

A photograph of several pink flowers with five petals and yellow centers, growing from a crack in a dark, layered rock. The rock surface is covered with patches of white lichen. The flowers have green stems and leaves.

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A photograph of several pink flowers with five petals each, growing from a blue-grey, textured rock surface. The flowers are in various stages of bloom, with some showing yellow centers. The rock has white, lichen-like patches. The overall scene is a close-up, focusing on the contrast between the vibrant pink and the cool, textured background.

DELAWARE RIVER BASIN COMMISSION

Annual Report 1998

This report covers calendar year 1998. It was compiled and edited by Christopher M. Roberts, the Commission's public information officer. Material for the report was generated by Commission staff.

Free copies are available by contacting the Commission at P.O. Box 7360, West Trenton, N.J. 08628. (Phone 608-883-9500, ext. 240; e-mail: croberts@drbc.state.nj.us). The report also is available on our web site: www.state.nj.us/drbc/.

Front cover: *Dame's rockets and lichen along the Delaware River.*
Photo by J.J. Raia

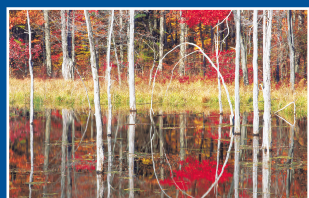


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Executive Director's Report

By Carol R. Collier

Ms. Collier



I am very excited about being the third executive director of the Delaware River Basin Commission (DRBC). In fact, when I saw the job announcement last year, I just knew the DRBC is where I belonged. My love is water resources; my capabilities are environmental planning and management.

As I was preparing my resume, it seemed that all of my past experiences were relevant to the DRBC executive director position:

- During my 18 years in the private sector, I learned project management and the technical skills of environmental analysis and assessment, particularly in the areas of water resources, wetlands, and land use. I gained experience with projects in headwater areas as well as in estuaries and marine environments.
- My two years as regional director of the Pennsylvania Department of Environmental Protection's (PADEP's) Southeast Region Office broadened my awareness of multimedia issues and the fact that similar problems do not necessarily have the same solution. I also learned that we must do a better job including the local community in environmental decisions. Changes in philosophy brought about by PADEP Secretary Jim Seif empowered staff to be problem solvers, driven more by mission than by bureaucracy.
- Most recently, the year and a half I spent as executive director of Governor Tom Ridge's 21st Century Environment Commission, a 40-member body tasked with recommending Pennsylvania's environmental priorities for the next 100 years, was a tremendous experience. It allowed me the opportunity to work with outstanding commissioners and exposed me to many environmental initiatives in other states and nations. I learned while traveling around Pennsylvania that people *are* concerned about the environment and *are* worried about sprawling land use patterns and their impact on water resources. The most important lesson I learned is that if we maintain adversarial relationships, the environment will suffer. We, as diverse stakeholders, need to make our resource decisions by considering potential impacts on economic health, community well-being, and protection of the natural environment. All three are interconnected. The best solution is one that advances all three—environment, economy, and community.

There have been many accomplishments in the 38 years of DRBC history. I believe the most significant accomplishment lies in the fair allocation of water among the four signatory states. The Compact that created the DRBC and the Good Faith Agreement that adjusted the basin's water allocation formula both work! In the past, the Delaware River was considered a boundary. The DRBC has been instrumental in turning that image around to a shared resource, effectively working with the states, federal government, and local organizations to improve the basin. Another accomplishment that can be attributed to my predecessor, Jerry Hansler, is the development of advisory committees and involving stakeholders in the process.

As we build upon this record of accomplishment and prepare to meet the challenges of the next century, the DRBC will be addressing the difficult issues of resource management, including water demand forecasting, watershed management, and equitable use of limited water resources. We will provide service to our constituents—the four states, federal government, environmental organizations, recreators, and water users—by providing a framework within which economic progress and environmental protection can continue.

The DRBC must first develop goals and objectives for the future of the basin, built on the foundations of the Compact and significant public input. We will be developing action plans, budgets, and staffing schemes to address the needs of the basin. It's very important that we monitor and track our progress toward these agreed-upon goals and reassess our direction as necessary.

The commission offers a unique opportunity to plan and manage a resource on a regional scale. So often we get lost in the trees of individual projects and actions that we miss the significance of the whole forest. When dealing with a natural resource like the Delaware River Basin, a big-picture view is required to set the priorities. That is the role of the DRBC.

I believe that issues of water scarcity will increase in the next few years. We will see greater demands for water supply, as well as increased use of the waterways for recreation. The importance of aquatic habitats is becoming

more apparent, and our understanding of habitat protection is growing. Are we properly allocating surface and ground waters? How can we most effectively protect our stream and river biological systems? The DRBC needs to play a key role in this debate. We must be an information source so decisions can be based on sound science. We must provide education so people better understand water systems and the connection between water quantity and quality; ground water and surface water, stormwater and water supply. We must maintain our regulatory functions so that use of water resources is equitable throughout the basin.

I strongly believe that a watershed is the correct unit for environmental management, whether it is a large watershed (the whole Delaware River Basin) or a small one, like the Rancocas or Brodhead Creeks. While the DRBC needs to look at the big picture, most improvements will be made at the local watershed level. In my opinion, watershed decisions—quality goals, water use, and processes to address these issues—are best made (and implemented) by watershed partnerships with significant input from local interests. We will be there to help.

Finally, I want to ensure that the DRBC is viewed as having an open mind and an open-door policy. As I stated before, public participation is very important to me. We need to find ways to engage interested persons in issues before the eleventh hour of decision making. As the DRBC goes through the process of comprehensive planning, we will be calling on concerned members of the public for input. After all, you know the river and can express your concerns for the river and basin. We also will be looking to you for problem-solving ideas.

In closing, I recently read Dick Albert's book, *Damming the Delaware*, which spells out an incredibly interesting history. In the beginning of the book is this quote attributed to Chief Justice Oliver Wendell Holmes in the 1930s: "A river is more than an amenity, it is a treasure."

Enough said.

"The most important lesson I learned is that if we maintain adversarial relationships, the environment will suffer."



The Commission

Photo by J.J. Raia: *Thunder Mountain Lake, Delaware Water Gap National Recreation Area*

Changing of the Guard

Carol R. Collier became the Commission's third executive director in the agency's 37-year history during 1998, succeeding Gerald M. Hansler who retired after 21 years of exemplary service. Her appointment marked the first time a woman has been named

head of an interstate-federal compact agency.

Before joining the Commission, Ms. Collier served as executive director of Pennsylvania's 21st Century Environment Commission, established to set the Commonwealth's future environmental priorities. Prior to that she was director

of the Pennsylvania Department of Environmental Protection's Southeast Region, which takes in much of the lower Delaware River Watershed.

Ms. Collier worked 19 years with BCM Environmental Engineers, Inc., beginning as a student intern and ultimately becoming vice president of environmental planning, science, and risk before entering state government.

A native of Monmouth County, N.J., Ms. Collier holds a bachelor of arts degree in environmental biology from Smith College and a master's in regional planning from the University of Pennsylvania. She is a professional planner licensed in New Jersey, a member of the American Institute of Certified Planners, and a senior ecologist as certified by the Ecological Society of America.

Ms. Collier, who was sworn in on September 9, won the 1998 Women of Distinction Award presented by the *Philadelphia Business Journal* and other organizations to honor the career and community contributions made by women in the Greater Philadelphia Region. A year earlier, she received the Touchstone Award from the Society of Women Environmental Professionals. She has published widely on environmental and water-related topics, and is a frequent lecturer on a variety of environmental issues.

Deputy Director Named



Mr. Featherstone

Jeffrey Featherstone, a 16-year veteran of the Commission, was appointed to the newly-created post of DRBC deputy executive director. As the Commission's chief policy analyst, he was a leader in the "Retreat" process which redefined the DRBC's mission and goals.

He also has spearheaded the Commission's water conservation programs, establishing the DRBC as a leader in the international water conservation arena.

Mr. Featherstone has spent his entire career in environmental and water-related areas. Prior to joining the DRBC, Mr. Featherstone was planning director for the Upper Mississippi River Basin Commission and a planner and hydrologist with the Minnesota Department of Natural Resources.

He holds a bachelor of arts degree in geography from the University of Minnesota, a master of arts degree in public administration from Rider University, and is a Ph.D. candidate in public administration at Temple University.

A True Friend of the River



Mr. Hansler

Jerry Hansler joined the Commission as executive director in 1977, after stand-out careers with the U.S. Environmental Protection Agency and the U.S. Public Health Service. At the time of his retirement he was commended in a Commission resolution that read in part:

Gerald M. Hansler has skillfully advocated on behalf of the Commission and has provided unmatched leadership which has culminated in a myriad of major accomplishments. [His] watershed management policies ... have served as a model for watersheds across the country and around the world. He has been a true friend of the Delaware River ... and has left a lasting legacy in the Delaware River Basin and in the lives of all who know him.

The Commission's first executive director was the late James F. Wright, who was appointed in 1962 to begin organizing what was seen as a vanguard experiment in regional federalism.

New Commissioners

Maj. Gen. Jerry L. Sinn has been appointed by President Clinton to serve as the Commission's new federal representative.

A career soldier, he assumed command of the North Atlantic Division of the U.S. Army Corps of Engineers in July 1997. The division is one of eight supervisory regional offices reporting to the Corps' headquarters in Washington, D.C. It is responsible for federal water resource projects and military construction in the Mid-Atlantic and New England states, the District of Columbia, and overseas.

