 1981 storm actually would have been higher without large volumes of runoff being impounded in reservoirs upstream.

Cold-Water Fishery

The Commission helped coordinate the fifth consecutive year of experimental operating procedures at New York City's three upper basin reservoirs which have improved stream conditions on the river's three major tributaries in New York State and on the upper mainstem. The program has won widespread support among fishing, recreation and environmental interests. It is anticipated that it will be adopted as a permanent arrangement in 1983.

With the overall acceptance of the benefits of the revised conservation releases program comes an opportunity for continuing cooperative efforts between New York City and New York State to consider further refinements to flow regimes to provide additional enhancement during good hydrologic conditions as well as greater protection of the aquatic ecosystem during drought conditions. Reduction of flows more rationally during drought periods, initiation of an intermediate schedule of releases during drought-warning conditions, upgrading the schedule of releases during droughts, retaining the thermal stress release bank for use at all times, and pursuing completion of downstream storage facilities to enhance the basin-wide flow management program, are all possibilities for consideration. In addition, a program for improved flexibility in relation to temperatures and flow quantities could be considered in plans for modification of release works for hydroelectric power development, water-supply and conservation-release improvement at Cannonsville dam.



The Delaware River Basin

Other Programs

Low-head Hydropower

The Federal Energy Regulatory Commission (FERC) notified DRBC and the Commonwealth of Pennsylvania in May of 1982 that a study they had conducted jointly had established the feasibility of generating hydroelectric power at Blue Marsh reservoir, located on a Schuylkill River tributary west of Reading in Berks County. The following month, the Commission and Commonwealth followed up the finding by applying for a FERC license to build and operate the facility. The application was accepted and a decision on the license is expected in mid-1983. A similar study by DRBC and the state concluded that hydropower at Prompton, a Lackawaxen valley flood control facility in Wayne County, is infeasible at this time. Prompton is one of the reservoirs recommended in the Interstate Water Management report for enlargement, by the end of 1995, at which time adaptation for hydropower could be reconsidered. Lehighton Borough has applied for a hydropower license at Beltzville, a Lehigh valley reservoir in Carbon County, and Weatherly Borough, also in Carbon County, hopes to install a power operation at Francis E. Walter reservoir. All four reservoirs are Army Corps of Engineers' installations.

Water Sales Policies Upheld

A decade ago DRBC adopted a system for raising funds with which to reimburse the federal government for incorporating needed water supply into a group of multi-purpose reservoirs in the basin. It provides for assessing charges for new or increased withdrawals from the basin's surface waters. But, in keeping with a provision Congress wrote into DRBC's enabling compact, amounts of water for which a user already had a state permit or actual pumping capacity were to remain free. Philadelphia, with surplus free water, was selling supplies to the Bucks County Water and Sewer Authority. DRBC contended that Philadelphia's exemption from Commission charges was not transferrable and billed the authority, which declined to pay. DRBC sued and won in federal district court, but on appeal the case was sent back to the trial court to decide if the free-water provision violates the Constitution's equal-protection provisions. In 1982, DRBC again won in the trial court, and the ruling was affirmed by the U.S. Court of Appeals. The authority then sought a U.S. Supreme Court review. Nullification of DRBC's free-entitlement policy could mean that the charges would be spread among all surface water users, most of whom get their supplies free.

New Shad Management Plan

The Delaware Basin Fish and Wildlife Management Cooperative is a confederation of agencies of the four river states and federal government that grew out of DRBC's old Fish and Wildlife Technical Advisory Committee. It has been involved with an ambitious project — development of a comprehensive fishery-management plan that in about a year will include plans for 24 species of Delaware fishes. The popular American shad, whose growing migrations up the Delaware as the river's quality improves are being celebrated each springtime, was selected for the initial planning effort. In October 1982, the Cooperative produced its strategic and operational plan for managing the habitat to achieve, by 1995, an average annual spawning population of at least 500,000 shad passing Lambertville and to provide 100,000 angler-days of sport fishing above Lambertville yearly with a harvest of 50,000 shad. It also seeks to maintain a basin commercial harvest at least as large as the average for 1977 to 1981 — with a target of 125,000 fish — and restore migrations into tributaries where they once ran.

The Commission's executive director is an invited participant in annual meetings of the group's policy committee, and DRBC biologists have provided liaison with the technical committe from its inception, with other Commission staffers providing special services as needed. The cooperative usually meets at DRBC's centrally located headquarters.

