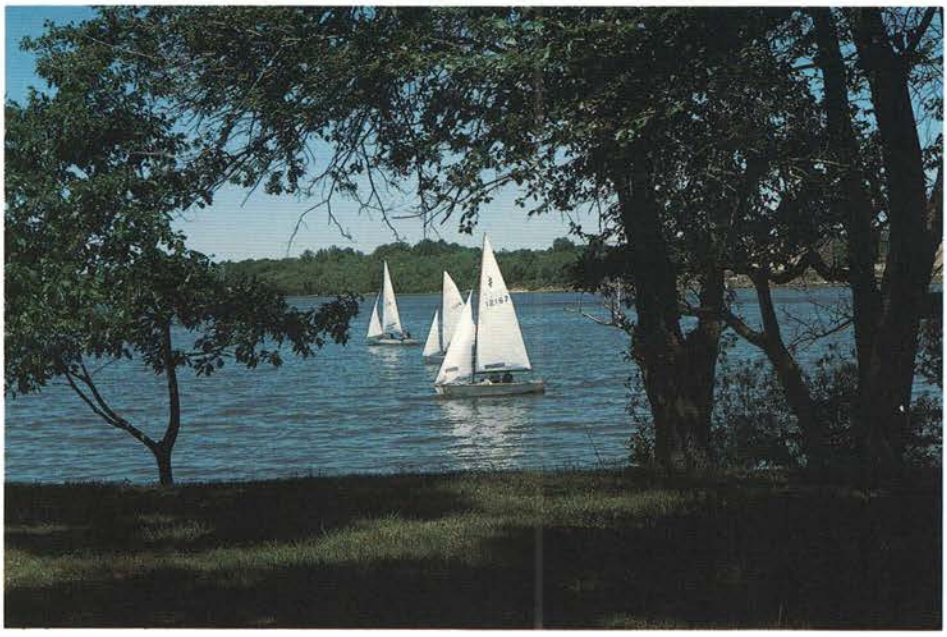
DELAWARE RIVER BASIN COMMISSION

Annual Report 1989

Front cover: Sanderlings patrol a Delaware Bay beach during the height of the shorebird migration. Up to one million birds visit the bay each spring, gorging on some 300 tons of horseshoe crab eggs in one of nature's most boisterous banquets. (Clay Sutton photo). Story on page 26.

This report was compiled by the DRBC staff; designed by Odette P. Taft, DRBC graphic artist/ illustrator; and edited by Christopher M. Roberts, DRBC's Public Information Officer.



Sailboats under a gentle breeze on the Delaware River downstream from the Burlington-Bristol Bridge. (Photo by Seymour P. Gross)

Contents

The Commission • 1989


Governor Cuomo

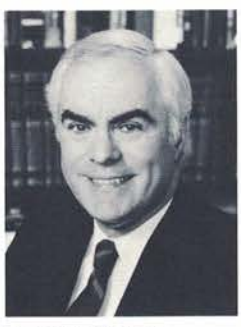

Mr. Jorling


Governor Kean


Mr. Catania


Governor Castle


Mr. Ashbee


Governor Casey


Dr. Grace


Secretary Lujan


Ms. Brooks

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Governor Mario M. Cuomo
Chairman

Thomas C. Jorling
Alternate

Russell C. Mt. Pleasant
Second Alternate

Harvey W. Schultz
Advisor

New Jersey

Governor Thomas H. Kean
Vice Chairman

Michael F. Catania
Alternate

Eric J. Evenson
Second Alternate

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Second Vice Chairman

R. Wayne Ashbee
Alternate

Gerard L. Esposito
Second Alternate

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Alternate

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Second Alternate

John Plonski
Advisor

United States

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Manuel J. Lujan Jr.
Member

Irene B. Brooks
Alternate

Lt. Col. G. William Quinby
Advisor

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Executive Director

David J. Goldberg
General Counsel

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Secretary

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Chief Engineer

Jeffrey P. Featherstone
Policy Analyst

Branch Heads

David P. Pollison
Planning

George C. Elias
Project Review

Richard C. Tortoriello
Operations

Changing of the Guard

U.S. Interior Secretary Manuel J. Lujan Jr. was appointed by President George Bush on June 14, 1989 to serve as the federal member of the Delaware River Basin Commission.

"As the representative of the United States, you will be working closely with the federal and state agencies to develop a coordinated water resources program (for the Delaware River Basin)," the President stated in his appointment letter.

Secretary Lujan succeeds former Interior Secretary Donald P. Hodel on the Commission. The other members are the governors of the four basin states — Delaware, New Jersey, New York and Pennsylvania.

Mr. Bush also appointed an alternate federal member, naming Irene B. Brooks of Chester County, Pa.

Alternate commissioners from New York, New Jersey and Delaware likewise were named during 1989.

"Serving on the Commission and helping to meet the water needs of 20 million people in the Northeast is directly related to the Interior Department's responsibility for monitoring, assessing and helping to manage the quantity and quality of our nation's water resources," Secretary Lujan said at a June 28 Commission meeting which he chaired in Washington, D.C. "Federal partnerships with the states through organizations such as the DRBC are increasingly important as we attempt to develop solutions to the many problems associated with maintaining an adequate supply of good quality water for all Americans."

New Commission officers were elected at the Washington meeting: New York Gov. Mario M. Cuomo, chairman; New Jersey Gov. Thomas H. Kean, vice-chairman; and Delaware Gov. Michael N. Castle, second vice-chairman. Their terms run from July 1, 1989 through June 30, 1990. (The vice-chairmanship automatically passed to James J. Florio when he took office as New Jersey's 49th elected governor on January 16, 1990.)

Mr. Lujan was sworn in as Interior Secretary on Feb. 3, 1989 following a 20-year career in the U.S. House of Representatives where he was the senior Republican member of the Energy and Environment Subcommittee. He co-sponsored seven major environmental protection bills including the Clean Air Act of 1970 and the Clean Water Act. He also successfully sponsored legislation setting aside more than 600,000 acres of land in his home state of New Mexico as wilderness areas.

Ms. Brooks has been active in local government in southeastern Pennsylvania, serving on numerous planning commissions and policy committees. At the time of her appointment to the DRBC (Sept. 7, 1989), she was a Chester County Commissioner.

She also founded and chaired the Chester County Open Space and Environmental Task Force which developed a plan for open space preservation in the county.

Ms. Brooks is a past member of the Greater Philadelphia Economic Development Coalition, the Pennsylvania State Association of County Commissioners, and the Delaware Valley Regional Planning Commission.

In 1988, she was named "Elected Official of the Year" by the Pennsylvania Planning Association.

She succeeded George J. Kanuck Jr. as the DRBC federal alternate com-

missioner. Mr. Kanuck resigned in the spring of 1988.

In other assignments, Lt. Col. Kenneth H. Clow, who in early 1990 became the 43rd Commander and District Engineer of the Army Corps of Engineers' Philadelphia District, is the new federal advisor to the DRBC. He succeeds Lt. Col. G. William Quinby who retired.

Col. Clow, a 1970 graduate of the U.S. Military Academy, formerly served as Director of Engineering and Housing for the Seventh U.S. Army Training Command, Grafenwoehr, Germany. He also is a former

Lt. Col. Clow

Deputy Commander and Deputy District Engineer of the Corps' San Francisco District.

Col. Clow holds a master's degree in engineering mechanics from the University of California at Berkeley.

* * *

Edwin H. Clark II, secretary of Delaware's Department of Natural Resources and Environmental Control (DNREC), was appointed by Gov. Castle to serve as the governor's alternate to the DRBC, effective at the start of 1990. He replaced R. Wayne Ashbee, who became Dr. Clark's Special Assistant.

Dr. Clark joined DNREC in May of 1989 after serving as vice president of the Conservation Foundation and director of the Foundation's Water Resources Program and its Environ-

Dr. Clark

mental Conditions and Trends Program. Prior to that, he was acting assistant administrator for pesticides and toxic substances at the U.S. Environmental Protection Agency. He also served as an executive assistant to the Administrator of EPA.

He joined EPA after five years in the pollution control division of the President's Council on Environmental Quality, serving as senior economist, acting executive director, and senior staff member.

Dr. Clark has taught economics and directed the Center for Environmental Studies at Williams College in Massachusetts and served as agricultural advisor to the government of Pakistan.

He holds a Ph.D. in applied economics and master's degrees in water resources engineering and public policy from Princeton University and has a bachelor's degree in civil engineering from Yale University.

* * *

Gov. Castle also appointed Alan J. Farling, administrator of the Groundwater Management Section in DNREC's Division of Water Resources, to serve as one of two second alternates on the Commission. Mr. Farling joins Gerard L. Esposito, director of the Division of Water Resources, who was named alternate to Mr. Ashbee in 1987.

As head of DNREC's Groundwater Management Section, Mr. Farling is in charge of Delaware's water supply, water allocation, groundwater protection, and permitting programs.

Before joining DNREC in 1986, he held a variety of positions in both the private and public sectors managing water supply, sewage disposal, highway construction, and resource recovery projects. He is a former pub-

Mr. Farling

lic works director of both York County, Virginia, and Dover, Delaware.

Mr. Farling is a retired intelligence officer with the U.S. Naval Reserve and holds bachelor's and master's degrees in engineering from Old Dominion University. He is a licensed professional engineer in Virginia and Delaware.

* * *

Gov. Cuomo announced on Sept. 13, 1989 that he was appointing Russell C. Mt. Pleasant as the DRBC alternate to Thomas C. Jorling, commissioner of New York State's Department of Environmental Conservation (DEC).

Mr. Mt. Pleasant is director of DEC's Bureau of Water Resources in the Division of Water. He succeeded former division director Daniel M. Barolo as Mr. Jorling's alternate.

Mr. Mt. Pleasant, who also served as an alternate DRBC commissioner from 1980 to 1983, began his career

Mr. Mt. Pleasant

in government in 1962 with the New York State Department of Health's water pollution control program. He moved to DEC when it was created in 1970 and absorbed Health Department programs involving water and air quality and solid waste.

He serves as New York State's official representative to the Delaware River Master Advisory Committee, manages the public water supply permit and reservoir release programs for the DEC, and is Commissioner Jorling's designate to chair New York's Interagency Drought Management Task Force.

Mr. Mt. Pleasant graduated from Syracuse University in 1960 with a degree in civil engineering and received his master's degree in sanitary engineering from Syracuse in 1962. He is a licensed professional engineer in New York State.

* * *

Eric J. Evenson, acting director of the Division of Water Resources, New Jersey Department of Environmental Protection (DEP), was appointed on June 28, 1989 by Gov. Kean to serve as New Jersey's DRBC alternate to Michael F. Catania, DEP's deputy commissioner.

Mr. Evenson succeeded Dirk C. Hofman, a DRBC commissioner for ten years.

Both Mr. Evenson and Mr. Catania represented Gov. Kean at DRBC meetings for the remainder of his term and were reappointed to the Commission by Gov. Florio after he took office.

A graduate of the University of Nebraska with a bachelor's degree in aquatic biology and a master's in ecology, Mr. Evenson joined the DEP's Division of Water Resources in 1979. He was promoted to deputy director in the fall of 1987 with responsibilities over New Jersey's water supply and municipal wastewater assistance programs. He was elevated to acting director in September of 1989.

Mr. Evenson

He also served as the DEP's Superfund coordinator and currently is the department's ocean program coordinator.

Prior to joining the DEP, Mr. Evenson was a biologist with the U.S. Fish and Wildlife Service.

Executive Director's Report

F. E. Walter: A Sensible Approach to Drought Management

By Gerald M. Hansler

The year 1989 showed some movement towards construction of the F. E. Walter Reservoir Project which would provide additional needed storage in the Basin. The enlarged reservoir would provide releases during dry and drought periods averaging an additional 290 cubic feet per second (cfs) at the Trenton gaging station (about 188 million gallons per day). However, modification of Section 15.1(b) in the Federal Reservations to the Delaware River Basin Compact is needed to give the DRBC authority to charge pre-Compact water users for the facility.

Section 15.1(b) was inserted by the Federal Government when it joined the four Basin states in ratifying the Compact. It prohibits the Commission from imposing any charges for water withdrawals or diversions from the Basin if they lawfully could have been made without charge on the effective date of the Compact — October 27, 1961. This "grandfather" clause was not included in the Compact itself as enacted by the four states.

Because of this Federal Reservation, the Commission is barred from charging these "grandfathered" water users — who make up the vast majority of water users in the Basin — for existing projects or critically needed new ones.