Gen. Sinn enlisted in the Army in 1968. As a lieutenant he served as a "tunnel rat" in Vietnam and later held command positions in Korea and Southeast Asia.

A graduate of the University of Missouri, the Command and General Staff College, and the U.S. Army War College, he also has taught mathematics at the U.S. Military Academy at West Point. His military decorations include the Legion of Merit, the Bronze Star, the Purple Heart, and the Army Commendation Medal.

Gen. Sinn succeeds Vincent P. D'Anna, who served as the federal representative under President Clinton from 1994 to 1998 and was instrumental in policy deliberations that culminated in the Commission's reexamination of streamflow needs and its drought operating plan.

Col. George C. Clarke, deputy commander and deputy division engineer at the Army Corps' North Atlantic Division, has been named the alternate federal commissioner.

Col. Clarke began his military career in 1972. He has served in Okinawa, Japan, with the U.S. Army Engineer District; in Panama as commander of the 518th Engineer Company, 193rd Infantry

Brigade; and in Korea as commander of the 802nd Engineer Battalion. Prior to being named to his current post in 1997, he was the Corps' engineer inspector general.

Col. Clarke is a graduate of the Virginia Polytechnic Institute and State University, where he earned a B.S. in nuclear engineering, and the University of Virginia, graduating with a master's in civil engineering. He also is a graduate of the Marine Corps Command and Staff College and the U.S. Army War College.

Col. Clarke's awards include the Legion of Merit, the Defense Meritorious Service Medal (with oak leaf cluster), the Joint Service Commendation Medal, and the National Defense Service Medal (with bronze star).

"[Gerald Hansler's] watershed management policies ... have served as a model for watersheds across the country and around the world."



The members of the Commission are the governors of the four basin states (Pennsylvania, Delaware, New York, and New Jersey) and a federal member appointed by the President of the United States. A federal alternate commissioner also is appointed and the governors select high-ranking officials in the four state environmental regulatory agencies as their representatives. Annual elections are held for Com-

mission chair, vice chair, and second vice chair, based on a rotation of the five signatory parties.

The Commission holds regular business meetings and hearings on policy matters and water resource projects under regulatory review. These sessions, along with meetings of the Commission's various advisory committees, are open to the public.

Each commissioner has one vote of equal power, with a majority vote needed to decide most issues.

The Commission (in good years) is funded by the five signatory parties, receiving additional revenue from project review fees, water use charges, fines, and public and private grants.

The Delaware River Basin

The mainstem Delaware River extends 330 miles from the conflu-

ence of its East and West branches near Hancock, N.Y., to the mouth of the Delaware Bay.

The river is fed by 216 tributaries, the largest being the Schuylkill and Lehigh Rivers in Pennsylvania.

In all, the basin takes in 13,539 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 (2,362 square miles, or 18.5%); and Delaware (1,002 square miles, or 7.9%).

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

In view of its proximity to large cities and concentrations of heavy industry, the Delaware River and its feeder streams are, for the most part, in remarkably good health.

Two reaches of the Delaware River, and the Maurice River in New Jersey, have been included in the National Wild and Scenic Rivers System. Another reach of the Delaware, a 54-mile stretch linking the Delaware Water Gap and Washington Crossing, Pa. (just upstream of Trenton, N.J.) is being studied for possible inclusion in the system, as is the White Clay Creek, which flows from Pennsylvania into Delaware.

The Delaware Bay and the tidal reach of the Delaware River also are part of the National Estuary Program, a project set up to protect estuarine systems of national significance with priority management strategies.

The Commission at a Glance



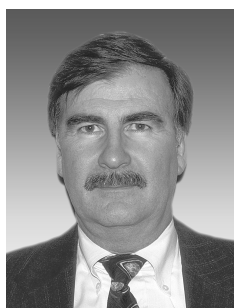
Mr. Gast

William A. Gast, chief of the Division of Water Use Planning in Pennsylvania's Department of Environmental Protection (PADEP), has been appointed the Commonwealth's second alternate commissioner to the DRBC.

He joined the division in 1969, and during the 1970s worked actively in developing data management systems for Pennsylvania's State Water Plan. He was named chief of the division in 1980 and in that capacity has managed the division's surface water allocation, water planning, and data management programs.

Mr. Gast holds a bachelor of science degree in civil engineering from Lehigh University and is a licensed professional engineer in Pennsylvania.

He succeeds Stephen A. Runkle, who had served as commission alternate to Pennsylvania Governor Tom Ridge since 1995. Mr. Runkle, who played key roles in the crafting of the Commission's ground water and water conservation programs, has joined the Susquehanna River Basin Commission as a consultant.



Mr. Tudor

Robert Tudor, assistant commissioner for Environmental Planning and Science in New Jersey's Department of Environmental Protection (NJDEP), has been named by Governor Christine Todd Whitman to serve as her second alternate on the DRBC.

The first alternate is Robert C. Shinn, Jr., the NJDEP's commissioner.

Mr. Tudor, a career NJDEP employee with 18 years of service, oversees the agency's Division of Science and Research, the Office of Environmental Planning, and the Office of Air Quality Management. He served as the administrator of the Office of Environmental Planning from 1996 to 1998 and as program director for the Delaware Estuary Program from 1993 to 1995. Prior to that he had been administrator of the Land Use Regulation Program.

Mr. Tudor is a graduate of Rutgers College and the University of Connecticut.

Stephen P. Nieswand, who served as DRBC alternate to New Jersey Governors Whitman and Jim Florio beginning in 1991, left the NJDEP during 1998, accepting a position with the U.S. Geological Survey. At the Commission, he chaired the Flow Management Technical Advisory Committee, displaying inspirational leadership qualities in guiding the basin through three drought periods in the 1990s.



Dr. Huerta

Sergio Huerta, director of the Division of Water Resources in Delaware's Department of Natural Resources and Environmental Control (DNREC), has been appointed by Governor Thomas R. Carper to serve as his second alternate on the Commission. He succeeds Gerard L. Esposito,

who left state government to join the private sector.

Governor Carper's first alternate to the DRBC, DNREC Secretary Christophe A.G. Tulou, also resigned in 1998 and hadn't been replaced by year's end.

Dr. Huerta, a physician, has vast experience in managing technical and legislative issues within the corporate and government sectors. He previously served as Delaware's environmental laboratory administrator.

He attended George Washington University in Washington, D.C., and is a specialist in surgical and clinical laboratory pathology. He also has done specialty work in tissue oncology at St. Barnabas Medical Center in Livingston, N.J.



Dr. Otto

Harry W. Otto, senior science advisor in DNREC's Division of Water Resources, has been named Governor Carper's third alternate on the DRBC. Dr. Otto's myriad duties in his post include serving as alternate commissioner to the Appalachian States Low-Level Radioactive Waste Compact and as

the governor's liaison to the U.S. Nuclear Regulatory Commission.

Prior to being assigned to his current position in 1995, he was environmental laboratory director

in DNREC's Division of Environmental Control where he directed statewide environmental surveillance programs targeted at such areas as air, drinking water, and solid waste. From 1965 to 1971, he was senior research chemist with Esso Research and Engineering Co.

Dr. Otto has a Ph.D. in mathematics and physical and organic chemistry from Penn State University, where he also earned a master's in chemistry, and has a B.S. in chemistry from Muhlenberg College.

Since 1987, Mr. Esposito served on the Commission as alternate to Delaware Governors Carper and Michael Castle. During his tenure, he provided skillful leadership, including his guidance of the "Retreat" process which laid the groundwork for charting the DRBC's future.

New Advisor



Col. Lewis

Lt. Col. Debra M. Lewis is the Commission's new federal advisor. She was sworn in in August 1998 as the U.S. Army Corps of Engineers' 50th commander of the Philadelphia District.

Col. Lewis graduated from the U.S. Military Academy in 1980 and holds a master's in business administration from Harvard University. She then served as a faculty member at West Point.

Prior to becoming the Philadelphia District's first woman commander, Col. Lewis served as a company commander and in other leadership posts in North Carolina, Hawaii, and Washington, D.C.

Gearing Up For the 21st Century

The Commission underwent an interim reorganization at the end of the year in an effort to become more agile and responsive to the changing needs of water resource management.

The reorganization, which involved both reassignment of staff and structural changes, will be revisited at the end of a directional planning process that the Commission is undertaking to

address environmental challenges of the 21st Century.

Among the changes were:

- the promotion of Richard C. Albert, a supervising engineer, to the newly-created position of Basin Planner;
- the promotion of Thomas J. Fikslin, director of the Commission's Estuary Toxics Management Program, to head a new Modeling and Monitoring Branch;
- the creation of Implementation Teams to address policy issues and such specific areas as monitoring and data management, public outreach/information technology, and water demand and water conservation; and
- the renaming of the existing Engineering Division to the Water Resources Division.

The interim reorganization required no new positions.

Dr. Fikslin joined the commission in March 1989 on loan from the U.S. Environmental Protection Agency. He became a full-time employee in 1993.

A graduate of Upsala College, he holds a master's degree in biological sciences from the University of Delaware and a Ph.D. in ecology from Rutgers University. He is an adjunct assistant professor at Ocean County College.

Mr. Albert has spent 27 years in the field of water resource management, serving as project leader

on numerous scientific and policy-related studies.