These are the agencies that comprise the Delaware Basin Fish and Wildlife Management Cooperative, which prepared the shad program:

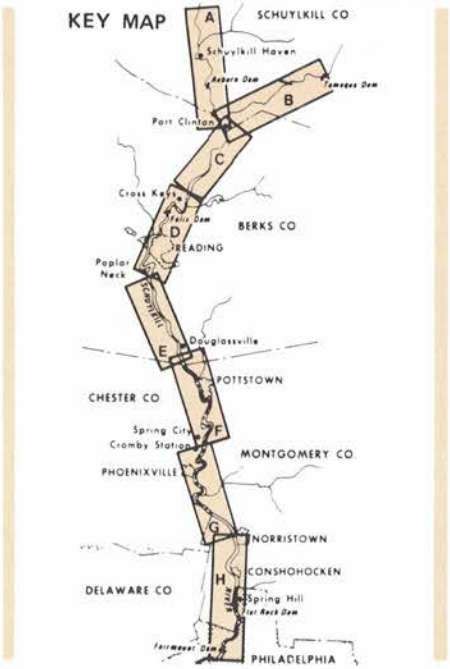
- *Delaware Division of Fish and Wildlife*
- *New Jersey Division of Fish, Game and Wildlife*
- *New York Division of Fish and Wildlife*
- *U. S. Fish and Wildlife Service*
- *National Marine Fisheries Service*
- *Pennsylvania Fish Commission*

Hazardous Wastes

DRBC issued the final report in 1982 of its Hazardous Waste Management Facility Study, covering the entire 13,000 square-mile Delaware Basin plus the non-basin portion of New Jersey. The report was issued as a guide to the basin states in implementing their respective hazardous-waste treatment and disposal programs. Included in the report were volume estimates of present and future waste generation; evaluation of technologies available for treatment and disposal; analysis of the size, type and general location of neded new treatment facilities; and regional criteria and methodologies for screening suitable vs. unsuitable sites for treatment, and disposal of hazardous materials. The study was conducted jointly with New Jersey's Department of Environmental Protection, which credited the effort with getting the state off to a good start with its own program, including the uncovering of areas sensitive to the siting of facilities. Director Jack Stanton of the department's waste management division called DRBC's management of the study "consistently outstanding" and "very professional." Following issuance of the final report, DRBC assisted the state of Delaware in a mapping program to designate suitable areas for siting of installations there.

Schuylkill River, Delaware Estuary Recreation Maps

To enhance the growing boating enjoyment of the Delaware, the Commission in 1966 published a 10-map recreation guide to the river's 200-mile nontidal reach from Trenton at the head of the estuary to Hancock, N.Y., where the East and West branches converge to form the mainstem. Since then, some 40,000 sets of the maps have been sold by DRBC, including 10,000 of the updated water- and tear-proof version that came out in 1979. In 1982, DRBC and Pennsylvania's Bureau of Parks published a similar eight-map durable guide to canoeing and other recreational opportunities on the Schuylkill River, the Delaware's largest tributary. For 102 miles of the Schuylkill from the headwaters to Philadelphia, the maps convey information on access points for boating and fishing, classification of rapids in accordance with the international scale of river difficulty, stream hazards, river channel and mileages, and historic and other landmarks.



This key map is reproduced from the new Schuylkill River recreation guide, where it appears on each of the eight map sections.

Work also has begun on a recreation map presentation for the 135-mile estuary and bay segments of the Delaware River from the ocean to Trenton. Upon its completion, all 335 miles of the mainstem will have been mapped and made available to the public.

Water Quality Improvement

The Commission issued its latest river-wide status report on water quality, entitled "Cleaning Up the Delaware River." It found that over the previous 23 years the total wasteload to the 85-mile estuary from Trenton to below Wilmington had been reduced by more than half. The worst reach, just below Philadelphia, had improved substantially in both oxygen and coliform bacteria after the recent upgrading of that city's southwest sewage treatment plant, the report said. Further purification is anticipated following scheduled improvements over the next few years at other municipal plants in Philadelphia and Camden. In Camden County, however, progress faces serious obstacles due to limitations in federal funding. Meanwhile, officials there hope to overcome the problem by developing alternative funding sources.
Eighty percent of the entire mainstem was classed as good-to-excellent and meeting the federal goal of "swimmable." The nontidal river above Trenton, with far less industrial and urban development, has the best quality. Publication of the status report is required biannually by the U.S. Environmental Protection Agency (EPA).

Over the past seven years, EPA has delegated to each of the four basin states

the authority to issue wastewater discharger permits under the National Pollution Discharge Elimination System (NPDES) established by Congress. DRBC provides basinwide overview by reviewing the permits to assure that its standards and wastewater allocation system are implemented through the NPDES process. DRBC's allocations are more stringent than called for in EPA's minimum standards.