Pennsylvania Congressman Paul E. Kanjorski, in whose Congressional District the F. E. Walter project is located, introduced legislation in February of 1989 which would modify Section 15.1(b). It called for the States and Federal Government to contribute one-third each towards the water supply storage aspects of the project, which is now about $106 million. The DRBC would be limited to charging all major users in the Basin for the remaining one-third of the water supply storage. Mr. Kanjorski's bill also specified that two-thirds of one-third of all water supply storage would be set aside for the four counties in his Congressional District — Luzerne, Lackawanna, Carbon and Monroe. Most of the land area in his District lies not within the Delaware River Basin, but in the neighboring Susquehanna River Basin.

Mr. Hansler

The three lower-Delaware Basin States, which have agreed to partially finance the project, have stated that their contribution would be held to $10 million each from Pennsylvania and New Jersey, and a pro-rata share from Delaware amounting to $800,000. The states disagreed with the Kanjorski bill provision that they contribute a full one-third.

They also expressed concern about the plan to set aside two-thirds of one-third of the entire 22.9 billion gallons storage which would be available in the proposed F. E. Walter Project. The project is to alleviate economic and environmental hardship during droughts within the Delaware, not the Susquehanna River Basin. However, Pennsylvania Governor Robert Casey partially supported Congressman Kanjorski's request for a set-aside. He requested that the DRBC amend its Compre-

hensive Plan to allow up to 20 million gallons per day (mgd) to be used in northeast Pennsylvania without specifying in-Basin or out-of-Basin diversions.

The Commission, after public notice and two public hearings, amended its Comprehensive Plan to set aside up to 20 mgd for new water withdrawals for use in northeastern Pennsylvania. This amounts to about 10 percent of the F. E. Walter Project yield. Any new takers would still be required, individually, to meet the application requirements of Pennsylvania's Department of Environmental Resources, the U.S. Army Corps of Engineers (including NEPA requirements), and those of the DRBC. Also, DRBC water charges in effect at the time of new water withdrawal approval would not be waived. The set-aside for northeastern Pennsylvania is also predicated upon the completion of the F. E. Walter storage project.

No action was taken nor were Congressional hearings held on the Kanjorski bill in 1989.

Senator Bill Bradley of New Jersey introduced a bill (S.J.R. 234) in November of 1989 which would also modify Section 15.1(b) of the Compact. That bill would provide for the Federal Government to contribute about 20 percent towards the water supply storage cost which is not now specifically authorized in the construction of the F. E. Walter Project. Such Federal contribution is authorized on a nationwide basis for agricultural irrigation and salinity repulsion in the 1986 Water Resources Act and the 1987 Clean Water Act, respectively.

The Bradley bill also specifies the geographical area in which a DRBC water charge program to pay for storage facilities could be applicable. That area is identical to the charging area of current post-Compact water users, who are now paying for storage costs for the Beltzville and Blue Marsh reservoirs. S.J.R. 234 also would limit the number of DRBC-sponsored storage projects subject to broad-based water use charges to three — F. E. Walter, Beltzville and Blue Marsh. This means that the DRBC could not develop any other project to be paid for by pre-Compact users without returning to Congress.

Finally, the Bradley bill specifies that any DRBC water charging program to pay for these three facilities should be based upon benefits derived. Anyone in the Basin who evaporates or otherwise depletes water which has an effect on salinity in the estuary would rely upon DRBC storage for releases to make up for such evaporation. The DRBC's storage and release program is such a direct benefit. Also, with the additional storage provided by the F. E. Walter Project, the Basin would be in drought warning or emergency on fewer occasions; and the likelihood of curtailing essential water use during droughts, with the attendant economic and environmental consequences, would be diminished.

If the Bradley bill were to be enacted, what would be the additional *annual* cost to a family, say in Trenton, New Jersey? About 42 cents.

There continue to be some forces opposed to the modification of 15.1(b). Most of those support the need for additional storage, but want to pay nothing, or not their fair share. Some interests are merely anti-dam. That's ironic, because there

exists at the F. E. Walter Project site a huge dam and spillway now utilized for flood control. A vast area behind the dam has already been utilized to store flood waters. It makes good sense to provide water supply storage at an existing site, rather than create a new impoundment on a major Delaware tributary, or the main stem itself — such as Tocks Island.

Hopefully, congressional hearings will be held in the near future followed by amendment of the Compact so that modification of F. E. Walter can begin.

If F. E. Walter is not modified, more frequent drought warnings and emergencies will be triggered. The threat of salt water contamination of the Potomac-Raritan-Magothy aquifer in southern New Jersey will be heightened. And the curtailment of essential economic activity as the result of cutbacks in depletive water use is a strong possibility.

Francis E. Walter Dam

The Delaware River Basin: Rich Past, Demanding Future

Its good wing thrashing, the injured duck retreated in quacking circles as a man and a boy chased it down in a canoe. Near shore the bird was snared by underbrush. Discarded fishing line clamped the other wing and a leg together in a monofilament trap, the line cutting into the leg. The man held the duck and the boy cut out the tangles with a pocket knife.

Both wings pumping now, the bird splashed away from the Delaware River bank and lifted off the water, closing quickly on a cotton ball cloud in a bright blue August sky.

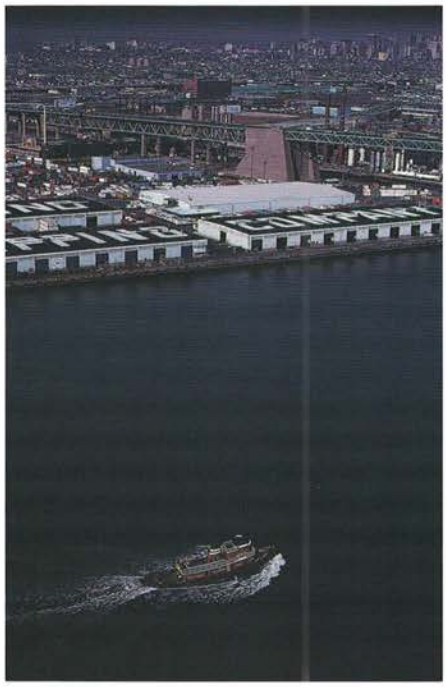
That duck taught the boy something about the river that day.

He had witnessed the harm that can be inflicted when man and nature clash in competition over a common resource, be it a puddle, a stream, a river, or a mountain. He had witnessed, too, the good that can come when people work together, pulling collective oars in pursuit of a cure.

He had learned the lesson in the small part of an afternoon. It had taken his forefathers centuries, and when they finally did understand, the hourglass was near empty.

This then is the story of the Delaware River and Bay, about a valley that was spoiled by man, who then tried to clean it up; about a valley that in recent years suffered through a killer flood and record drought, calamities that helped remove political fences and make for better neighbors.

The story's ending hasn't been written yet. The boy's children and their children will do that.



A tugboat heads north on the Delaware River approaching the Walt Whitman Bridge. Philadelphia's skyline is off to the left. Although the Delaware River Basin drains only 0.4 percent of the total U.S. land area, almost ten percent of the nation's population relies on the basin's waters for drinking and industrial use. (Courtesy of C. Carlton Read, Delaware River Port Authority)

The Delaware isn't a big river as rivers go. But it is fed from runoff from parts of four states and flows through the nation's fifth largest urban area, supporting 22 million people. The competition picks up with each river mile as the Delaware tumbles out of New York's Catskill Mountains, trips over the rocks at the head of tide at Trenton, N.J. then glides towards the bay, past Philadelphia and a giant concentration of heavy industry and the second largest oil refining-petrochemical center in the United States.

Rafters and tubers dot the river on hot summer days. Fishermen hunt out open water. Backers of free-flowing rivers and open space live on the river's banks; so do land developers and builders of dams. Pleasure craft dodge tankers in the river's busy estuary. Thirsty governments compete for her waters.

But let's turn back to the beginning, about 250 million years ago, when Africa and Europe were shoved by earth's forces against North America and there was no Atlantic Ocean. Another 50 million years passed and the earth moved again. The continents were wrenched apart and the ocean filled the divide. Scientists believe it was about this time that the Delaware's drainage area began to evolve, to be transformed in years to come by migrating sands and melting ice sheets.

Among the first recorded inhabitants of the 12,755 square-mile Delaware River Basin were the Lenape (Le-náh-pay) Indians. They fished and clammed in the waters and grew corn and squash on the land. The river, they believed, was a gift from their Creator, who also made the moon and the stars.

Then came a day in 1609 which would change the valley forever. A giant wooden creature with square white wings appeared on the waters off shore. It puffed smoke and roared, shooting a shiny black pumpkin from its side. Europe's explorers had arrived.

The Dutch settled the valley first, followed by the Swedes and the English. They cut down the forests and plowed the fields, dammed the streams and built lumber and grist mills. Soil ran off into the river and bay, choking inland ports.

Waterfront forts became towns, some towns cities. Among the early settle-

ments: Salem and Greenwich in New Jersey, Lewes and New Castle (formerly Fort Casimir) in Delaware, Philadelphia and Upland (now Chester) in Pennsylvania, the bluestone quarry towns of Kilgour Spur and Pond Eddy in New York.

The river and bay, and the numerous tidal streams that poke into them like arthritic fingers, were magnets for growth, offering vital transportation links. Rich fishing grounds lay offshore of many towns, as did the trade routes to Europe and the Orient.

The cities and towns grew. Water was drawn from the basin for use by the people, then returned as raw sewage. Belching factories, coal mines, tanneries, iron and steel mills and giant shipyards sprang up. Their products were sold and what was left, the waste and the wastewater, it too went into the river and bay and the streams. Deadly epidemics spawned by waterborne diseases broke out in Philadelphia. Coal silt suffocated the Schuylkill, the Delaware's largest tributary.

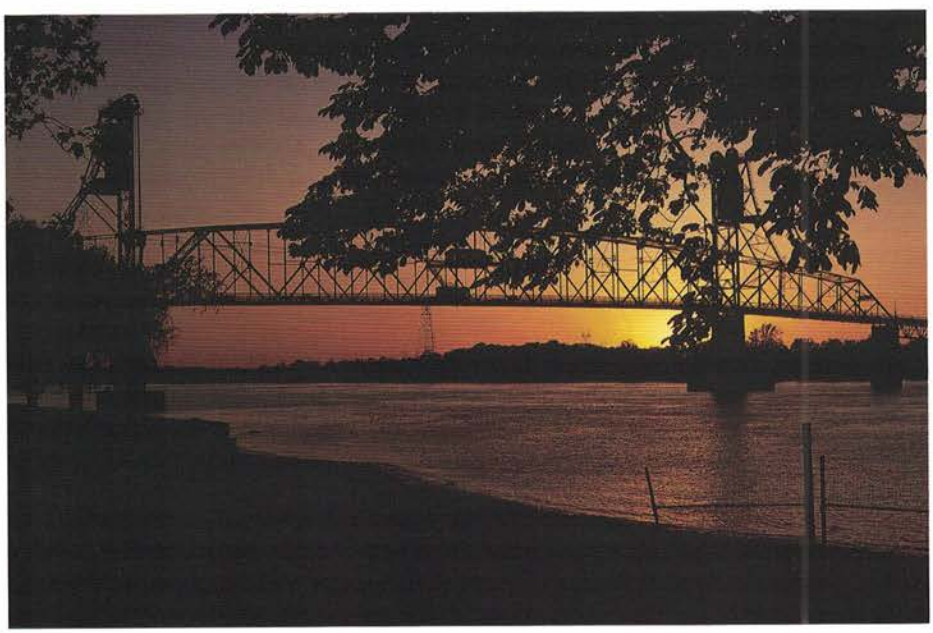
By World War II, the lower Delaware had become an open sewer, spewing septic gases that tarnished ships' metalwork and sickened sailors. Little or no oxygen remained to support fish and other aquatic life. The Delaware was near death.

To Whom Does the River Belong?

The people in the basin had been slow to learn the lesson taught to the boy in the small part of an afternoon. Having fouled their own nest, they began to look for answers.

But what was the solution? Attempts had been made before to manage the river. But the efforts were piecemeal, fraught with selfish motives.

Sun-bathed waters of the Delaware River sweep beneath the Burlington-Bristol Bridge. (Photo by Seymour P. Gross)



Turf wars were fought over water diversions, dam construction, fishing rights. Some disputes reached the U.S. Supreme Court.

Whose river was it anyway?

It was a vexing question, not unlike the one raised in the ballad, "Uncle Sam's River," at the turn of the century:

The river belongs to the Nation,
The levee, they say, to the State;
The Government runs navigation,
The Commonwealth, though,
pays the freight.
Now, here is the problem,
that's heavy —
Please, which is the right
or the wrong —
When the water runs over the levee,
To whom does the river belong?