He is the author of *Damming the Delaware: The Rise and Fall of Tocks Island Dam* (Penn State University Press), and numerous publications about water quality management and the history of the Delaware River.

A graduate of Otterbein College where he earned a bachelor's degree in biology, Mr. Albert also holds a master's degree in environmental science and engineering from Virginia Tech.

The Commission is undertaking a directional planning process to address environmental challenges of the 21st Century.

New Jersey



Gov. Christine Todd Whitman
Chair



Robert C. Shinn, Jr.
Alternate

New York

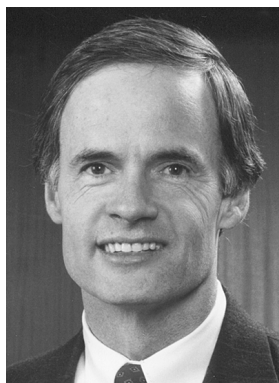


Gov. George E. Pataki
Vice Chair



N.G. Kaul
Alternate

Delaware



Gov. Thomas R. Carper
Second Vice Chair



Christophe A.G. Tulou
Alternate

United States



Maj. Gen. Jerry L. Sinn
Member



Col. George C. Clarke
Alternate

Pennsylvania



Gov. Tom Ridge
Member



Irene B. Brooks
Alternate

Second/Third Alternates, Advisors

New Jersey

Robert Tudor
Second Alternate

New York

John L. Middelkoop
Second Alternate

Warren T. Lavery
Third Alternate

Joel A. Miele, Sr.
Advisor

Delaware

Sergio Huerta
Second Alternate

Harry W. Otto
Third Alternate

United States

Lt. Col. Debra M. Lewis
Advisor

Pennsylvania

William A. Gast
Second Alternate

Kumar Kishinchand
Advisor

Signatory Members

Passing the Baton

New Jersey Governor Christine Todd Whitman was elected on June 24, 1998, to serve as Commission chair for the period July 1, 1998, through June 30, 1999.

Elected vice chair was New York Governor George E. Pataki. Delaware Governor Thomas R. Carper was elected second vice chair.

The elections, held at a Commission meeting in West Trenton, N.J., have historically been based on an annual rotation of the signatory parties.

Welcome Aboard

The DRBC hired the following employees in 1998:

- Carol R. Collier, executive director;
- Karen Reavy, geographic information system (GIS) specialist;
- Evelyn Borbely, water resources specialist;
- Pamela V'Combe, watershed planner; and
- Namsoo Suk, water resources engineer/modeler.

All staff can be reached by phone at (609) 883-9500. Follow e-mail address with @drbc.state.nj.us

Directorate	<u>Tel. Ext.</u>	<u>E-Mail Address</u>		<u>Tel. Ext.</u>	<u>E-Mail Address</u>
Carol Collier, <i>Executive Director</i>	200	ccollier	Pamela Merritt, <i>Secretary</i>	228	pmerritt
Jeffrey Featherstone, <i>Deputy Executive Director</i>	208	jfeather	Karen Reavy, <i>GIS Coordinator</i>	273	kreavy
Anne Zamonski, <i>Secretary</i>	222	annez	Judith Strong, <i>Librarian</i>	263	jstrong
David Goldberg, <i>General Counsel</i>	207				
Susan Weisman, <i>Secretary to the Commission</i>	203	sweisman	Planning and Implementation		
Richard Albert, <i>Basin Planner</i>	256	ralbert	David Pollison, <i>Branch Head</i>	255	pollison
Christopher Roberts, <i>Public Information Officer</i>	205	croberts	Forsyth Kineon, <i>Estuary Coordinator</i>	217	fkineon
Carol Everett, <i>Secretary</i>	240	ceveretg	Todd Kratzer, <i>Water Resources Engineer</i>	261	tkratzer
Judy Scouten, <i>Secretary</i>	224	jscouten	Peg Lebo, <i>Secretary</i>	257	plebo
Clarke Rupert, <i>Assistant Public Information Officer</i>	260	crupert	Pamela V'Combe, <i>Watershed Planner</i>	226	pvcombe
			Paul Webber, <i>Supervising Engineer</i>	236	pwebber
Administrative			Project Review Branch		
Richard Gore, <i>Chief Administrative Officer</i>	201	rgore	Thomas Brand, <i>Branch Head</i>	221	tbrand
Gregory Dusecina, <i>Support Services</i>	245	dusecina	Carol Adamovic, <i>Secretary</i>	216	carola
Carol Everett, <i>Secretary</i>	240	ceveretg	Page Fielding, <i>Supervising Geologist</i>	225	fielding
Carolyn Hartman, <i>Accounting Assistant</i>	249	chartman	Ronald Rulon, <i>Water Resources Engineer</i>	269	rrulon
Joseph Sosi, <i>Head, Financial Section</i>	211	jsosi	Paul Scally, <i>Water Resources Engineer</i>	251	pscally
Water Resources Division			Modeling and Monitoring		
David Everett, <i>Chief Engineer</i>	202	deverett	Thomas Fikslin, <i>Branch Head</i>	253	tfikslin
Susan Owens, <i>Secretary</i>	213	sowens	Gregory Cavallo, <i>Water Resources Engineer</i>	270	gcavallo
Information Services			Richard Fromuth, <i>Water Resources Engineer</i>	232	rfromuth
Richard Tortoriello, <i>Branch Head</i>	228	toriello	Robert Kausch, <i>Environmental Scientist</i>	252	bkausch
Gail Blum, <i>Water Resources Technician</i>	219	gblum	Peg Lebo, <i>Secretary</i>	257	plebo
Evelyn Borbely, <i>Water Resources Analyst</i>	264	eborbely	Robert Limbeck, <i>Environmental Scientist</i>	230	rlimbeck
Karl Heinicke, <i>RIMS Manager</i>	241	heinicke	Edward Santoro, <i>Monitoring Coordinator</i>	268	esantoro
Warren Huff, <i>Supervisor, Computer Operations</i>	237	whuff	Namsoo "Sam" Suk, <i>Water Res. Engineer/Modeler</i>	305	nsuk
Timothy Lazaro, <i>Network Administrator</i>	274	tlazaro	Jason Tsai, <i>Water Resources Engineer/Modeler</i>	266	jtsai

Commission Staff



Water Supply

Photo by S.C. Delaney, U.S. Environmental Protection Agency

A photograph of a wetland area. In the foreground, there are tall, green reeds. In the middle ground, there is a body of water with many small, dark, round objects (possibly rocks or debris) scattered across it. In the background, there is a sandy bank and more vegetation.

Stressed Ground Water Table to Get Beefed-Up Protection

The Commission held public hearings in March 1999 on proposed amendments to regulations governing ground water withdrawals in a stressed region of the Delaware River Basin.

The regulations establish numerical withdrawal limits for 14 subbasins, or watersheds, in the Neshaminy Creek Basin, located in the Ground Water Protected Area of Southeastern Pennsylvania.

The limits were derived from baseflow characteristics of geologic formations developed in a study by the U.S. Geological Survey (USGS). A geographic information system (GIS) was then used to generate overlay maps of the 14 subbasins. The study later was broadened to include 62 additional subbasins that fall either entirely or partly within the Protected Area. GIS mapping also was prepared for these watersheds.

With a complete map set now in hand, it is the DRBC's intent to amend its regulations to establish withdrawal limits for the entire area. Adding

A reduction in baseflows affects downstream water uses, may harm aquatic life, and can reduce the capacity of waterways in the region to assimilate pollutants.

the 62 subbasins to the DRBC's regulatory package was the subject of the March hearings.

"We now have a complete spatial analysis of this stressed resource," notes

Carol Collier, the DRBC's executive director. "This computer snapshot provides the information we need to manage that resource effectively."

The Ground Water Protected Area, where more stringent regulations apply to ground water withdrawals than they do in the rest of the Delaware River Basin, was established by the DRBC in 1980 at the request of the Commonwealth of Pennsylvania. The goal is to prevent depletion of ground water, protect the interests and rights of lawful users of the same water source, and balance and reconcile alternative and conflicting uses of limited water resources in the region. Special requirements for the protected area include:

- permits for withdrawals of 10,000 gallons per day or more during any 30-day period;
- advanced notice of exploratory drilling;
- a hydrologist report with the results of an extended pump test (not less than 48 hours' duration);
- well registration and metering;
- conservation requirements; and
- compliance with the Commission's "withdrawal-limits policy."

Lowered water tables in the Protected Area have reduced flows in some streams and dried up others. This reduction in baseflows affects downstream water uses, may harm aquatic life, and can reduce the capacity of waterways in the region to assimilate pollutants.

While it is clear that ground water withdrawals can impact the flows of perennial streams, it has been difficult to measure their effects on stream-flow on a project-by-project basis.

The regulations adopted by the Commission on January 28, 1998, that apply to the Neshaminy Creek Watershed address that problem by creating a two-tiered system of water withdrawal limits.

The first tier serves as a warning that a subbasin is "potentially stressed." In potentially stressed subbasins, applicants for new or expanded ground water withdrawals are required to implement one or more programs to mitigate adverse impacts of those withdrawals. Acceptable programs include: conjunctive use of ground water and surface water; expanded water conservation programs; programs to control ground water infiltration; and artificial recharge and spray irrigation.

The second tier serves as the maximum withdrawal limit. Under the regulations, ground water withdrawals may not exceed that limit.