Merrill Creek

In 1976, DRBC put the region's power companies on notice that they would have to start planning their own water storage facility. This is needed to provide cooling-water for their generating operations in order to prevent reduced streamflows in the Delaware in future droughts. The companies' water-planning unit, the Delaware River Basin Electric Utilities Group, examined scores of possible reservoir sites, finally settling on Merrill Creek in Warren County, N.J., as the most effective and least disruptive. The companies submitted a formal application a year later for DRBC permission to build the facility. Since then, two major reports, the Commission's Comprehensive (Level B) Study and the draft Interstate Water Management report to DRBC from the four river states and New York City, both endorsed Merrill Creek provided it is found technically and environmentally sound. Following delays for additional technical studies, the environmental review is moving ahead, with the draft impact statement having been published in July 1982 and a prodigious volume of hearing and written comments received. As the year ended, DRBC was about to start working on the final impact statement, a refinement of the draft that also responds to the many objections and other comments. The Commission's technical review will follow the environmental analysis, with a permit decision targeted for late-1983.

Point Pleasant Diversion

As the project to divert Delaware River water into Bucks and Montgomery counties in Pennsylvania for community supplies and cooling at a nuclear power plant moved closer to construction, the activities to halt it intensified through 1982. The U.S. District Court's approval of DRBC's environmental (1980) and permit (1981) clearances was affirmed by the Third Circuit Court of Appeals in March. Later in the year, opponents of the project petitioned DRBC to reopen its permit process and also sought a federal court injunction to delay the construction start scheduled for January 1983, but both petitions were denied. As 1982 ended, new administrative, legal and political challenges to both the pumping station and Limerick power plant, on which construction continued on the Schuylkill River downstream of Pottstown, were unresolved. These actions included a court contest to invalidate the stream encroachment permit issued by the Army Corps of Engineers in October. Also in 1982, Pennsylvania's Department of Environmental Resources issued an impact statement that found the project environmentally acceptable, a conclusion that opponents challenged as well.

Financial Summary*

Budgetary

Revenues	Budgeted	Received
Delaware	$ 138,400	$ 138,400
New Jersey	367,700	367,700
New York	250,000	250,000
Pennsylvania	424,600	424,600
United States	269,000	269,000
Total from Signatories	$1,449,700	$1,449,700
EPA Grant	230,000	230,000
Project Review Fees	0	8,007
Contractual Services	18,000	16,865
Interest Income	0	197,070
All Other	49,000	66,567
	$1,746,700	$1,968,209

Expenditures	Budgeted	Expended
Personal Services	$ 986,900	$ 985,977
Special and Contractual Services	249,200	248,944
Other Services	31,600	31,296
Supplies and Materials	31,400	31,274
Space (including $42,542 of principal payments on Plant Fund mortgage)	153,500	153,368
Communications	45,600	45,489
Travel	17,700	17,673
Maintenance and replacements	17,400	17,373
Equipment purchase or rental	26,600	26,520
Fringe benefits and other	186,800	186,644
	$1,746,700	$1,744,558

Non-Budgetary**

Special Programs and Projects	Fund Balances July 1, 1981	Revenues	Transfers	Expenditures	Fund Balances June 30, 1982
USGS Gaging	$ 0	$ 80,880	$ 0	$ 76,500	$ 4,380
Tocks Island Region Environmental Study	3,146	0	(3,146)	0	0
Tocks Island Reservoir — Fluctuation, Research	320	0	(320)	0	0
Thermal Study	4,393	0	(4,393)	0	0
New Jersey Personnel Contract	33	0	(33)	0	0
New Jersey Coastal Zone	1,612	0	(1,612)	0	0
Flood Plain Contract Fund — Pennsylvania No. 3	5,480	43,267	0	48,747	0
Blue Marsh, Prompton Dams	0	67,000	0	95,000	(28,000)
Study of Exotic Wastes — Phase II	87,411	8,100	0	36,014	59,497
Waste Load Allocation	66,501	0	0	24,216	42,285
Ground Water	649,297	270,000	0	623,354	295,943
Study of Salinity Intrusion in the Delaware Estuary	89	0	(89)	0	0
Level B Study	25,593	0	0	25,593	0
Merrill Creek	12,590	5,615	0	5,615	12,590
Model — Documentation	10,916	0	0	6,001	4,915
Model — Recalibration	12,326	0	0	12,326	0
Recreational — Scenic Rivers	6,857	20,000	0	23,100	3,757
Water Re-Use	18,030	42,625	0	60,655	0
Ground Water — Pennsylvania Protected Area	0	111,153	0	54,329	56,824
Flood Plain Contract Fund No. 1	39,164	50,000	0	89,164	0
Merrill Creek-P.S.E. & G.	0	111,946	0	88,083	23,863
Environmental — Level B	30	0	(30)	0	0
Environmental — Merrill Creek	710	0	(710)	0	0
Ground Water — Withdrawal Fees	250	645	0	0	895
Computer	0	10,761	10,333	0	21,094
	$944,748	$821,992	$ 0	$1,268,697	$498,043

*For Fiscal Year ended June 30, 1982.

**Revenues from sources outside current expense budget.

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

Delaware River Basin Commission
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