Slowly it sank in. The river didn't belong to anyone really. It belonged to everyone. It was a common resource with common troubles that bridged political boundaries. Its problems called for common solutions, to be worked out by the Nation, the States, and the People.

It was an idea that would flourish, helped along by the deadly flood and the record drought.

It was in July of 1955 that the governors of Delaware, New Jersey, New York and Pennsylvania and the mayors of Philadelphia and New York City first met to discuss the idea. The four basin states already were members of an advisory committee called INCODEL (Interstate Commission on the Delaware River Basin) which had been formed in the 1930s.

Under INCODEL, in-stream, water quality standards were eventually established. The silt-choked Schuylkill was dredged. Sewage treatment plants were upgraded, reflected in a modest improvement in water quality by the 1950s.

It had been a good beginning. But INCODEL, as an advisory committee, was without regulatory muscle. Something stronger was needed.

President John F. Kennedy joins basin state governors in a ceremonial signing of the Delaware River Basin Compact. Seated from left are New Jersey Gov. Robert Meyner, Delaware Gov. Elbert Carvel, and Pennsylvania Gov. David Lawrence. Gov. Nelson Rockefeller of New York, the fourth state joining in the Compact which created the Delaware River Basin Commission, was unable to attend.

And so the chief executives met on that July day to talk about the creation of a regional body with the force of law to oversee a unified approach to the development and control of the river system.

A month later, the flood, the worst in the valley's recorded history, took 99 lives and stirred a public clamor that prompted Congress to direct the U.S. Army Corps of Engineers to forge a comprehensive physical plan for the basin's waters.

The Corps completed its report in December of 1960, a massive document advocating a 50-year development program of 58 water control projects at a cost of $591 million (in 1960 dollars). Meanwhile, the chief executives continued to deliberate, and on Sept. 30, 1959 they accepted a recommendation from a second advisory committee for a joint federal-state commission to be created by compact.

The necessary legislation for the compact's enactment was drafted and on Feb. 1, 1961, the chief executives endorsed the package. By summer's end it had won approval in Congress and the four basin state legislatures and had been signed by the governors.

President John F. Kennedy added his name to the congressional action on Sept. 27, 1961. Thirty days later, the Delaware River Basin Compact became law, creating the Delaware River Basin Commission (DRBC) and marking the first time in the nation's history that the federal government and a group of states had joined together as equal operating partners in a river basin planning, development and regulatory agency.

It was a time for hurrahs and handshakes, but in the months ahead concern. The flood, fed by the soaking rains of two trailing hurricanes, had left a fear of high water in the valley. The record drought that lay just ahead would show how precious little water there was when it didn't rain hard enough.

But to understand the significance of the drought of the 1960s we must turn back to the 1930s, a decade which had recorded the previous drought of record and one in which a historic court action involving out-of-basin diversions would create unique challenges for the basin's future water managers.

On May 25, 1931, the U.S. Supreme Court granted New York City, which lies outside the basin, the right to withdraw 440 million gallons a day (mgd) of water from two reservoirs the city planned to build on headwater tributaries feeding the Delaware main stem. The impoundments (Neversink on the Neversink River and Pepacton on the Delaware' East Branch) became fully operational in the late summer of 1955.

The court action, in the form of a decree, stood for 23 years. Then in the early 1950s the decree parties — the four basin states and New York City — returned to the court, again in a dispute over the city's right to divert water out of basin. An amended decree was consented to by all parties and adopted on June 7, 1954. It permitted New York to increase its withdrawal rate to 800 mgd contingent on the city's construction of a third in-basin water supply reservoir — the Cannonsville impoundment on the Delaware's West Branch which was completed during the '60s drought.

In return, the city, under the amended decree, had to release from the three upper basin reservoirs sufficient water into the Delaware to meet a flow objective of 1,750 cubic feet per second at the tri-state line at Montague, N.J., to assure adequate streamflows downriver. A river master was appointed by the court to over-

Basin Bits

The Delaware River Basin Commission is responsible for water resources management in the basin. The Commission's members are the governors of the four basin states and a presidential appointee, traditionally the U.S. Secretary of Interior.

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Numerous other government agencies also are actively involved in the management effort and work closely with the Commission. They include: the Delaware Department of Natural Resources and Environmental Control, the New Jersey Department of Environmental Protection, the New York Department of Environmental Conservation, the Pennsylvania Department of Environmental Resources, the Pennsylvania Fish Commission, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Park Service, the U.S. Army Corps of Engineers, the U.S. Geological Survey, the New York City Department of Environmental Protection, and the Philadelphia Water Department.

* * *

"Watchdog" organizations like the Water Resources Association of the Delaware River Basin, the Watershed Association of the Delaware River, and the League of Women Voters' Inter-League Council of the Delaware River Basin also play an active and important role in shaping the management and regulatory process.

* * *

The Delaware River Basin extends from the mouth of the Delaware Bay 339 miles north to the river's headwaters above Hancock, N.Y. The basin contains 12,755 square miles, draining parts of Pennsylvania (6,422 square miles, or 50.3% of the basin's total land area); New Jersey (2,969 square miles, or 23.3%); New York

Releases are made from water supply reservoirs during low flow conditions in basin rivers to prevent salty water from migrating upstream from the Delaware Bay and contaminating aquifers in southern New Jersey. Releases also are made to improve water quality and protect basin fisheries by lowering in-stream temperatures and increasing dissolved oxygen levels. Shown above is the Pepacton Reservoir, a 140 billion-gallon impoundment located on the Delaware's East Branch and owned and operated by New York City. (Photo courtesy of John Goerg, NYDEC)

see the provisions of the decree, which also permitted an out-of-basin diversion of 100 mgd to central and northeastern New Jersey through the Delaware and Raritan Canal.

The high court had based its 1954 water sharing formula on the 1930s drought, the then drought of record. The 1960s drought, however, was much more severe; so severe, in fact, there simply wasn't enough water for both the city and the users downriver. The Supreme Court, it turned out, had unwittingly been too generous in its latest attempt to divvy up the basin water pie.

The 1960s drought would change the course of water resources management in the basin. So would a decision a decade later recommending that Congress not appropriate funds to begin construction of a mammoth reservoir, to be harnessed by a dam across the Delaware's main stem.

The DRBC, in adopting a Comprehensive Plan for managing the basin, had included in it a dozen multipurpose reservoir projects recommended in the Army Corps of Engineers' 1960 report.

Among them was Tocks Island Reservoir, the report's cornerstone. The reservoir, with a 100-mile shoreline, would stretch 37 miles upstream from just north of the Delaware Water Gap, providing hydro-power, flood control, water supply, and recreation. The dam was designed to hold back some 250 billion gallons of water, just shy of the 271 billion-gallon capacity of the three

New York City in-basin reservoirs which account for 75 percent of the basin's total surface water storage.

There was widespread, early support for Tocks, but it was eroded by Vietnam War-induced construction cutbacks and a budding environmental movement which grew increasingly opposed to damming the Delaware — the last major river east of the Mississippi without a dam on its main stem.

On July 31, 1975, the DRBC voted to recommend against congressional funding for Tocks, but failed to act on a motion to recommend that Congress deauthorize the project. New Jersey, New York and Delaware cast the majority votes against funding, Pennsylvania dissented, and the United States, as the project's sponsor, abstained.

The "Good Faith Agreement"

With Tocks' future thus clouded and the 1960s drought still a troublesome memory, the basin's water managers pondered the future. Should the decree parties once again engage in costly, lengthy litigation, returning to the U.S. Supreme Court for yet more adjustments to an aging edict? Or should a new blueprint for future water supply management be drafted?

At the DRBC's urging, the decree parties agreed in 1978 to deliberate in "good faith" on their own with the DRBC providing staff and technical support. Two years earlier, the Commission had initiated a program to revise its Comprehensive Plan in light of the decision to shelve Tocks.

A key to the revision process was the Delaware River Basin Level B Study which examined alternative ways of providing an adequate water supply during droughts.

Funded in part by the Federal Water Resources Council, the study involved numerous governmental agencies and the public. Briefings and formal hearings were held throughout the basin, attended by over 2,200 citizens who wanted a voice in the future management of one of earth's most precious resources.

The "good faith" negotiators drew heavily on data generated by the Level B Study, which concluded in 1981 with a report summarizing its findings. Two years later, the decree parties reached unanimous consent, resulting in a document entitled: "Interstate Water Management Recommendations of the Parties to the U.S. Supreme Court Decree of 1954 to the Delaware River Basin Commission Pursuant to Commission Resolution 78-20." Not surprisingly (and perhaps mercifully), it soon became known simply as the "Good Faith Agreement."

The document included 14 recommendations focusing on drought management, including the construction of additional water storage reservoirs. Nine of the recommendations have been implemented by the DRBC; others are being pursued.

Among the "Good Faith" accomplishments:

— Two drought management plans (one to deal with basinwide droughts, the other lower basin droughts) are now on the books. The basinwide plan calls for cutbacks in diversions to New York City and New Jersey as well as reductions in in-stream releases

(2,362 square miles, 18.5%) and Delaware (1,002 square miles, 7.9%).

* * *

Almost ten percent of the nation's population relies on the waters of the Delaware River Basin for drinking and industrial use and the Delaware Bay is but a day's drive away for 40 percent of the people living in the United States. Yet, the basin drains only 0.4 percent of the total U.S. land area.

* * *

Two stretches of the Delaware River have been included in the National Wild and Scenic Rivers System. The first section extends 73 miles from the confluence of the river's East and West branches at Hancock, N.Y. downstream to Mill Rift, Pa. The second stretch extends 34 miles from just south of Port Jervis, N.Y. downstream to the Delaware Water Gap, near Stroudsburg, Pa. Combined, the two designated river corridors total 124,929 acres. Stretches of four waterways in Pennsylvania also have been designated Scenic Rivers under the Commonwealth's Scenic Rivers Act of 1972. They include parts of the Schuylkill River, the Lehigh River, Brandywine Creek and French Creek, as well as numerous tributaries feeding them.

* * *

As a result of clean-up efforts in the Delaware, shad, sturgeon, herring and other anadromous fish (species that return from saltwater habitats to freshwater rivers and streams to spawn) are increasing in numbers. A recent study of shad fishing in the basin placed a $3.2 million annual value on this fishery alone.

* * *

A navigational channel, maintained by dredging, extends from the mouth of the Delaware Bay to Trenton, N.J. Authorized depth varies from 40 to 25 feet.

from the three New York City reservoirs. During the 1985 drought, the valves were turned and some 80 billion gallons of water saved. Another 50 billion gallons were saved during 1989, when the basin fell under a drought warning early in the year.