The regulations also:

- Provide incentives for holders of existing DRBC docket and Protected Area permits to implement one or more of the above programs to reduce the adverse impacts of their ground water withdrawals. If docket or permit holders successfully implement one or more programs, the Commission will extend the docket or permit duration for up to ten years.
- Specify criteria for the issuance and review of dockets and permits as well as procedures for revising withdrawal limits to correspond with integrated water resource plans adopted by municipalities for subbasins. (These plans would address such areas as future water demand, options for wastewater discharge, and floodplain and stormwater management practices.)
- Establish a protocol for updating and revising withdrawal limits to provide additional protection for streams designated by the Commonwealth of Pennsylvania as "high quality," or "wild, scenic or pastoral" as defined by state's Scenic Rivers Program.

The GIS mapping prepared by the USGS covers all of Montgomery County plus the portions of Berks, Bucks, Chester, and Lehigh counties that fall within the Protected Area. Portions of Delaware and Philadelphia counties, which fall outside the designated zone, also were mapped, as was a portion of Chester County that skirts the Protected Area.

The maps depict watershed and municipal boundaries, geology, stream locations, ground water withdrawal points, and discharge locations.

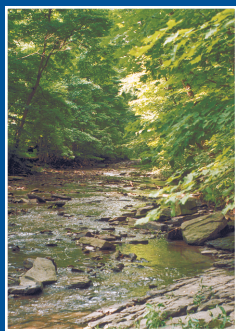
Getting Out the Word

The mapping data are available on compact disk (CD-ROM) at a cost of \$10. To order, call the DRBC at 609-883-9500 (ext. 249). To review the data at the Commission's offices, call 609-883-9500 (ext. 263) to make an appointment. To review the CD-ROM at locations within the Protected Area, call 609-883-9500 (ext. 203).

The study that provided the baseflow analyses for the 14 watersheds in the Neshaminy Creek Basin, and an accompanying map series entitled *Maps of Difference Between Ground-Water Contributions to Base Flow for the Various Recurrence Intervals and Ground-Water Withdrawals in the Neshaminy Creek Basin, Pennsylvania*, may also be reviewed at the Commission's offices.

In addition, review copies are available at the offices of the Bucks County Planning Commission (215-345-3400); the Bucks County Library Center (215-348-9082); the Montgomery County Planning Commission (610-278-3733); the Chester County Library (610-363-0884); and the Lehigh Valley Planning Commission (610-264-4544).

Water use data as recent as 1996, provided by the Pennsylvania Department of Environmental Protection, and approximate water and sewer service area boundaries in the Protected Area, can be downloaded from the Commission's web site: www.state.nj.us/drbc/. A color map of the Protected Area is also available on the web site.



**Fish Creek,
a tributary of
the Neshaminy.
Photo: Heritage
Conservancy**

The Ground Water Protected Area of Southeastern Pennsylvania takes in 1,200 square miles and includes 127 municipalities. Some of its larger watersheds are Perkiomen Creek (362 square miles), Brandywine Creek (325 square miles), Neshaminy Creek (242 square miles), and Wissahickon Creek (64 square miles).

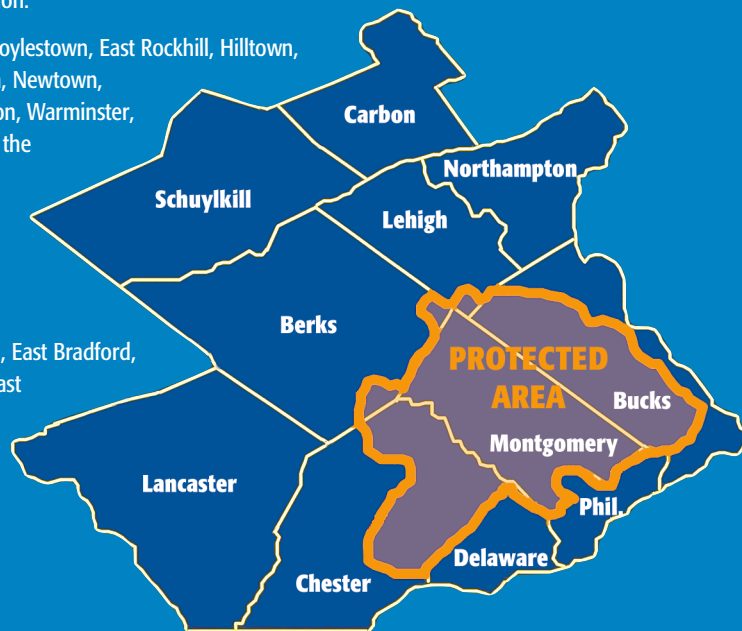
In addition to all of Montgomery County, these areas in surrounding counties fall within the Protected Area:

Berks: the townships of Douglass, Hereford, and Union.

Bucks: the townships of Bedminster, Buckingham, Doylestown, East Rockhill, Hilltown, Lower Southampton, Middletown, Milford, New Britain, Newtown, Northampton, Plumstead, Richland, Upper Southampton, Warminster, Warrington, Warwick, West Rockhill, and Wrightstown; the boroughs of Chalfont, Doylestown, Dublin, Hulmeville, Ivyland, Langhorne, Langhorne Manor, New Britain, Newtown, Pennel, Perkasie, Quakertown, Richlandtown, Sellersville, Silverdale, Telford, and Trumbauersville.

Chester: the townships of Birmingham, Charlestown, East Bradford, East Coventry, East Goshen, East Pikeland, Easttown, East Vincent, East Whiteland, North Coventry, Schuylkill, South Coventry, Thornbury, Tredyffrin, Warwick, West Bradford, West Goshen, Westtown, West Whiteland, and Willistown; the boroughs of Elverson, Malvern, Phoenixville, Spring City, and West Chester.

Lehigh: Lower Milford Township.



The Protected Area



Water Quality

Photo by S.C. Delaney, U.S. Environmental Protection Agency



Toxics: A Persistent Threat to the Health of the Estuary

While water quality in the Delaware River has shown remarkable improvement since the days when the tidal reach was little more than an open sewer, there are still problems that need remedies. The presence of toxics in the estuary is one of them.

In 1989, fish consumption advisories were issued for striped bass, white perch, and catfish by the states of New Jersey and Pennsylvania, and later Delaware, because of the presence of polychlorinated biphenyls (PCBs)

and chlorinated pesticides in the Delaware's water column and sediment. The advisories were prompted by DRBC toxic studies.

The studies documented that in addition to PCBs and chlorinated pesticides, there are other elevated levels of toxics in the river. These include polynuclear aromatic hydrocarbons (PAHs), DDT-related pesticides, and heavy metals such as chromium, copper, lead, mercury, and zinc.

The highest concentrations of these toxic pollutants occur in a 14-mile, heavily urbanized portion of the river between the old Philadelphia Navy Yard upstream to the Tacony–Palmyra Bridge. Sources include discharges from industrial and municipal wastewater treatment plants, non-point sources such as stormwater runoff, and atmospheric inputs.

In June 1998, the Commission released a report documenting current and historic sources of PCBs that are contributing to the toxic contamination of fish. The report indicates that the current problem cannot be attributed solely or predominantly to historic sediment contamination, as many scientists have believed. Instead, the active loadings entering the estuary from sewage treatment plants, combined sewer overflows (CSOs), and tributary streams are sufficient to cause water quality problems, independent of PCBs already present in the river.

These sources, however, are not themselves generators of PCBs. Rather, they are merely conduits for PCBs that have been inadvertently or deliberately introduced into sewage collection systems, carried in erosion from contaminated upland sites, or transported from tributary watersheds.

John Flomo of Newark, N.J., displays a three-foot, six-inch catfish he caught in October 1998 in the Delaware River at Trenton. As bottom feeders, catfish are susceptible to toxic contaminants found in riverbed sediment.



LESLIE BARBARO, THE TRENTONIAN

Sewage treatment plants, in fact, significantly reduce the amount of PCBs entering the estuary, as evidenced by much lower concentrations of PCBs in the water discharged from the treatment plants compared to that in the untreated wastewater entering the plants.

The report notes that sewage treatment plants and overflows from their collection systems nevertheless contributed up to 95 percent of the PCBs entering the river during both dry- and wet-weather sampling surveys. Significantly higher concentrations of PCBs (up to 60 times greater) enter the river during rainy spells.

In releasing the report, the Commission hopes to increase public awareness that PCBs are a current and not a historical threat to the health of the biota and to users of the estuary, and to encourage proper disposal of electrical equipment containing PCBs.

The study that generated the report was jointly funded by the U.S. Environmental Protection Agency and the Commission.

The Next Step: Wasteload Allocations

As a result of this and other studies, the DRBC has adopted regulations governing the discharge of toxic pollutants from wastewater treatment plants to the tidal Delaware.

The regulations, which took effect January 1, 1997, set uniform water quality criteria for the pollutants for the 85-mile reach of the river from the head of tide at Trenton, N.J., downstream to the Delaware Bay, including tidal portions of tributary streams.

They also established procedures for setting wasteload allocations and effluent limitations for those discharges that contain pollutants that exceed stream quality objectives and impact the designated uses of the river.

The water quality criteria are designed to address the effects of acute and chronic toxicity to aquatic life and the potential for harmful effects on humans through ingestion of untreated river water and/or the consumption of resident finfish and shellfish.

Establishment of the wasteload allocations is dependent on a determination by the Commission that the assimilative capacity of the tidal Delaware River is being exceeded for certain toxic pollu-

tants. Public hearings on the topic took place in the spring of 1999.