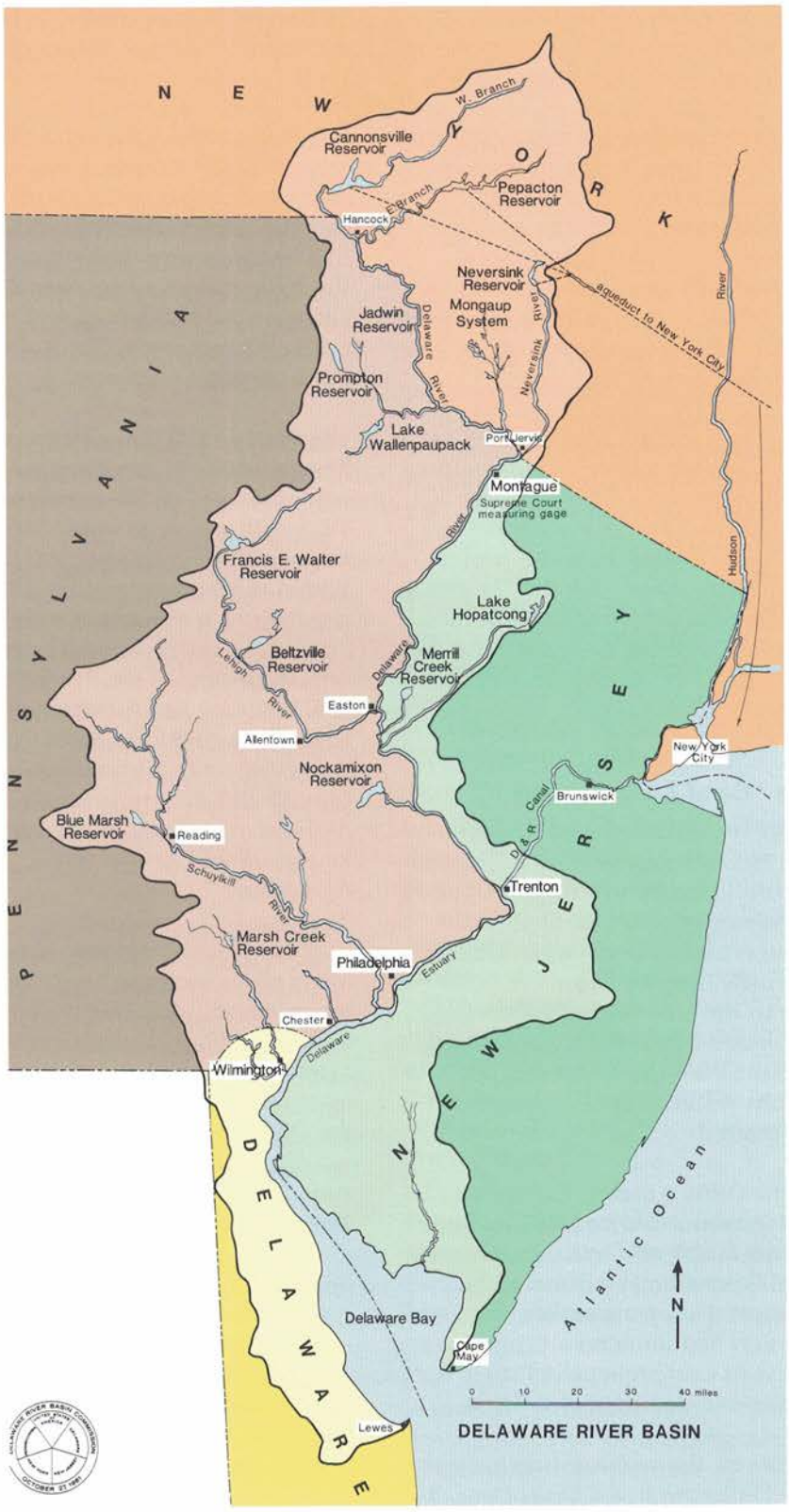
— Merrill Creek Reservoir, a pump storage impoundment near Phillipsburg, N.J., was recently completed by a consortium of electric utilities at a cost of $217 million. Releases from the 15 billion gallon reservoir make up for water evaporated at the utilities' in-basin generating plants during low flow periods in the Delaware.

— Special releases from the New York City reservoirs to protect the cold water fisheries in the upper Delaware have been authorized on a permanent basis.

The framers of the "Good Faith" pact had made mid-course corrections to the 1954 decree, addressing weather's latest whims while recognizing a drought of a different nature: a paucity of federal dollars for new reservoir projects. Structural solutions were still needed, of course, but the "money drought" was shifting attention to another area: water conservation. And the thinking went like this: Save water during wet years as well as dry ones.

It was a popular notion. Within a two-year span, the DRBC adopted regulations that:

— require leak detection and control programs for in-basin, public water suppliers in an effort to locate unaccounted-for water projected at some 240 million gallons a day. Estimated treatment



and delivery costs for that lost water: $80 million a year.

— require the metering of major, in-basin, public water supply systems at the customer end of the pipe with all water bills based on metered usage instead of a flat, periodic rate for an unlimited supply. Thus, water consumption became a pocketbook issue with a compelling economic incentive: save water, save money.

— establish water conservation performance standards for such plumbing fixtures and fittings as toilets, lavatory faucets and shower heads that are installed during new construction or major renovations. Basinwide savings of 110 million gallons per day are projected by the year 2020 as a result of switching to these water-saving devices.

The basin states initiated their own water conservation efforts. And New York City, the single biggest user of Delaware River surface water, began a ten-year program to install 630,000 water meters in residential buildings at an expected cost of $290 million. Projected cutbacks in water use once the program is completed and metered billing is in place: 300 million gallons a day. The city also has initiated a leak detection and repair program to locate breaks in its 6,300 miles of underground pipes.

The River Bounces Back

The decree, the record flood, the record drought, the "Good Faith" pact (signed by four governors and the mayor of the nation's largest city) had, of course, all made headlines. But something else had been happening in the basin, and because it didn't involve natural calamities or prominent statesmen, it wasn't getting as much attention. The Delaware and its tributaries were getting a lot cleaner.

The DRBC, in putting together its Comprehensive Plan for managing the basin, had included in it the water quality standards established by INCODEL back in the early 1940s. New, higher standards were adopted by the DRBC in 1967 based on a computerized water quality model developed by the U.S. Public Health Service, forerunner of the Federal Water Pollution Control Administration and the current U.S. Environmental Protection Agency (EPA). A year later the DRBC, in order to meet these new standards, issued wasteload allocations to 90 major dischargers in the basin.

Meanwhile, antiquated sewage treatment plants were being upgraded, partly with funds generated by the 1972 Federal Water Pollution Control Act.

Water quality studies were initiated, focusing on such areas as bacterial concentrations, toxics, thermal stress, sediment oxygen demand, chlorination, heavy metals, pesticides, phenols, PCBs, and the impact of combined sewer overflows.

Over a 20-year period, this joint federal-state pollution abatement effort resulted in a 76 percent reduction in the amount of oxygen-demanding wastes being discharged into the Delaware River estuary, the tidal stretch between Trenton and the bay.

Today, the Delaware River supports year-round fish populations, offering excellent smallmouth bass, walleye, and trout fisheries. Shad and herring are migrating upriver in increasing numbers, once again sustained by the water's oxygen. Marinas are being built on the river's banks, along with bike trails and parks. There are even plans for a floating hotel off Philadelphia.

And the future?

* * *

The duck winged higher toward the cotton ball cloud, then veered north and disappeared over a ridge.

The man and boy paddled downstream, beaching at the Delaware Water Gap, the final stop on a three-

Joseph Miller, Delaware fisheries coordinator for the U.S. Fish and Wildlife Service, displays a lunker striped bass caught with electrofishing equipment in the Delaware River off Wilmington, Del. as part of a striped bass survival study. Striped bass are returning to this once heavily polluted stretch of river in increasing numbers. On April 11, 1989, a Pennsylavnia state record was broken when a 53-pound, 13-ounce striper was caught in the Delaware with rod and reel near the Commodore Barry Bridge. (Photo courtesy Charlie Wooley, USFW)

One of the DRBC's main functions is the regulatory review of projects to assure they do not have a substantial impact on the water resources of the basin. Since the Commission was formed in 1961, more than 4,000 projects have undergone technical and environmental reviews. Above, fishermen try out a stretch of the Upper Delaware Scenic and Recreational River extending 73 miles from Hancock, N.Y. to Matamoras, Pa. The DRBC assisted in the review and implementation of a Management Plan for this scenic stretch of river, addressing interstate concerns relating to water quality, environmental protection and flow management. (Photo courtesy of the National Park Service)

day journey that had carried them past lush woodlands, bluffs, islands and corn fields, a world filled with chuckling river riffles, jumping fish, white-tailed deer, red-tailed hawks.

Now their car carried them home over Interstate 80, a major four-lane highway which crosses the river at the Gap, a concrete stream of cars and clanking trucks flowing past new shopping malls, industrial parks and housing projects.

It's an incredible contrast and it underscores the real challenge for the basin's future water managers. For they must both allocate and protect a limited resource.

They must preserve the natural beauty of the Delaware and her tributaries while allowing for orderly growth. They must provide enough water through new storage projects and water conservation programs to meet the needs of these thirsty new communities while making sure there's enough fresh water flowing downstream to control saltwater invasion of the estuary.

Surely, as in the past, there will be differences. For it's foolish to think that presidents, fishermen, congressmen, scientists, governors, boaters, cabinet members, builders, housewives, and businessmen are ever going to agree precisely on anything.

But, learning from the mistakes of the past, they now share a common concern for a common resource. And when Tricia Bonamo, a sixth grader from Staten Island, recently submitted a winning poem in a contest promoting wise water use, she probably spoke for most of them.

She wrote:

Did you ever stop and think
How precious our water is to drink
Close those drips,
don't spoil our streams
So on the lakes our children
can dream

* * *

— ***Christopher M. Roberts***

Hydrologic Report

Drought Threat Doused by May Rains

Hydrologically speaking, calendar year 1989 proved that normal weather is a fictional statistic — that normals are merely averages that encompass all weather extremes.

In the Delaware River Basin, there was almost a serious drought. Then it rained so hard that streams jumped their banks and farmers couldn't get into muddy fields to plant crops, and reservoirs swelled with runoff from the storms.

The year began on the heels of record-breaking summer heat that placed heavy demands on water supply followed by one of the driest Decembers on record. By January 16, the Basin had dropped into the first stage of drought warning due to unseasonable low storage levels in three major upper basin reservoirs. A day later a "drought watch" was declared in New York City.

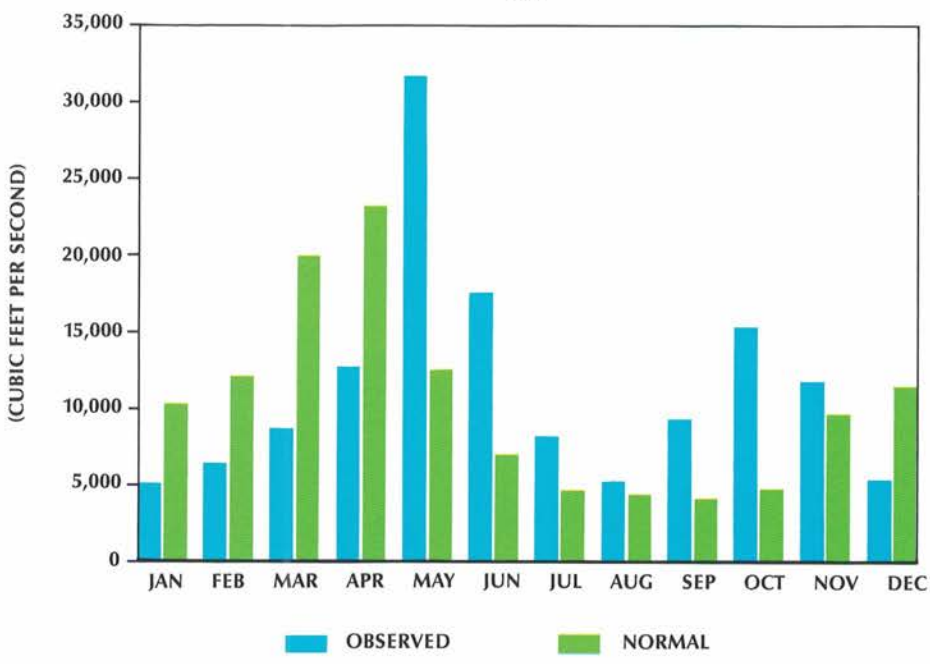
The flow in the Delaware River during January reached its lowest mark for the month in eight years with the average monthly flow the fourth lowest on record.

Combined storage in the three reservoirs, Neversink, Pepacton and Cannonsville, stood at 130 billion gallons or 48 percent of the reservoirs' 271 billion gallon capacity. Normal for the date (January 16) is 199 billion gallons or 73 percent of capacity. The reservoirs, part of New York City's water supply system, account for 75 percent of the total surface water storage in the basin.

The Delaware River Basin Commission called for voluntary water conservation and noted that precipitation amounts in the next four to five months would be critical in determining whether water shortages occurred during the summer and fall.

AVERAGE MONTHLY DELAWARE RIVER FLOWS

1989



Under terms of a basinwide drought management plan which is geared to the storage levels in the three reservoirs, out-of-basin diversions to New York City and central and northern New Jersey were automatically cut back.

The city's take from the reservoirs dropped from 800 million gallons a day (mgd) to 680 mgd and New Jersey diversions from the Delaware River through the Delaware and Raritan Canal were reduced from 100 mgd to 85 mgd. Also reduced was the minimum flow target of the Delaware River at Montague, N.J., dropping from 1,750 cubic feet per second (cfs) to 1, 655 cfs.

The three reservoirs are located in the Catskill Mountains on headwater tributaries to the Delaware. By reducing in-stream reservoir releases (as measured at Montague) as well as withdrawals by the city which gets roughly half its water from the reservoirs, the Commission conserved existing supplies in the three impoundments.

But the dry weather continued and on February 5 the basin dropped into the second stage of drought warning as storage in the three reservoirs continued to drop — 124 billion gallons or 46 percent of capacity compared to normal storage for that date of 212 billion gallons or 79 percent of capacity.

A renewed call for voluntary water conservation went out and again the valves were turned: New York City's withdrawal was cut back from 680 mgd to 560 mgd and the New Jersey diversion from 85 mgd to 70 mgd. The flow target at Montague dropped from 1,655 cfs to 1,550 cfs and later was suspended under emergency order in a further effort to conserve storage.

On March 3, the Commonwealth of Pennsylvania issued a drought warning urging voluntary water conservation in 16 eastern Pennsylvania counties. On March 16, New York Gov. Mario M. Cuomo declared a drought "disaster emergency" for New York City and eleven counties in the southeastern portion of the state.

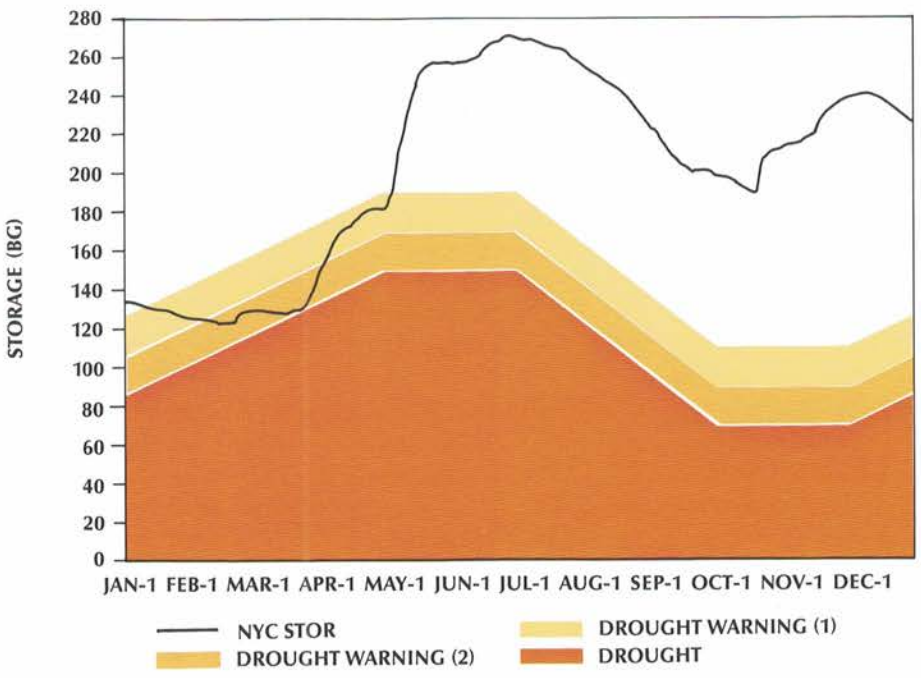
By the third week of March, reservoir storage in the three New York City reservoirs was hovering just above the drought emergency line. At a Commission meeting on March 21 a resolution was adopted setting in place mandatory water-use restrictions to be imposed throughout the basin should an emergency be triggered. The next day, New York City Mayor Edward I. Koch declared his own drought emergency, imposing mandatory water cutbacks "in order to keep the reservoirs as full as possible."

Precipitation in the basin had averaged well below normal since January 1, 1988, especially in the Catskill Mountain region of New York State. In fact, many coastal resort towns in southern New Jersey received more snow during the winter of 1988-89 than did the Catskills, where normally deep snow pack melts in the spring, sending billions of gallons of runoff into the reservoirs which feed the Delaware River.

By late March, the 15-month precipitation deficit in the upper basin (as measured above the tri-state boundary at Port Jervis, N.Y.) was eleven inches. Precipitation shortfalls in the rest of the basin ranged from four to eight inches for the same period.

TOTAL 1989 NYC DELAWARE BASIN STORAGE

IN BILLION GALLONS



In a normal year, storage in the three New York City reservoirs from January 1 through March would be increasing rapidly — going from 197 billion gallons to 260 billion gallons over the three-month span. In 1989, storage *decreased* by five billion gallons during that period.

But rain fell in late March followed by intermittent April showers. Then torrential rains in May swelled flows in the Delaware River to record levels. On May 12, DRBC's drought warning was lifted after storage had climbed 15 billion gallons above the drought warning line and remained there for five consecutive days as called for in the DRBC's drought operation plan.

It had been close. Without the drought operating plan and the resultant cutbacks in out-of-basin diversions and in-stream releases, dwindling storage levels in the three New York City reservoirs surely would have triggered a drought emergency before the rains came. In all, some 50 billion gallons of water were saved through these conservation efforts.

Normal operating conditions were reinstated in the basin on May 12 with New York City once again having access to 800 million gallons a day from the three in-basin reservoirs and New Jersey 100 million gallons a day from the Delaware River. The Montague flow target also reverted back to 1, 750 cfs.

During May alone, the three reservoirs collected some 77 billion gallons of runoff from the almost daily downpours which triggered flash floods on small streams. Delaware River flows at Trenton during the month averaged a record 31,780 cfs, two-and-a-half times higher than normal. By June 26, the three reservoirs were full with two of them spilling.

Near normal seasonal drawdowns occurred during the summer of 1989 with above average precipitation in September and October helping to replenish storage. At year's end, the three impoundments held 226 billion gallons of water, compared to combined storage of 134 billion gallons at the end of 1988.

Because winter river flows normally are higher than summer flows, even with precipitation shortfalls, salty water from the Delaware Bay never migrated far enough upstream to cause contamination problems. The "salt front" (the point in the river where the concentration of chlorides in water is 250 parts per million) hovered near River Mile 72, three miles above the Delaware Memorial Bridge, for the first three months of 1989. This is well below the location of surface water intakes for public water supply or South Jersey's well fields which are recharged in part by Delaware River water. The late spring rains flushed the salty water back to River Mile 68.

The basin has entered the drought warning mode five times this decade. Two times, in 1981 and 1985, conditions worsened and drought emergencies were triggered.

Precipitation in the upper basin during 1989 averaged 43.7 inches, a mere four-tenths of an inch above the annual average of 43.3 inches.

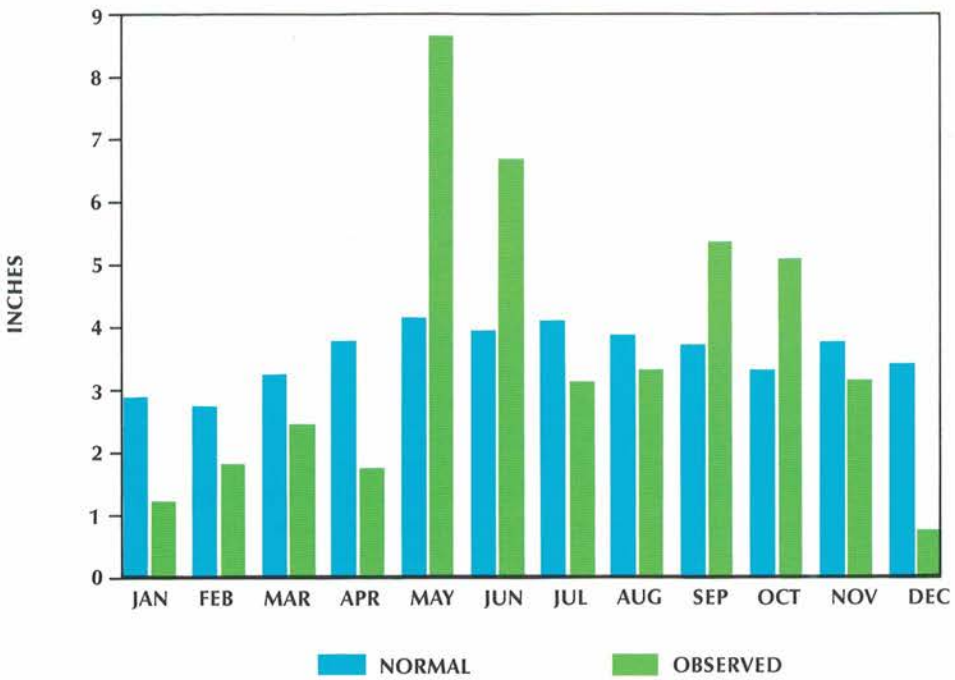
Yet eight months out of the twelve had precipitation deficits.

That's extreme.

It's also just about normal when considered as a whole.

1989 PRECIPITATION

ABOVE MONTAGUE, N.J.



Conservation
Investing for the Future

On May 24, 1989, the Commission amended its regulations concerning water conservation performance standards for plumbing fixtures and fittings to require 1.6 gallon per flush (low consumption) toilets in the basin as of January 1, 1991.

This amendment was made following an extensive review by the Commission's Water Conservation Advisory Committee. The review addressed the performance and sanitary aspects of low consumption toilets, state and local experience with these products, and the status of their availability at the wholesale and retail levels. The new requirement applies to toilets installed in new construction or renovations. It does not involve retrofitting.

The amended regulations stipulate that all water conservation performance standards for plumbing fixtures and fittings adopted by the signatory states or political subdivisions shall comply with the following minimum standards:

— Maximum flow for sink and lavatory faucets and shower heads shall not exceed three gallons of water per minute.

— Maximum flow for water closets (toilets) and associated flushing mechanisms shall not exceed an average of one and six-tenths gallons of water per flush; maximum flow for urinals and associated flushing devices shall not exceed one and one-half gallons of water per flush.

Regulations in effect that contain performance standards that do not comply with the DRBC standards must be revised to meet compliance by January 1, 1991.

There are many benefits that accrue from water-saving plumbing fixtures. For one, the amount of wastewater is reduced, increasing the capacity of sewage treatment plants and, in some cases, delaying the need to build costly new plants or expand existing ones.

Saving water by reducing per capita use also can save energy, which in turn can save money on both water bills and utility bills for hot water heat. In addition, the use of low consumption plumbing fixtures can improve the performance of septic tanks and soil absorption systems by decreasing hydraulic loads.

The Commission has projected a water use reduction in the basin of 42 million gallons of water per day by the year 2020 through use of 1.6 gallon toilets in lieu of the current 3.5 gallon units. This reduction alone might defer about $250 million (1988 dollars) in additional capital costs for water supply and wastewater treatment facilities.

Water-Conserving Landscapes

The Water Conservation Advisory Committee scheduled a third technology transfer session for the late winter of 1990. The session, entitled "Water-Conserving Landscapes," was designed to provide information to developers, nurserymen, turf-grass specialists, landscape architects and designers, planners, and government officials on how to create attractive commercial and residential landscapes that require little or no watering.

Recent water shortages in the Delaware River Basin have clearly demonstrated that there are limits

to the supply of fresh water. Water-conserving landscapes are well-suited to withstand dry periods when drought restrictions on such non-essential water use activities as the watering of lawns, plants and shrubs may well be in force.

Previously, the Water Conservation Advisory Committee held sessions with representatives of the pulp and paper industry (February 18, 1988) and chemical and pharmaceutical industries (November 17, 1988). The landscaping seminar was set for March 6, 1990. These sessions enable industry representatives to trade off information on how certain industrial sectors save water through conservation programs.

The Water Conservation Advisory Committee is chaired by Bruce Stewart, executive director of the Water Resources Associaton of the Delaware River Basin; vice-chairman is Joseph Miri, chief of the Office of Water Policy Analysis, New Jersey Department of Environmental Protection.

Enforcement Efforts Pay Off

During 1989, the Commission took steps to improve compliance with its source metering regulation. Under resolutions adopted June 25, 1986, all water withdrawals exceeding 100,000 gallons per day (10,000 gpd in Pennsylvania's Ground Water Protected Area) must be metered or measured at the source. The regulation requires affected water users to report their withdrawals to regulatory agencies in their respective basin states. The program became effective January 1, 1987.

Two water closets currently on the market are shown below. One uses 3.5 gallons per flush, the other 1.6 gallons. Which is which? Head to the inside back cover for the answer.

At the time the regulation was adopted, most of the affected water users in the Delaware and New Jersey portions of the basin had already instituted source metering to comply with the requirements of the Delaware Department of Natural Resources and Environmental Control and the New Jersey Department of Environmental Protection. Users in New York State were also in compliance. In the Pennsylvania portion of the basin, however, a large number of users were not metering their withdrawals — about one-third of the 625 Pennsylvania users were in violation of the Commission's regulation in 1987.

In response, the Pennsylvania Department of Environmental Resources (PADER) instituted an aggressive program to implement the Commission's source metering regulation. Through the efforts of PADER, the number of noncomplying users was reduced from about 200 to 30 by the summer of 1989. These 30 users were notified by the Commission of possible penal sanctions for noncompliance.

By the end of 1989, all affected Pennsylvania users except one had either complied with the source metering requirement, or agreed to comply by early 1990.

Water Conservation: Easy to Swallow!

Water conservation programs often are self-enforced because they are driven by economic incentives. Water costs money, and by cutting back on its use, financial savings are realized.