If it is found that the assimilative capacity is being exceeded, the DRBC's executive director would then be authorized to set wasteload allocations for specific point-source (end-of-pipe) discharges as needed for 76 riverbank treatment plants.

Sewage treatment plants, in fact, significantly reduce the amount of PCBs entering the estuary.

The down-basin states (Pennsylvania, Delaware, and New Jersey) would use the wasteload allocation numbers to establish effluent limitations to be used in current NPDES (National Pollutant Discharge Elimination System) permits governing the Delaware River discharges.

A document entitled *Wasteload Allocations for Volatile Organics and Toxicity: Phase I TMDLs for Toxic Pollutants in the Delaware River Estuary* has been prepared. It describes in detail the process being used for developing the wasteload allocations.

Three supporting documents describe the mathematical models used in the process:

- *Calibration and Validation of a Water Quality Model for Volatile Organics and Chronic Toxicity in the Delaware River Estuary;*
- *Calibration and Validation of the DYNHYD5 Hydrodynamic Model for the Delaware River Estuary; and*
- *Development of a Tidal Version of the CORMIX Models for Application to Discharges in the Delaware Estuary.*

They are available on the Commission's web site: <www.state.nj.us/drbc/> or by calling the Commission at 609-883-9500, ext. 205.

The wasteload allocations were developed with scientific and policy input from the Commission's Toxics Advisory Committee, a 13-member body that includes representatives from the state environmental agencies in Delaware, New Jersey, Pennsylvania, and New York; the U.S. Environmental Protection Agency (Regions II and III); plus representatives from private environmental groups, academia, and the regulated community.

Bait Your Hook

Despite the presence of toxics, fish populations in the lower Delaware River and Bay have shown a sharp increase in recent years, due in large part to a significant improvement in overall water quality.

These findings are contained in a Commission report prepared in cooperation with the Delaware Estuary Program, a project set up in 1988 to protect estuarine systems of national significance. Fisheries on the rebound include American shad, weakfish, striped bass, Atlantic croaker, Atlantic

silversides, bay anchovy, black drum, hogchoker, northern kingfish, and American eel, according to the report, released in August.

Within the past decade, the striped bass fishery has shown a remarkable recovery and the number of weakfish, the bay's most economically important fishery, is also on the rise, the report notes.

Within the past decade, the striped bass fishery has shown a remarkable recovery.

On the downside, Atlantic sturgeon populations appear to be on the decline, as does the number of horse shoe crabs in Delaware Bay. Blue crab populations increased during the 1990s, but sampling surveys indicate their numbers have tapered off in the past two years, the report states.

The improved water quality that brought the fish back is tied to sharp increases in dissolved oxygen in the river. Annual average oxygen levels today range from 3.5 to 4.0 milligrams per liter (mg/l) at Delaware River and Bay monitoring stations, meeting or exceeding on a yearly average the required minimum DRBC and federal standards.

In the meantime, bacterial levels have dropped off, with mean levels of fecal coliform averaging consistently below the federal standards for primary contact recreation in the tidal river and bay. Sampling indicates enterococcus levels likewise are in compliance with these standards.

The two reports on which this article is based are: *Delaware Estuary Monitoring Report* and *Study of the Loadings of Polychlorinated Biphenyls (PCBs) from Tributaries and Point Sources Discharging to the Tidal Delaware River*. These, too, are available on the Commission's web site.

Al Ambler, a National Park Service employee assigned to the Delaware Water Gap National Recreation Area, helps survey cross sections of Flat Brook as part of a study to assess water quality during high-flow conditions on basin rivers and streams. The project is a joint effort by the Commission and the New Jersey branch of the U.S. Geological Survey.



ROBERT LIMBECK

The Lower Delaware: A Plateful of Goals

The Commission and the Delaware Riverkeeper Network have completed the first year of a pilot water quality monitoring program that initially focused on an eight-mile reach of the Delaware River and nine tributary streams from Washington Crossing, Pa., to the head of tide at Trenton, N.J.

Working under the auspices of the Delaware River Greenway Partnership, DRBC and Riverkeeper staff, along with citizen volunteers, gathered water quality and aquatic plant data in an effort to fulfill a plateful of goals.

One is to increase the long-term monitoring cover-

age of the Lower Delaware, a need recognized in the National Park Service's Lower Delaware River Management Plan.

The plan, which the Commission supports, contains goals directed at water quality, natural and historic resources, recreation, economic development, and open space preservation for the Delaware River from the Delaware Water Gap to Philadelphia.

Sections of this river reach are being proposed for inclusion in the National Wild and Scenic Rivers System, a position the Commission has endorsed.

Other goals of the Lower Delaware Cooperative Monitoring Program are to:

- statistically define existing water quality as a baseline for detection of future change;
- develop abatement priorities for both point and non-point sources of pollution;
- prioritize Delaware River tributaries for monitoring and watershed planning purposes; and
- safeguard the health and safety of the river-using public.

In addition to the Delaware mainstem, monitoring was conducted on these tributaries: Piddcock, Jericho, Houghs, Dyer, and Buck/Brock creeks in Pennsylvania; and Moore, Fiddler, Jacobs, and Gold Run creeks in New Jersey.

As the high streamflows of spring gave way to low flows in late summer and early fall, several impacts on water quality were detected in tributary streams: low dissolved oxygen levels, high nutrient concentrations, habitat degradation, and eroded streambanks and channel disturbances which contribute to increased sediment loads.

During July, a 24-hour (diel) study was conducted at three locations on the Delaware to measure total aquatic community productivity. Monitoring took place day and night from the Washington Crossing Bridge, the Yardley Pa. Access Area, and Trenton's Calhoun Street Bridge. Readings for water and air temperature, dissolved oxygen, pH, and conductivity were taken hourly in an effort to measure photosynthesis and respiration rates which can yield valuable information on the river's productivity and ecological health.

A Stunted Growing Season

The diel study was augmented by a boat and canoe survey of aquatic plant beds.

One of the findings was that high-flow conditions caused the aquatic plants' growing season to be shortened. As a result, very little aquatic vegetation was found during the survey, making productivity estimates difficult to make. If resources and flow conditions permit, the diel study will be repeated in 1999.

The data from this and other studies on the river and the nine tributaries are being analyzed. The results will be published at a later date in a report that also will contain summary descriptions of biological sampling (rapid bioassessment protocol results), using aquatic insects as indicators of water quality. Tributary flow data, which are used to calculate pollutant loads to the Delaware River, also will be presented along with climatic data for the survey period, and GIS analyses of watershed characteristics.

In coming years the program, subject to available funding, hopefully will be expanded to cover the Delaware from Trenton upstream to the Water Gap.

One of the goals is to increase the long-term monitoring coverage of the Lower Delaware, a need recognized in the National Park Service's Lower Delaware River Management Plan.

Water Snapshot '98

Partnering hi-tech know-how with youthful curiosity, hundreds of individuals fanned out across the Delaware River Basin during the spring of 1998 to test the waters.

Sampling took place on 221 waterways as part of *Water Snapshot '98*, an Earth Week survey of the Delaware River, its feeder streams, ponds, and lakes.

Participating were schools, youth groups, government agencies, environmental organizations, business and industry, and folks who sampled solo just because of a hankering to find out about the health of a local stream or creek.



PAMELA V'COMBE

Robert Limbeck, water resources analyst for the DRBC, tests for turbidity from the Stockton Bridge as part of Snapshot '98.

Samples were taken at 490 locations between April 17 and April 26 by youngsters with simple test kits and highly trained government scientists with sophisticated gear. The sampling bracketed

The top five criteria selected during the prioritization process were land use, water quality, habitat, socio-economic factors, and road density.

Earth Day, focusing attention on the importance of protecting the environment.

The first *Water Snapshot* was held in 1996, the brainchild of a group of government officials and

environmentalists who were meeting to promote volunteer monitoring programs in the basin. *Water Snapshot '98* was co-sponsored by the Commis-

sion, the Departments of Environmental Protection in Pennsylvania and New Jersey, the Delaware Department of Natural Resources and Environmental Control, the Upper Delaware Council, the New York Department of Environmental Conservation, the Delaware Riverkeeper Network, the U.S. Environmental Protection Agency, and the Pennsylvania Department of Conservation and Natural Resources.

A report entitled *Water Snapshot '98—An Earth Week Survey of Delaware River Basin*, which contains the results of the monitoring effort, can be obtained from the Commission at no charge or accessed on the DRBC web site.

Setting Watershed Priorities

The Commission sponsored two workshops in September on its Special Protection Waters regulations in an effort to get stakeholders more involved in the implementation process.

The workshops were held in Matamoras, Pa., and addressed two subjects:

1. an explanation of the project review criteria that trigger the regulations, with hypothetical project cases presented by DRBC staff; and
2. identification and ranking of criteria for prioritization of Special Protection Waters' watersheds.

About 60 people attended the workshops, including federal, state, and local officials; representatives of watershed associations; and members of the regulated community.

The DRBC regulations, crafted in cooperation with the National Park Service, were sparked by increasing development in the northern tier of the basin, especially in the Pocono Mountain region. They are designed to protect the high water quality in the 125-mile reach of the Delaware River from Hancock, N.Y., to the southern boundary of the Delaware Water Gap, including portions of some tributary streams.

In determining watershed priorities, the regulations stipulate that certain criteria be considered, including:

- the physical characteristics of the watershed, including slopes, soils, existing land use, and land cover;

- the anticipated mass loadings of pollutants from new non-point sources;
- the watershed management and planning priorities of local, state, and federal agencies; and
- the status of local land use and non-point source controls in the watershed.