A good example is what happened recently in the Downsville Water District in New York State. Robert A. Homovich, a supervisor in the town of Colchester, N.Y. (in an April 12, 1989 letter to the DRBC) explains:

"The Downsville Water District had, like many other water systems in the country, an old decaying system. We didn't seem to have enough water.

"Our only solution to the problem was to install a whole new system, with water meters on both the supply sources and the users. On the old system, no one had any idea how much water he had, or how much was being used. The first meter readings on the new system showed that we were using about 120,000 gallons a day. After one year under the use of the meters, we are now at about 60,000 gallons a day.

"Once the water customers had an accurate reading and billing of the amount of water they were using, they needed no further explanation about conserving water. They saw the light. The leaking faucets and toilets were repaired and unnecessary use was curtailed."

Water Quality

Raising Standards in the Delaware Estuary

Based on the results of a three-year project, recommendations were in place at year's end to raise dissolved oxygen and fecal bacterial standards in portions of the Delaware estuary in order to meet national water pollution control goals.

The recommendations are contained in the DEL USA Project's Final Report, the culmination of a multi-agency study required under federal regulations for any waterways where water quality standards and designated uses do not conform to the goals of the Federal Clean Water Act.

Section 101(a)2 of the act calls for "water quality which provides for the protection and propagation of fish, shellfish and wildlife, and provides for recreation in and on the water" where attainable. These are commonly referred to as the national "fishable" and "swimmable" goals.

The study, formally titled the "Delaware Estuary Use Attainability Project," was initiated in 1986 by the Delaware River Basin Commission. The final report was issued in October of 1989. Among its findings:

— Fishable water quality (as defined by a dissolved oxygen concentration of 4.0 milligrams to 5.0 milligrams per liter or greater) can be attained throughout the Delaware estuary through wastewater treatment plant upgrades. The middle portion of the estuary in the vicinity of Philadelphia, however, will continue to have a higher degree of impairment than other reaches of the estuary. Regardless of this impairment, the fishery obtained in this reach can be vastly improved if the treatment plant upgrades are carried out.

— Higher dissolved oxygen standards and resulting improvement in the estuary fishery can be attained by upgrading treatment at a minimum of ten of the 75 currently allocated estuary wastewater treatment plants. Six of these plants are responsible for 94% of the dissolved oxygen deficit at the Bristol sag and the other four plants account for 97% of the deficit at the Philadelphia sag.

— Thirty-four miles of the estuary can be upgraded to primary-contact recreation ("swimmable") use from their existing secondary-contact recreation use. This would require no additional pollution abatement actions since studies show that the water quality criteria needed to meet the "swimmable" goal have been attained as the result of past abatement programs. The studies suggest, however, that some tributaries feeding the estuary require additional abatement actions since their bacterial levels are excessively high.

Upgrading the 34 miles of the estuary to "swimmable" would leave only a 20-mile reach of the river in the Philadelphia/Camden area at a secondary-contact use designation. This heavily used stretch of river is impacted by constant overflows from combined sewer systems which carry both untreated wastewater and storm water runoff. A major recommendation of the DEL USA Project is a reduction of this overflow which results in significant water quality degradation.

It should be noted that the "fishable" and "swimmable" designations represent water quality attainment goals and do not necessarily reflect current uses or conditions of the river.

For instance, fish are now distributed throughout the estuary. This, however, does not necessarily mean the fishable goal is being met. The goal is more demanding. It requires a balanced, reproducing, indigenous aquatic community to exist year-round, something that research suggests is not occurring in some areas of the estuary where dissolved oxygen drops to levels that impair aquatic life during hot summer months.

Similarly, while much of the estuary is now designated "swimmable" from a water quality standpoint, dangerous currents, floating debris, ship traffic and other factors can make this activity unsafe in many areas.

Although the DEL USA Project focused mainly on bacterial and dissolved oxygen levels in examining ways to meet the federal water pollution control goals, it also looked at other important water quality parameters in the tidal portion of the river, stretching 85 miles from Trenton, N.J. to Liston Point, Del.

It found, for example, that toxics are not necessarily a problem in the entire estuary, but that toxic levels in some areas of the tidal river and in some fish are high enough to generate major concern. Numerous water samples taken during the study exceeded acute values for various heavy metals. At some of these sites, toxic organics also were excessively high. Extensive contamination of estuary sediments was indicated as well.

As a result of these findings, fish consumption advisories were issued by Pennsylvania and New Jersey alerting anglers that some fish species in parts of the estuary had high toxicity levels.

Findings from the DEL USA project also were highlighted in the nomination package which led to the Delaware estuary being included in the National Estuary Program under the 1987 federal Clean Water Act.

Information briefings on the DEL USA study are planned for 1990 to present the findings to the public. Formal public hearings on recommendations to upgrade designated uses and water quality standards will follow.

In addition to the DEL USA Final Report (titled "Attaining Fishable and Swimmable Water Quality in the Delaware Estuary"), the following reports generated by the project also may be obtained by contacting the Commission:

— Fish Population Study
— Fish Health and Contamination Study
— Chronic Toxicity Bioassay Report
— Toxic Review of the Delaware Estuary
— Sediment Oxygen Demand Study
— Recalibration/Verification of the Dynamic Estuary Model for Current Conditions in the Delaware Estuary
— Zone 2 and Upper Zone 3 Bacterial Study
— Report on the Delaware Estuary Bacterial Study: Chester, Pa. to New Castle, Del. and other 1987 Data Collection Activities
— Combined Sewer Overflow Report.

Scenic Rivers Protection

The Delaware River Basin Commission and the National Park Service continued their efforts during the year to develop a scenic rivers protection plan for the Delaware Water Gap National Recreation Area (DWGNRA).

Started in 1987, the program is examining both point and non-point source pollution issues which threaten the quality of the Middle Delaware Scenic and Recreational River. The goal of this joint effort is to evaluate the need for special protection policies and to recommend needed water quality management alternatives.

At a Commission meeting in Matamoras, Pa. in August of 1989, Richard Ring, DWGNRA superintendent, and Richard Albert, DRBC supervising engineer, outlined the study program, explaining it was triggered by rapid development in the area with numerous proposals for sewage outfalls.

Mr. Albert stated that water quality degradation is already measurable and will only worsen unless specific protection strategies are implemented.

Supt. Ring said proposals generated by the cooperative planning program could include revisions to DRBC's water quality standards and discharge regulations, modification of management and monitoring policies, changes in treatment plant approval processes, and consideration of alternatives to conventional wastewater treatment technologies.

A month after the meeting, the Watershed Association of the Delaware River, a private basin "watchdog" group, filed a petition with the DRBC requesting that the Commission amend its Comprehensive Plan to designate waterways in the upper part of the basin as Outstanding National Resource Waters.

The requested designation would apply to 121 miles of the Upper and Middle Delaware main stem from just below Hancock, N.Y. to just below the Delaware Water Gap and those tributary segments which flow within the Upper Delaware Scenic and Recreational River corridor or the Delaware Water Gap National Recreation Area.

The Commission responded to some of the issues raised in the petition and stated it planned to give it full consideration once the joint DRBC/NPS study released its own recommendations.

Controlling Toxics

The DRBC has initiated a project to develop ways to control the discharge of substances from industrial and municipal wastewater treatment facilities that are toxic to humans and aquatic life in the tidal portions of the Delaware River.

The project will seek to identify toxic substances of concern and document their distribution in the river's water column, as well as in wastewater discharges, river sediment deposits and fish tissue.

The three-year Delaware Estuary Toxics Management Program is a combined effort of the Commission, the states of Delaware, New Jersey and Pennsylvania, and the U.S. Environmental Protection Agency which assigned a toxics' expert full-time to the project under the Intergovernmental Personnel Act. The study area stretches from the head of tide at Trenton, N.J. to Liston Point, Del.

Previous DRBC studies under the Delaware Estuary Use Attainability Project found that toxic organic and inorganic chemicals are present in the river.

A plan of study has been completed for the first year of the program which runs from October 1, 1989 through September 30, 1990.

Major elements of this plan include:

— Development of a toxics database on estuary dischargers

— Preliminary modeling efforts for both near-field and far-field toxic effects

— Formulation of policies for developing water quality standards and effluent limitations for toxic pollutants

— Field studies of toxics in the water column and river sediment.

A major effort during the first year is the monitoring of specific toxic chemicals and whole effluent toxicity at estuary discharge points. Under a provision of the Clean Water Act, much of the monitoring will be carried out by major dischargers who operate under National Pollutant Discharge Elimination System (NPDES) permits. Monitoring of discharges also will be conducted by several of the basin states.

Chlorination Study

Field and laboratory work has been completed for a study to determine whether the amount of toxic chlorine compounds being discharged into a segment of the Delaware River can be reduced without impacting on human health or on the shellfish beds in the upper Delaware Bay.

Data collection in the two-year study began in July of 1987 and ended in June of 1989. The data were fed into U.S. Environmental Protection Agency (EPA) computers and later transferred to the DRBC's computer network for retrieval and analysis, which continued at year's end.

A final report containing results and recommendations was planned, pending completion of the data analysis by DRBC staff and review of the material by other agencies involved in the study.

Personnel from the U.S. Environmental Protection Agency prepare to take a sediment sample from the Delaware estuary for use in studies on sediment oxygen demand and toxics. (Photo courtesy Richard C. Albert)

The toxic compounds in question are a by-product of wastewater disinfection, achieved through chlorination. This process virtually eliminates bacteria not removed by secondary waste treatment plants which kill 97 to 99 percent of these organisms. But there is a downside. While chlorine provides human health safeguards, some chlorine by-products can be harmful to fish and other aquatic life.

During the first phase of the study, chlorination was suspended in the fall of 1987 at 25 wastewater treatment plants discharging to the Delaware River between Trenton, N.J. and Marcus Hook, Pa. All other treatment requirements remained in force. Chlorination was resumed in the spring of 1988 with the return of recreational activity on the river.

To provide comparison data, chlorination continued throughout the second year and now is required year-round pending final results of the study.

Any permanent change in chlorination practices or water quality standards by the DRBC would require public notice and public hearing.

Monitoring programs to detect bacterial levels were carried out over the length of the study with samples taken at 100 locations by the New Jersey Department of Environmental Protection (NJDEP) and Delaware's Department of Natural Resources and Environmental Control (DNREC).

The study was endorsed by the Pennsylvania Fish Commission and approved by the EPA, the U.S. Food and Drug Administration, the Pennsylvania Department of Environmental Resources, NJDEP, DNREC and by shellfish regulators in both New Jersey and Delaware.

A total of $399,250 was committed to fund the project, $200,000 from a National Oceanic and Atmospheric Administration grant and $199,250 contributed by municipalities in the study area.

DRBC staffer Warren R. Huff takes a sample of Delaware River water for a bacterial analysis as part of the DEL USA Project. (Photo courtesy Richard C. Albert)

The Delaware Bay

A Crucial Link in the Migratory Chain

A wave slaps the Delaware Bay shore and an American horseshoe crab tumbles out of the surf.

It's early May.

The crab claws its way in a slow, clumsy advance over a mudflat, jerking along like a toy Army tank with a cranky spring-wound motor.

One by one the crabs leave the sea for beaches on both sides of the bay until millions of these olive drab creatures blot mud and sand. It is one of the oldest journeys on earth, older than dinosaurs, and it is an important one. For it is on the bay's beaches that the horseshoe crabs breed, propagating a species that dates back 250 million years.

At water's edge males court females, attaching themselves to the rear of the female's carapace, or shell, with pincer-like appendages (pedipalps) that resemble little blue boxing gloves.

Then the females tow their suitors up the beach, scratch out hollows in the sand, and lay tiny pea green eggs which are fertilized by the males.

But the waves at high tide wash away much of the sand and soon billions of the eggs lay exposed on the beaches.

Thousands of miles away, another biological clock is ticking. Red knots, ruddy turnstones, sanderlings, and semi-palmated sandpipers are already in flight, leaving behind their wintering grounds on the mudflats of Surinam, the rocky nooks in Tierra del Fuego, the meadows on the Argentine Pampas. They're winging some 4,000 miles toward the bay and the little green eggs which are now crucial to their survival.

In the weeks ahead, up to a million migrating shorebirds will visit Delaware Bay's beaches, gorging on some 300 tons of horseshoe crab eggs. Depleted of fat reserves on arrival, many birds will almost double their body weight during their two-week stopover before departing on the next leg of their journey — a 3,000-mile, non-stop flight to their Arctic breeding grounds.