Over 40 of the workshop attendees participated in the prioritization process. The top five criteria selected were: land use, water quality, habitat, socioeconomic factors, and road density.

The Commission plans to use the information gleaned at the workshops, along with data from

other sources, in structuring a final methodology for prioritizing watersheds within the Special Protection Waters area. The process will include an analysis of each watershed's location, as well as a determination of future impacts on existing water quality.

Detailed results of the workshop's findings regarding the prioritization process are contained in a DRBC document titled *Special Protection Waters Watershed Prioritization Workshop Report*. It can be obtained by contacting the Commission for hard copies or by accessing it on our web page.



Flat Brook, a Delaware River tributary located in northern New Jersey, was the subject of water quality studies during high flow conditions.

ROBERT LIMBECK



Looking Ahead

Photo by S.C. Delaney, U.S. Environmental Protection Agency

A white bird with a red beak stands on a sandy beach. The background shows a blurred view of the ocean with white-capped waves breaking. The bird is positioned in the lower-left foreground, facing right.

Exploring New Management Techniques

The Commission established a new advisory committee in 1998 to address the ever-increasing interplay between ground and surface water sources.

Two existing committees, the Ground Water Advisory Committee and the Water Conservation Advisory Committee, were dissolved with their functions folded into the new body—the Water Management Advisory Committee.

Besides carrying on the functions of the two dissolved bodies, the new

committee will advise the DRBC commissioners and staff on the following topics:

- water demand and consumptive use forecasting techniques;
- implementation of Commission water conservation regulations and recommendations for additional technology transfer sessions;
- models and methodologies for characterizing ground water flow patterns and instream flow needs;
- baseflow frequency analyses and water supply assessments for upstream watersheds;
- protocol for review of integrated resource plans;
- potential watersheds to be considered for watershed action teams;
- recommendations for watershed-based plans that consider the interrelationships of ground water recharge and discharge, stormwater management, and instream flow needs.

Committee membership consists of representatives from the four basin states; the U.S. Army Corps of Engineers; the U.S. Environmental Protection Agency; the U.S. Geological Survey; the cities of New York and Philadelphia; county water

resource agencies; the Water Resources Association of the Delaware River Basin (WRA); industry, water utilities, and agriculture; the League of Women Voters and other civic organizations; envi-

ronmental and watershed organizations; academia; and recreation and fisheries groups.

In creating the new committee, the Commission expressed its appreciation to the members of the dissolved bodies, recognizing in particular the exemplary work of the two chairs: David Yaeck of the Ground Water Advisory Committee and Joseph Miri of the Water Conservation Advisory Committee.

The ground water committee was established in December 1982 to advise the Commission on the implementation of a special ground water study. It went on to develop two basinwide regulations (well registration and source metering) and prepared new amendments to regulations governing the Southeastern Pennsylvania Ground Water Protected Area. These were adopted by the Commission.

As the years passed, the ground water committee became more involved in surface water issues, recognizing that both water sources must be considered in any effective management campaign.

The water conservation committee was established in April 1983 to advise the Commission on the adequacy of state drought contingency plans and ongoing conservation policies and programs. The committee developed four regulations that were adopted by the Commission—service metering, leak detection and repair, water conservation performance standards for plumbing fixtures and fittings, and water pricing structures that encourage conservation. It also sponsored technology transfer work shops to encourage conservation in the commercial and industrial sectors. With most of its responsibilities behind it, the committee lately had been meeting infrequently.

The new committee will take on new tasks, including the development of models and methodologies for characterizing ground water flow patterns and instream flow needs.

Catching Up on All the Dirt

Commission staff will be gaining a new tool in the near future to help manage the basin's water resources.

In December 1998, a resolution was adopted by the Commission to contract with the U.S. Army Corps of Engineers to provide digitized soil surveys for seven counties located within the Pennsylvania portion of the basin.

The Commonwealth's Department of Environmental Protection had determined there was a growing need by its counties and municipalities to have computer access to GIS (geographic information system) soil data in digital format instead of relying on old paper soil maps. The Commonwealth directed the Corps to use Section 22 funds for the project.

The Corps is empowered to assist states in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources under Section 22 of the Water Resources Development Act of 1974 (as amended).

The Corps was authorized under the Energy and Water Development Appropriations Bill of 1999 to spend \$500,000 to provide GIS assistance to the Commonwealth. Of this amount, \$250,000 was slated for the Delaware River Basin. The Commission was required under the Section 22 program to put up \$250,000 in matching funds.

The soil surveys will be conducted in the following Pennsylvania counties: Wayne, Carbon, Schuylkill, Montgomery, Philadelphia, Northampton, and Delaware.

Soil classification data are important to more than just the agricultural community. Types of soil, say sandy versus clay, are being used more widely to determine the impacts of

There was a growing need for computer access to GIS soil data in digital format instead of old paper soil maps.

Types of soil are being incorporated into computer models that determine pollutant loadings for watersheds.



stormwater runoff and are being incorporated into computer models that determine pollutant loadings for watersheds.

Once digitized, soil data can aid in identifying areas within a watershed that are at risk for erosion, sedimentation, and nonpoint-source pollution problems. Combining digitized soil data with other GIS data, such as topographic and geologic mapping, can provide a broader understanding of the overall movement of water.

The expansion of the Commission's GIS during the year included the creation of data layers for use by the technical staff in creating maps for a variety of uses.

The GIS data are available to staff on the Commission's internal computer network, making it

easier to fold GIS information into regular daily work tasks.

Maps created by staff are placed on the DRBC's web site where they can viewed or downloaded. The site features a map gallery. Locate it at: <www.state.nj.us/drbc/gallery.htm>.

Building Bridges: Visitors from Foreign Lands

The Commission is constantly exploring new management techniques at home, working closely with its five signatory parties and staff. For almost four decades, it also has hosted water resource managers from foreign countries as part of an

Robert M. Houston, right, vice president of Stanley Consultants, Inc., in Muscatine, Iowa, strolls across the bridge spanning the Delaware River with a delegation of officials representing the Japan Institute of Construction Engineering. The institute has over 100 staff members who represent the Japanese Ministry of Construction, prefectural and municipal governments, public corporations, and private firms. Their programs center around construction work involving road, river, and city planning.



CHRIS ROBERTS

informal program to help solve water-related problems in the international arena.

Delegations from scores of countries have toured the basin and visited the DRBC's offices over the years to learn about our mission and the unique arrangement under which four states partner on an equal basis with the federal government. In exchange the Commission has picked up useful

information that can be helpful in forging its own policies.

These photos were taken during 1998 on the footbridge that spans the Delaware River between Lumberville, Pa., and Bulls Island, N.J. Perhaps that's fitting, because of the informational bridges that connect the Commission with so many foreign lands.



CHRIS ROBERTS

Alexander Tarasov, left, from Orenburg, Russian Federation, breaks away from a conversation with Joseph Sosi, head of the Commission's Fiscal Department, to mug for the camera. Dr. Tarasov is director of Aquatech Research and Manufacturing, Ltd., a private Russian company specializing in research, development, and installation and servicing of water treatment/purification systems and water filters. Clients include private homes, schools, hospitals, and large industries.



Jeffrey Featherstone, left, the Commission's deputy executive director, joins Jacques Huberts and Jos von Winkelen of The Netherlands. Both are managing directors of two large water supply companies.



Weather's Whims



Soaking Rains and a Record Dry Spell

If nothing else, hydrologic conditions in the basin during 1998 proved out the old bromide that normal weather is a fictional statistic—that normals are merely averages that encompass all extremes.

The year started out with the basin under one drought warning. It ended under another. In between, there was a soggy spring followed by a record-breaking dry spell.

The first warning was triggered on October 27, 1997. It lasted less than three months, being lifted on January 13,

1998, after soaking rains and melting snow boosted storage in three major water supply reservoirs in the Catskill Mountains by nearly 60 billion gallons.

The second warning kicked in on December 14, 1998, following five months of parched weather that in New Jersey turned out to be the driest July-to-November span since records were first kept in 1895.

In Pennsylvania, wells serving 73 families in Northampton County went dry on Christmas Eve, and dropping water levels in a fish hatchery forced earlier-than-planned stocking of 14,000 adult trout.

The reenactment of George Washington's crossing of the Delaware on Christmas night to launch a surprise attack on Hessian troops in Trenton took place on a bridge, not in boats, because the river was simply too low. It was the first time in the 45 years of the reenactment that drought conditions forced the Continental Army to cross on foot.

Precipitation deficits of almost a foot were notched in some parts of the basin during the last six months of 1998.

The second warning ended on February 2, 1999, again after drenching rains and melting snowpack helped replenish reservoir storage and flush salt-laced water in the Delaware River downstream toward the ocean.

Low water levels caused by drought conditions forced George Washington and his Continental Army to cross the Delaware on foot. Only twice before in the reenactment's 45-year-history has the crossing in Durham boats been canceled—not because of drought but because of storms and ice-choked river water.



JONATHAN WILSON, THE PHILADELPHIA INQUIRER

Under the Commission's drought management plan, a warning ends when combined storage in three huge water supply reservoirs in the upper basin increases to at least 15 billion gallons above a designated drought warning zone and stays above that level for five consecutive days. Storage topped the 15-billion-gallon buffer on January 28, 1999.

The three impoundments—Pepacton, Neversink, and Cannonsville—are owned by New York City, which lies outside the basin, but gets roughly half its water from the reservoirs through gravity-fed aqueducts. The impoundments are located at the Delaware River's headwaters in the Catskill Mountains and account for roughly 75 percent of the total surface water storage in the basin.

The reservoirs hold 271 billion gallons of useable water when full. In a healthy hydrologic cycle, storage in the reservoirs would be increasing during the late fall and winter months when water demand drops off and thirsty vegetation has died off or is dormant. In 1998, however, storage fell by 78 billion gallons from October 1 through December and the decline continued into early January.

Flows in the Delaware River and tributary streams also were far below normal going back to mid-July. In the Delaware, flows, as recorded at Trenton during November and December, averaged 2,936 cubic feet per second (cfs), compared to normal flows for that two-month span of 10,752 cfs.

By late November, reservoir levels were 25 percent below normal, prompting the DRBC to preempt its formal drought operating plan in an effort to get a head start on the worsening drought conditions.

Under an agreement among the Commission and the parties to a 1954 U.S. Supreme Court decree that apportioned the waters of the Delaware, a decision was made to throttle back both releases from the reservoirs into the Delaware and reservoir withdrawals by New York City.

During normal hydrologic conditions, New York can take up to 800 million gallons a day

(mgd) from the impoundments. In return, it must release sufficient water into the Delaware to meet a downstream flow target of 1,750 cfs at Montague, N.J., located just downstream of Port Jervis, N.Y. In addition, the DRBC directs releases from two lower basin reservoirs to maintain a flow target of 3,000 cfs at Trenton.

Under the agreement reached on November 21, the flow targets were reduced to 1,655 cfs at Montague and 2,700 cfs at Trenton, and New York City's take from its reservoirs was cut to 680 mgd.

When the basin entered the first stage of drought warning on December 14, a water diversion to northern New Jersey through the Delaware and Raritan Canal was reduced from 100 mgd to 85 mgd. The water supply channel feeds off the Delaware River upstream of Trenton and winds its way to the Raritan River at New Brunswick.

A second-stage drought warning kicked in on December 23 and the diversions were further reduced: New York City dropped from 680 mgd to

560 mgd, and New Jersey from 85 mgd to 70 mgd. The Montague streamflow target was lowered from 1,655 cfs to 1,550 cfs.

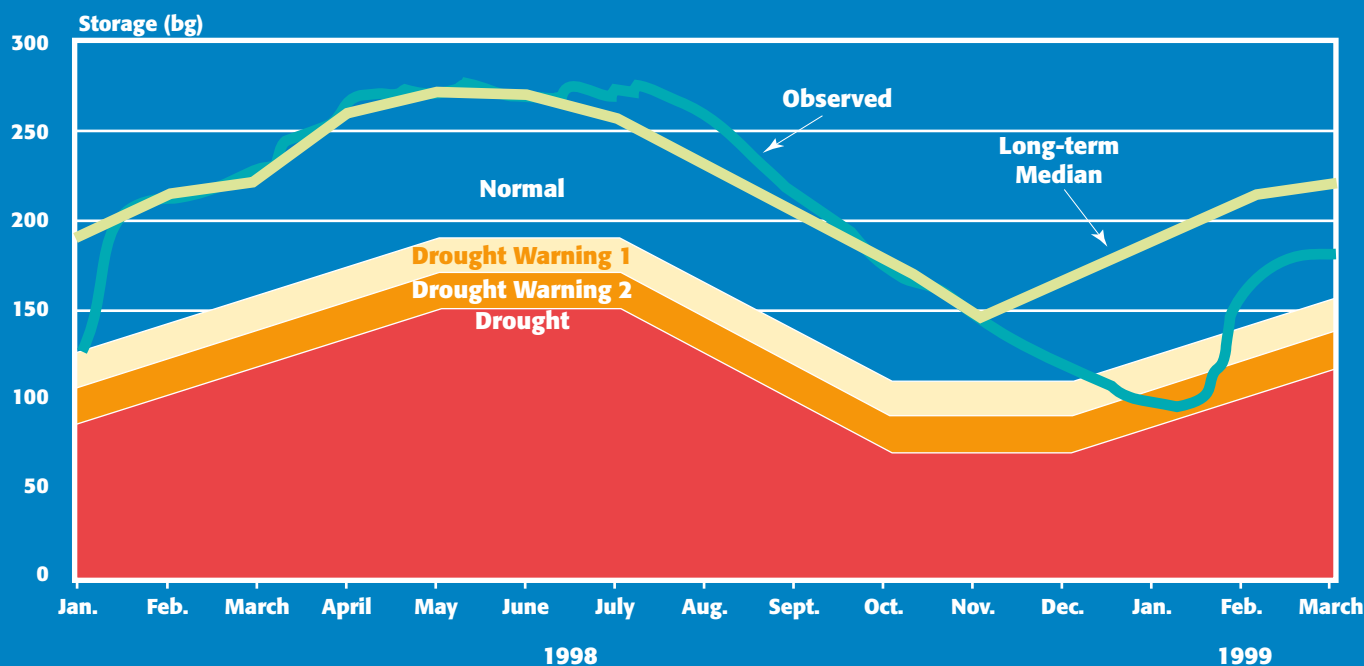
A Drought Emergency Looms

With conditions worsening, the Commission declared a conditional drought emergency on January 5, 1999. It would have kicked in had the storage in the three New York City reservoirs dropped into a "drought zone" and remained there for five consecutive days.

The Commission took the action at a public hearing, which is required by law as a preface to any drought emergency declaration. As part of the hearing, the Commission adopted conservation orders that would have been activated had the dry weather persisted.

Two of the orders called for marshalling of water supplies in state, federal, and power company reservoirs in order to conserve storage and coordi-

Heavy back-to-back rain storms in January 1999 helped replenish storage in three major water supply reservoirs in the upper basin. The impoundments—Pepacton, Neversink, and Cannonsville—are owned by New York City. They account for roughly 75 percent of the total surface water storage in the basin.



Reservoir Storage

nate releases from the impoundments to help bolster streamflows.

A third called for major, self-supplied water users in the basin to prepare drought contingency plans for water curtailment, had it become necessary.

A fourth conservation order would have restricted non-essential water use in the basin.

A week later heavy and persistent back-to-back rain storms soaked the basin and in another two weeks the drought warning was lifted. The out-of-basin diversions to New York City, and the Montague and Trenton streamflow targets reverted back to normal levels.

In all, 12.8 billion gallons of water were saved in reservoir storage as the result of drought management actions taken during the year's second water shortage.

A Unique Relationship

At a meeting in December, David Goldberg, the DRBC's general counsel, noted that it was

rather extraordinary that four states and a major city could get together and agree on how to share a common resource like water. He stated that this is not common in other parts of the country.

"Sometimes people question what is the value of the DRBC, or what is it that the Commission can do with its members," said Mr. Goldberg. "One of the things we do on an ongoing basis based on relationships that we have developed over 37 years, is to reassess how the waters of the Delaware are to be shared and managed in times of stress and shortage.

"It does happen, but not without a lot of work and not without the power and constraints of this Commission to make it happen."

The lack of rain that began in mid-July not only impacted reservoir storage and streamflows, but caused significant decreases in ground water levels throughout the basin. Flows rebounded as a result of the January storms and ground water levels were recovering, but were still well below normal when the year ended.

The Commission's drought plan focuses on salinity intrusion—the upstream migration of salty water from the Delaware Bay during low-flow conditions in basin rivers and streams.



PHOTOS BY KEVIN MINGORA, *POCONO RECORD*

A five-mile-long ice jam formed on the Delaware River in late January 1999, stretching downstream from near the bridge spanning Milford, Pa., and Montague, N.J., to just south of Namanock Island, near Dingmans Ferry. The ice eventually broke up without causing any serious flooding.

As part of a pact generated by the Commission among the basin states and New York City (the parties to the 1954 U.S. Supreme Court decree), the city must release sufficient water into the Delaware River from its three reservoirs to help repel, or flush back, the salt-laced water, known in water jargon as the “salt front” (a seven-day average 250 milligrams per liter chloride concentration).

Runoff from January’s storms swelled the Delaware and tributary streams, the rush of sea-bound fresh water pushing the salt front downstream to River Mile 69 at the Delaware Memorial Bridge. During the height of the drought, the salty water had migrated as far north as River Mile 85, about four miles downstream of the Philadelphia International Airport.

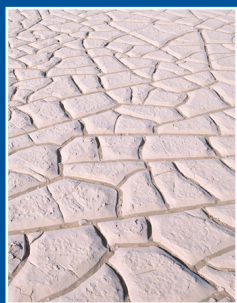
As the salt-laced water moves upriver it increases corrosion control costs for surface water users, particularly industry, and can raise the treatment costs for public water purveyors. In recent dry years, salty water also has migrated into streams

and creeks in Delaware, threatening water supplies in northern New Castle County.

In addition to releases from the three New York City reservoirs, 4.89 billion gallons of water were released during the year’s second dry spell from Beltzville Reservoir on the Lehigh River and Blue Marsh Reservoir on the Schuylkill River to improve flows, enhance water quality, and protect fisheries. The releases also helped to repel salinity.

And, when the drought warning was in effect, a consortium of electric utilities in the basin released water from Merrill Creek Reservoir to make up for evaporative losses at their riverbank generating stations. The 16-billion-gallon impoundment, located near Phillipsburg, N.J., came on line in

In all, 12.8 billion gallons of water were saved in reservoir storage as a result of drought management actions.