By late June, the shorebirds will be nesting on the thawing tundra and the laughing gulls, native to the bay, will have reclaimed the beaches, littered now with the rotting carcasses of horseshoe crabs that didn't make it back to the sea.

Flipped onto their backs by the surf, then stranded on the beach at low tide, these crabs struggled for days to right themselves with their rigid, spear-like tails. But as successful tilting devices, the tails, or telsons, were somehow left out of evolution's scheme.

Rising and toppling backwards over and over again, the crabs baked to death under the warming spring sun.

* * *

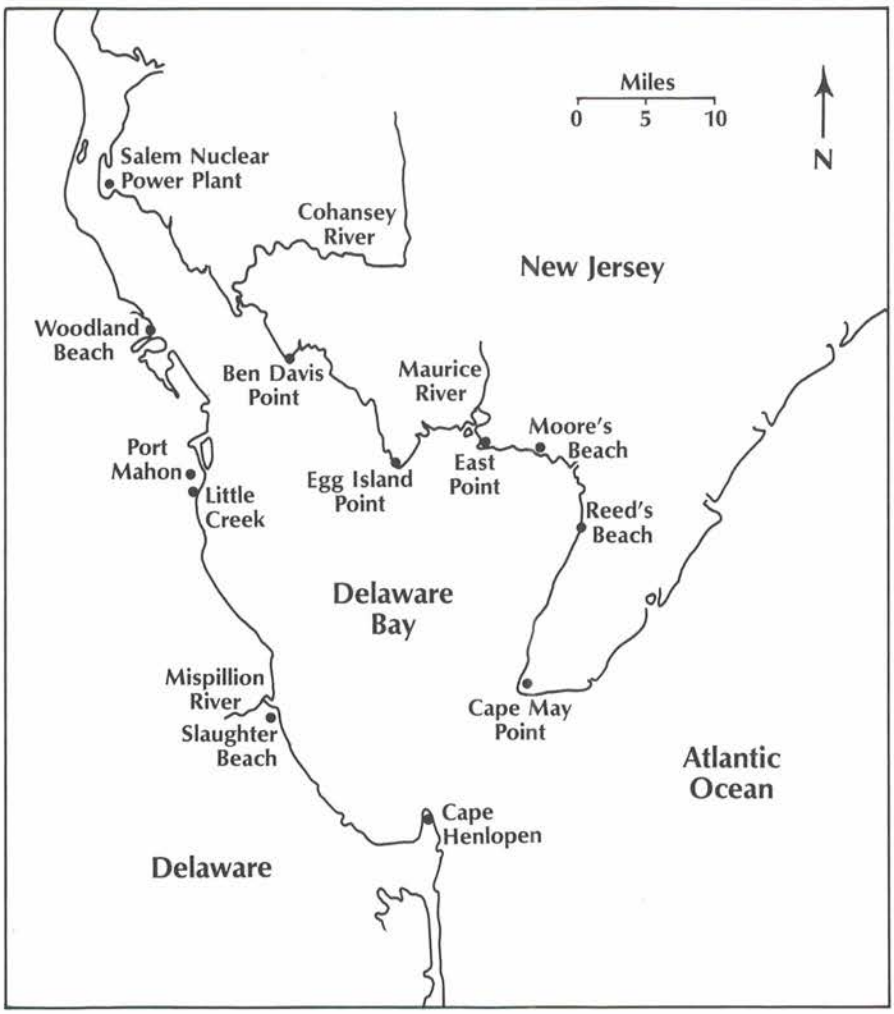
The Delaware Bay is the principal breeding ground for American horseshoe crabs on the East Coast and among the largest staging areas for shorebirds in North America. And it is unique in that there's only one main course on the menu: the little green eggs. Destroy the horseshoe crab's habitat and a vital link in the migratory chain would be broken, and millions of shorebirds endangered.

Recognizing the need to save this fragile environment from encroaching development, the states of Delaware and New Jersey, which flank the bay, were the pioneers in an international effort to protect the chain of critical shorebird habitats in both South and North America.

Horseshoe crabs mingle at water's edge after leaving the bay to breed (left). At right, a female tows a male out of the surf en route to the nesting grounds. A single female crab can lay up to 80,000 eggs. The tiny eggs are dwarfed by a dime. (Photos courtesy of Dave Ward)

In 1986, the two states designated the lower 25 miles of bay shoreline as the first refuge in the Western Hemisphere Shorebird Reserve Network (WHSRN). The WHSRN had been created a year earlier in a multi-organizational campaign by such groups as the International Association of Fish and Wildlife Agencies, the World Wildlife Fund, the National Audubon Society, and the Academy of Natural Sciences.

Today, nations involved in this migratory preservation plan include Peru, Brazil, Chile, Argentina, Surinam, Panama, Canada, as well as the United States.



Favorite feeding spots of Delaware Bay shorebirds.

In addition, the U.S. Fish and Wildlife Service, working with state and private conservation groups, is mapping out a national refuge in Cape May County, N.J. to encompass some 15,000 acres of wildlife habitat. In Delaware, the Bombay Hook National Wildlife Refuge, stretching eight miles along the bayshore north of Little Creek, already protects another 15,000 acres and other stretches of Delaware coastline are protected by state wildlife refuges.

Rapid beach-front development is one threat to migrating shorebirds. There's another: the Delaware Bay is the largest oil transfer point on the East Coast. A massive spill during the horseshoe crab breeding season could kill huge numbers of crabs or contaminate their eggs with oil.

The shorebirds, famished after their long journey from South America, could be stranded with little or nothing to eat. Too weak to fly on, many would likely die with entire species at risk: consider that 80 percent of the red knots migrating through the eastern United States each spring stop off at the Delaware Bay to feed.

* * *

For centuries the shorebirds have landed on the bay's beaches to dine on the little green eggs, mostly ignored by mankind. But the bay today is but a day's drive for 40 percent of the people living in the United States. So now cars and buses arrive too. They carry people intent on witnessing one of nature's most colorful and boisterous banquets. They come with cameras and binoculars and some come too close. Startled, the birds abandon the eggs and fly off.

"It can be a problem," says David S. Wiedner, a staff biologist with the New Jersey Audubon Society's Cape May Bird Observatory. "What people don't realize is that if the birds linger too long, they may arrive at their Arctic breeding grounds too late to raise young successfully. It's important they build up their body weight as quickly as possible and move on."

The Cape May Bird Observatory, the New Jersey Department of Environmental Protection (NJDEP), and Delaware's Department of Natural Resources and Environmental Control (DNREC) urge visitors to view the birds from a distance, keep dogs

leashed and keep motorized vehicles off the beach. Bird viewing areas and camera blinds have been set up at some sites to create buffer zones.

The largest concentrations of shorebirds occur on the Delaware side of the bay from Woodland Beach north of Leipsic to Cape Henlopen, and on the New Jersey bayshore from just south of the Cohansey River to North Cape May.

Their movement is monitored almost daily during the spring stopover. Birds are banded to determine migratory patterns, placed on scales to measure weight gain, surveyed from aircraft to tabulate flock and species densities. Overnight nesting activities also have been studied in an effort to preserve vital habitat. The birds are protected under the Federal Migratory Bird Act.

Not as much attention has been showered on *Limulus polyphemus*, the American horseshoe crab.

It is known that the crabs' tails were used by American Indians to spear fish, their shells to bail out boats. And horseshoe crab blood is used as an ingredient to test the purity of pharmaceutical drugs.

Actually, the horseshoe crab is not a true crab at all and often is classed with the arachnids because it more closely resembles spiders and scorpions. The crabs are not protected by any laws and sometimes are battered to death by youngsters with clubs or hauled away by the truckload for eel bait or fertilizer.

But that may be changing. Realizing the vital link they play in the migratory food chain, the state of New

A cluster of red knots and sanderlings dine at the bay's shore before departing for the Arctic. (Photo by Clay Sutton)

Jersey is considering a permitting system under which anyone removing horseshoe crabs from state beaches would be required to pay a hefty fee. And Delaware's Division of Fish and Wildlife is engaged in a five-year study in an effort to protect the crabs by tracking growth and mortality rates and spawning ground activity. In the spring of 1989, volunteers, including Delaware school children, tagged 286 horseshoes, or "swordtails," riveting plastic IDs on their helmet-like shells.

Hopefully these programs will help assure that these pre-historic creatures stay around a good bit longer — that their biological clocks never lose a tick.

For the shorebirds already have made their reservations for next spring: little green crab eggs for a party of about one million, please, with place-settings overlooking the bay.

— Christopher M. Roberts

Sanderlings patrol the beach in search of crabs eggs. (Photo by Clay Sutton)

Laughing gulls join ruddy turnstones in raucous flight, shattering the spring silence. (Photo by Clay Sutton)

Other Basin Highlights

Flood Emergency Operations

The DRBC initiated a program during 1989 for improving the level of flood warning and flood preparedness in the Delaware River Basin.

With the curtailment of funding for additional federal flood insurance studies, and the availability of computer software designed for emergency planning and management, opportunities exist for the DRBC to assist other state and federal agencies in obtaining the data required to improve flood emergency operations.

Such data include flood stage profiles and flood stage forecast maps which tie forecasted flood crests to areas of inundation. These maps are useful to emergency personnel responsible for evacuations prior to flooding. The maps also can be digitized for use on the computerized systems maintained at the emergency operating centers in each of the four basin states.

The key information required for development of flood stage forecast maps is detailed topographic base mapping. The DRBC is making efforts to obtain such mapping and will seek to coordinate preparation of the flood stage forecast maps with federal and state agencies.

A few of the counties within the Delaware River Basin maintain strong flood warning programs and take advantage of National Weather Service forecasts and the technical assistance available from both the Weather Service and state emergency management agencies. However, from a basinwide perspective, the level of participation in the Local Flash Flood Warning Program administered by the Weather Service could be upgraded. The DRBC expects to assist basin counties in improving their use of available flood warning information.

When requested, the Commission will continue to assist in the preparation of technical evaluations used for flood insurance studies. In addition, the DRBC will continue to relay information about flood forecasting to the public and other agencies when requested.

Fisheries Management

One of the goals of the Delaware Basin Fish and Wildlife Management Cooperative is the restoration and protection of the striped bass population in the Delaware River.

Studies conducted by the Cooperative during 1989 focused on:

— Investigating the effects of a major oil spill on young-of-year striped bass in nursery areas

— The relationship between water quality and the survival rate of striped bass larvae spawned in the river

— Assessment of whether a genetically distinct striped bass stock exists in the Delaware River.

The results were contained in a draft report issued at year's end. Among the findings:

Larval bioassay tests indicate that water quality in the Delaware is sufficient to support striped bass reproductive success. However, storm-related events, which can alter water temperature, bacterial and pH levels through heavy runoff, were found to significantly increase mortality rates.

Effects of the oil spill, which resulted in 300,000 gallons of No. 6 oil being released into the river on June 24, 1989 when a tanker (the Presidente

Rivera) ran aground at Marcus Hook, Pa., were believed to be small and localized in relationship to the river's striped bass population.

The study was begun five days after the spill. Two of the study sites were located in areas identified by the National Oceanic and Atmospheric Administration as having the highest visual concentration of oil. Testing equipment was coated by the gooey substance.

Yet water-soluble concentrations of aromatic hydrocarbons were not detected at any of the testing stations.

"This may have resulted from initiating our study five days after the spill occurred," the report stated. "(Other studies have suggested that the water-soluble fraction of oil is degraded due to fungal action, bacterial digestion and volatilization within the first 48 hours after a spill. As such, the late start could have been responsible for our observed lack of toxic effects.)

"However, our inability to detect water-soluble aromatic compounds, and our lack of detected effects on striped bass, are more likely a result of the type of oil that was spilled," the report continued. "Number 6 oil is the heavy residue of refining in which the most toxic low molecular weight water-soluble fractions (e.g. benzene, toluene) have been removed..."

Analysis of oil from the ship showed that the most toxic compounds had in fact been removed and that those that remained leached slowly, the report stated. Moreover, sampling conducted by the State of Delaware the day after the spill found only three aromatic compounds to be above detection limits, and even then in very low concentrations.

The report cautioned, however, that the results should not be construed as indicating that there was no effect of the oil spill on the Delaware River. It concluded:

"Clearly there were aesthetic effects. Additionally, studies from previous oil spills have suggested that the greatest effects are on inter-tidal benthic (river bottom) communities that come in indirect contact with the oil and such effects may have occurred in the Delaware.

"There were numerous reports of heavily-oiled crabs that may have suffered mortality. It is even possible that there were subtle food chain effects on striped bass..."

* * *

The results of the 1989 stock assessment studies add support to earlier findings that a genetically distinct striped bass stock likely exists in the Delaware River, according to the report. However, quality control measures used in the 1989 study were being questioned at year's end and further analysis was planned.

The Delaware Basin Fish and Wildlife Management Cooperative is funded by the states of Pennsylvania, New Jersey and Delaware. The Delaware River Basin Commission provided the administrative and contractual functions for implementation of the striped bass study.

Scenic Rivers

The Commonwealth of Pennsylvania designated the Lower Brandywine as a Scenic River in the spring of 1989 and the Commission voted in October to include the project in its Comprehensive Plan.

The Scenic River designation applies to the Brandywine main stem from the Pennsylvania/Delaware border north to the confluence with its East and West branches above Lenape, Pa., as well as portions of both branches. In addition, stretches of Pocopson Creek, Valley Creek, Broad Run, Buck Run, Doe Run, Green Valley Stream and an unnamed tributary are included. In all, 66 miles of stream in the Lower Brandywine system in Chester and Delaware counties were designated as Scenic River waters.

Other Pennsylvania waterways located within the basin also have been given Scenic River status over the years under the Pennsylvania Scenic Rivers Act of 1972. They also have been incorporated in the Commission's Comprehensive Plan. They include:

— A 30-mile stretch of the Lehigh River from the Francis E. Walter Dam in Carbon County to Jim Thorpe, Pa., and 30 miles of Lehigh River tributaries, including portions of Hayes Creek, Sandy Run, Hickory Run, Leslie Run, Mud Run, Drakes Creek, Stoney Creek, Black Creek, Bear Creek, Little Bear Creek, Glen Onoko, Jeans Run and Nesquehoning Creek.

— A 94-mile stretch of the Schuylkill River main stem from Port Clinton in Schuylkill County to the Fairmount Dam in Philadelphia, 22 miles of the Schuylkill's West Branch, and a 27-mile reach of the Little Schuylkill River.

— A 22-mile stretch of French Creek from Hopewell Lake in Berks

County to Phoenixville in Chester County, and 21 miles of tributary streams, including portions of French Creek's South Branch, Pine Creek, Rock Run, Beaver Run, and the Birch Run main stem and West Branch.

The intent of the Pennsylvania Scenic Rivers Act is to protect the natural, cultural and recreational values of unique waterways in the state through planning and management programs.

In addition to the Pennsylvania designations, two portions of the main stem Delaware River (a 72-mile reach between Mill Rift, Pa. and Hancock, N.Y., and a 34-mile reach linking Milford, Pa. and the Delaware Water Gap) have been designated as Scenic and Recreational under the National Wild and Scenic Rivers Act.

In November of 1989, U.S. Rep. Peter H. Kostmayer of Pennsylvania introduced legislation to designate a 32-mile stretch of the Delaware River flanking Bucks County as a component of the federal Wild and Scenic Rivers System.

Ice Jam Project

The State of New Jersey has determined that a proposed project to reduce ice jam flooding on the Delaware River in the Port Jervis, N.Y. area must meet new regulations contained in New Jersey's Freshwater Wetland Protection Act, a factor that could escalate the project's cost and delay its completion.

As a result of the act, which became effective in July of 1988, additional habitat mitigation may be required as well as consideration of any downstream impacts should an ice jam occur once the project is completed. A stream encroachment permit already has been obtained from the New Jersey Department of Environmental Protection.

Envisioned is a diversion channel, 200 feet wide and 13,000 feet long, along Mashipacong Island, just south of Port Jervis. The channel would be designed to provide a passageway for river water when the main channel becomes ice-clogged.

The island is located on the New Jersey side of the river in a sparsely populated area. Upstream in Pennsylvania and New York are a cluster of communities which hug the riverbank and have pushed for the project.

In 1981, flooding in the Port Jervis area claimed one life and caused an estimated $14 million in property damage. The Delaware River rose 14.5 feet in one hour as a result of ice which jammed against the island, acting as a makeshift dam.

The original price tag for the project was $1 million, to be paid on a cost-sharing basis: 75 percent by the U.S. Army Corps of Engineers and 25 percent by the Commonwealth of Pennsylvania, New York State, the City of Port Jervis, the Borough of Matamoras, Pa., and Westfall Township, Pa. That figure is expected to rise as a result of an increase in the estimated cost of acquiring real estate easements and the additional work required to comply with the Freshwater Wetland Protection Act's new regulations.

It was in 1982 that the DRBC, through Congress, requested that the Corps of Army Engineers conduct a study of the flooding problem. The DRBC agreed in the spring of 1986 to act as the project's non-federal sponsor after the Corps indicated that creation of the diversion channel was economically feasible.

That fall the Corps received authorization from Congress to prepare project plans and specifications. The DRBC voted to add the proposed project to its Comprehensive Plan on May 28, 1988.

Before work can begin, the Commission must execute a formal agreement with the Corps, contingent on the signing of local cooperative agreements by New York and Pennsylvania and the local communities involved.

Because final costs are not known, there has been a reluctance by the states to sign off on the project.

Financial Summary

Statement of Revenues and Expenditures — General Fund

Year ended June 30, 1989

REVENUES	Budget	Actual
Signatory parties:		
State of Delaware	$ 203,600	$ 203,600
State of New Jersey	550,000	550,000
State of New York	269,600	269,600
Commonwealth of Pennsylvania	631,900	631,900
United States	263,000	263,000
Water Quality Pollution Control Grant	240,000	240,000
Reimbursement of overhead — Agency Fund	29,000	29,000
Sale of publications and sundry	5,000	9,140
Project review fees and other income	101,700	73,045
Interest income	0	127,689
Fines and assessments	0	5,500
TOTAL REVENUES	$2,293,800	$2,402,474
EXPENDITURES		
Personal services	$1,375,825	$1,359,833
Special and contractual services	164,200	162,647
Other services	54,750	54,668
Supplies and materials	53,000	52,300
Space	116,500	116,051
Communications	83,200	82,797
Travel	31,100	30,833
Maintenance, replacements, and acquisitions	66,500	66,010
Equipment rental	22,000	21,647
Fringe benefits and other	326,725	326,596
Expenditures for roof repair	0	136,310
TOTAL EXPENDITURES	$2,293,800	$2,409,692
Excess (deficiency) of revenues over expenditures	0	(7,218)
Other financing sources:		
Operating transfers in	0	70,483
Operating transfers out	0	(48,940)
Total net other financing uses	0	21,543
EXCESS OF REVENUE OVER EXPENDITURES (BUDGETARY BASIS)	0	14,325
Reconciliation to GAAP basis of reporting — encumbrances	0	(87,131)
EXCESS (DEFICIENCY) OF REVENUES OVER EXPENDITURES (GAAP BASIS)	$ 0	$ (72,806)

Statement of Revenues and Expenditures — Capital Projects

Year ended June 30, 1989

REVENUES	Budget	Actual
Signatory parties:		
State of New Jersey	$ 2,000	$ 2,000
Commonwealth of Pennsylvania	25,000	25,000
Water Charges	961,100	1,018,510
Interest Income	191,000	212,416
Western Berks-Facilities Use	20,500	20,500
TOTAL REVENUES	$1,199,600	$1,278,426
EXPENDITURES		
Debt Service on Projects	$ 859,000	$ 552,024
Operation and Maintenance Cost on Projects	146,000	168,227
Administrative Cost	70,200	50,511
TOTAL EXPENDITURES	$1,075,200	$ 770,762
Excess of revenues over expenditures (Budgetary Basis)	$ 124,400	$ 507,664

NOTE: Debt service and operating and maintenance cost are for the Beltzville Reservoir Project and the Blue Marsh Reservoir Project and payments are made to the United States Army Corps of Engineers.

Statement of Changes in Special Projects Fund Balances

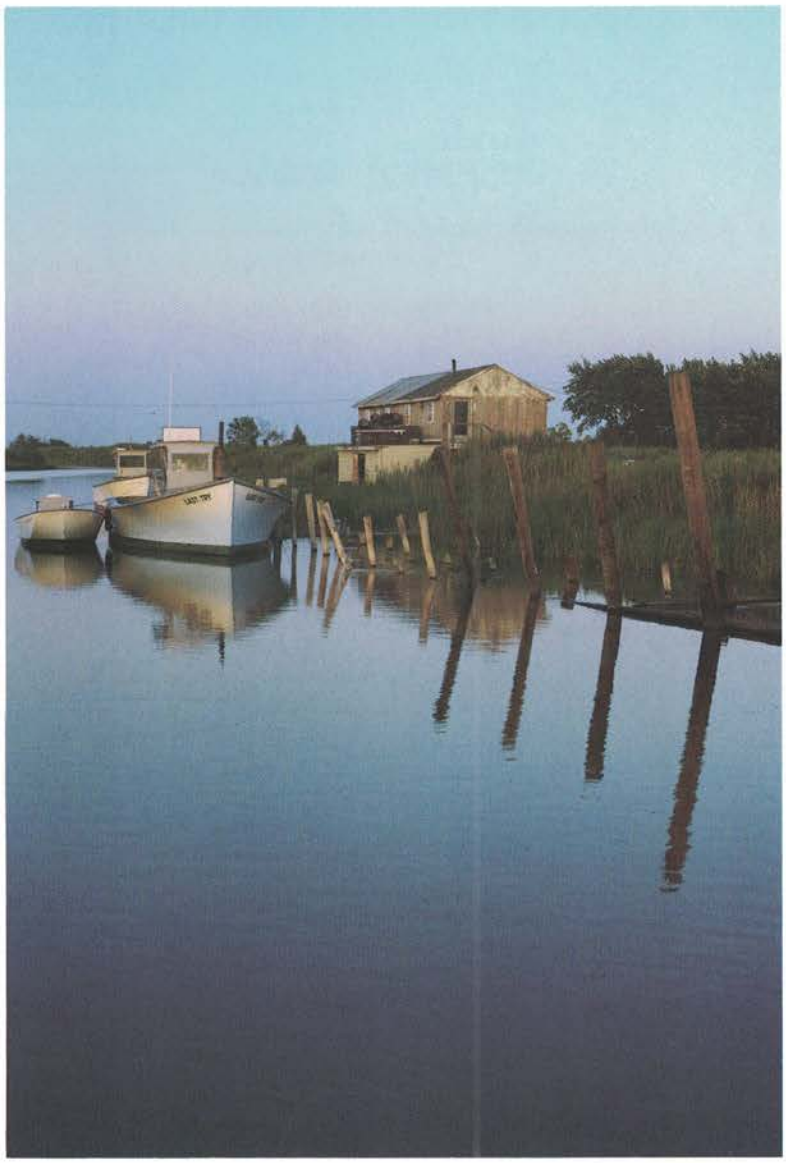
Project	Fund Balances July 1, 1988	Revenues	Transfers	Expenditures	Fund Balances June 30, 1989
Recreational rivers	$ 14	$ 0	$ 0	$ 0	$ 14
Daily Flow Model	0	28,575	0	3,338	25,237
USGS monitors	46,093	137,145	0	150,147	33,091
Delaware Estuary	0	22,500	0	22,500	0
Blue Marsh	41	0	0	0	41
Ground water — Pennsylvania Protected Area	86,528	150,000	(66,715)	123,606	46,207
Salinity — U.S. Army Corps of Engineers	0	32,483	0	15,455	17,028
Ground water — Withdrawal fees	1,135	0	0	0	1,135
Computer Project	4	0	48,940	48,940	4
Disinfection Study	155,053	100,000	0	148,576	106,477
Delaware Fish Study	25,000	80,100	0	105,100	0
Toxics Management Study	0	25,543	(3,768)	21,775	0
	$313,868	$576,346 [A]	$(21,543)	$639,437 [B]	$229,234

[A] Revenues were derived from:

United States Government	$175,158
Pennsylvania Department of Environmental Resources	175,543
Other States	66,000
Corporate and other grants and fees	159,645
	$576,346

[B] Expenditures were primarily for payroll costs and contractual services.

The records of the Commission are audited annually as required by the Compact.



Little River near Little Creek, Del. (Photo by Jim White, Delaware Nature Society)

Maps Sought

The DRBC is trying to obtain detailed topographic base mapping for development of Flood Stage Forecast Maps for the basin. Anyone with knowledge about the existence of such maps should contact Richard K. Fromuth of the Commission staff at 609-883-9500. For details on the DRBC's flood warning and flood preparedness program see page 30.

The Solution:

The 1.6 gallon per flush toilet, shown on the right on page 21. The DRBC has projected a water use reduction in the basin of 42 million gallons a day by the year 2020 through use of these low consumption models.

Delaware River Basin Commission
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