The DRBC’s Home Page

The Commission’s web site (www.state.nj.us/drbc/) offered a variety of hydrologic data during the drought, information that helped the public, other government agencies, environmental organizations, and the news media keep abreast of the ever-changing conditions. Some highlights included:

- graphs depicting daily storage figures for major water supply reservoirs, updated daily;
- streamflow information, updated daily;
- monthly summary reports on hydrologic conditions in the basin, including precipitation trends;
- weather forecasts for every county in the basin;
- explanations of the DRBC’s drought warning and drought emergency operating plans;
- links to the four basin state web sites which, when pertinent, carried localized drought information;
- precipitation and river stage reports for the basin, updated daily;
- automated rainfall data from the National Weather Service; and
- a link to the National Drought Mitigation Center.

Where It’s @ for Drought Information

1982. In all, 666 million gallons of water were released into the river from Merrill Creek.

The basin has entered into drought warning ten times since the early 1980s when the Commission's drought management plan was adopted. Two times, in 1981 and 1985, conditions worsened and drought emergencies were declared.

Water Conservation: Investing in the Future

The Commission has an ambitious water conservation program to reduce water demand. The program, which is recognized both nationally and internationally, has resulted in significant cost savings, environmental protection, and improved drought preparedness.

The DRBC estimates savings of some 80 million gallons a day of water by the year 2020 through the continued implementation of its water conservation performance standards for plumbing fixtures and fittings. This reduction should save or defer from \$250 million to \$400 million in additional capital costs for water supply and wastewater treatment plants.

The regulation requires the installation of low-consumption toilets and other water-saving

plumbing devices in new construction and remodeling projects in the basin.

The DRBC also has regulations requiring large water purveyors to develop systematic programs to monitor and control leakage.

New York City, which draws roughly half its water from the Delaware Basin, has taken similar conservation steps. It is nearing completion of a customer metering program to get a better handle on water consumption and has installed over 1.3 million new low-flow toilets through a rebate program. The savings are permanent and have resulted in a 13 percent reduction in water use since 1994.

News Media Help Pitch Commission's Message

The news media often are the Commission's voice when it comes to getting the word out about a particular event. Droughts are no exception.

During the most recent water shortage, the media not only did a thorough job of covering the story; in many cases they helped pitch the Commission's message to use water wisely. That provided a public service, one the Commission appreciated. Following are some excerpts from a few editorials:



FRAN KITEK, THE MORNING CALL

Two workers check to see how much water a well is producing in East Allen Township, located in Pennsylvania's Northampton County. Wells serving 73 families in the township went dry on Christmas Eve forcing the residents to use water from barrels the local fire department placed in the streets.

The time is long past to be conscientious about conserving water. Take shorter showers, wash clothes and run dishwashers only with full loads, and fix leaky toilets and faucets. The Lehigh Valley and surrounding counties will continue to grow. Water conservation must be a lifelong habit.

—*The Morning Call* (Allentown, Pa.), 12/30/98

We do place enormous demands on our water resources, and as the region grows, those demands continue to increase. Fortunately, this is a situation that everyone can help to control. Not wasting water is no hardship. Not having water? That's a hardship.

—*The Intelligencer/Record* (Doylestown, Pa.), 12/15/98

If we don't conserve now and the dry weather continues, Delawareans will find themselves in serious trouble when spring planting drives demand up sharply.

—*The News Journal* (Wilmington, Del.), 12/29/98

... our water is finite, in Hunterdon and on Earth. There is no more water today and there will be no more tomorrow than there was at the beginning. And most of it is salty. We'd be wise to plan accordingly.

—*Hunterdon County Democrat* (Flemington, N.J.), 12/17/98

Water conservation measures are in the interest of all of us.

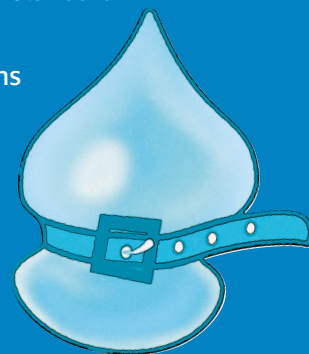
—*Courier-Post* (Cherry Hill, N.J.), 12/31/98

It's difficult to understand the thinking of the weather people on the TV—why are they jubilant to report the rain has left our area and the sun is coming out when we are in desperate need of rain to fill our reservoirs? Sure, we all love a day with perfect weather, but we also like to drink water, shower, and flush the toilet!

—*Springfield Press* (Springfield, Pa.), 1/6/99

Noting that awareness is the first step in conservation, the Commission shared information with the public that hopefully would make people think twice about how they used water while the basin was under drought warning:

- The average person uses this much water daily: toilet flushing, 19 gallons; bathing and hygiene, 15 gallons; laundry, 8 gallons; kitchen, 7 gallons; housekeeping, 1 gallon. Total: 50 gallons.
- Approximately two-thirds of residential interior water use is for toilet flushing and bathing.
- An old vintage toilet uses between four and six gallons of water per flush. A low-consumption model uses 1.6 gallons.
- Leaks inside a toilet can waste up to 200 gallons of water a day.
- Hot water leaks not only are a waste of water, but are a waste of the energy used to heat the water.
- A dishwasher uses between eight and 12 gallons per load.
- A top-loading clothes washer uses between 40 and 55 gallons of water per load. Front-loading models use roughly half that amount.
- Approximately 90 percent of the water used to sprinkle lawns is either absorbed by the grass or lost to the atmosphere through evaporation. Less than 10 percent is returned to the hydrologic cycle.
- A garden hose discharges up to six-and-a-half gallons of water per minute under standard household water pressure.
- Soaker hoses and trickle systems reduce the amount of water used for irrigation by 20 to 50 percent.



H₂O: Did you know...



Financial Summary



New Budget Lacks Federal Funds

On December 6, 1995, the Commission adopted its fiscal year 1997 operating budget for the period July 1, 1996, through June 30, 1997. This budget anticipated a receipt of federal funds in the amount of \$534,000.

A provision in the Energy and Appropriations Bill (P.L. 104-206) eliminated federal funding for the Commission for the federal fiscal year

1997, which ran from October 1, 1996, through September 30, 1997. The impact of this action amounted to a \$427,000 shortfall.

The Commission's fiscal year 1997 budget was subsequently amended to reflect this action and the fiscal year 1998 budget was adopted on June 25, 1997, without a federal contribution.

Efforts were underway at the close of 1998 to restore the federal monies.

Statement of Revenues & Expenditures— General Fund

Year Ended June 30, 1998	Budget	Actual
Revenues		
Signatory parties:		
Delaware	\$344,000	\$344,000
New Jersey	688,000	688,000
New York	481,500	481,500
Pennsylvania	688,000	688,000
Water Quality Pollution Control Grant	253,125	253,125
Sale of Publications	23,000	5,398
Project Review Fees	64,500	64,566
Reimbursement of Overhead-Agency Fund	70,000	70,000
Interest Income	246,000	217,172
Net Increase in Fair Value of Investments	-	29,262
Fines, Assessments & Other Income	5,000	22,674
TOTAL REVENUES	\$2,863,125	\$2,863,697
Expenditures		
Personnel Services	\$1,842,800	\$1,842,743
Special & Contractual Services	310,200	310,185
Other Services	131,100	131,106
Supplies & Materials	97,000	96,954
Building Operations	156,200	153,154
Communications	49,100	49,108
Travel	51,500	51,473
Maintenance, Replacements & Acquisitions	85,400	85,378
Fringe Benefits	501,100	500,615
TOTAL EXPENDITURES	\$3,224,400	\$3,220,716
Excess of Revenues Over (Under) Expenditures	(\$361,275)	(\$357,019)
Other Financing Sources:		
Operating Transfers In	-	\$606,146
Operating Transfers Out	-	(75,079)
Net Transfers In	-	\$531,067
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES AND OTHER FINANCING SOURCES*	(\$361,275)	\$174,048

* On December 6, 1995, the Delaware River Basin Commission adopted its fiscal year 1997 operating budget (July 1, 1996, through June 30, 1997). This budget anticipated a receipt of federal funds in the amount of \$534,000. The Energy and Water Appropriations Bill (P. L. 104-206) eliminated federal funding for the Delaware River Basin Commission for the federal fiscal year 1997 (October 1, 1996, through September 30, 1997). The impact of this action amounted to a \$427,000 decrease in federal funding. The fiscal year 1997 budget was amended to reflect this action, and the fiscal year 1998 budget was adopted on June 25, 1997, without a federal contribution. Efforts have been undertaken for the restoration of federal funding. At this time the results of such efforts are unknown. Comprehensive audited financial statements are available for inspection at the Commission's headquarters.

Statement of Revenues & Expenses— Water Supply Storage Facilities

Year Ended June 30, 1998

Operating Revenues

Water Charges	\$1,998,626
TOTAL OPERATING REVENUE	\$1,998,626

Operating Expenses

Personnel Services	\$50,898
Special and Contractual Services	153,526
Supplies and Materials	345
Travel	1,168
Maintenance, Replacement, Acquisition and Rental	3,220
Amortization	421,487
Fringe Benefits and Other Contributions	11,966
TOTAL OPERATING EXPENSES	\$642,610

Operating Income	\$1,356,016
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Nonoperating Revenue (Expenses)

Interest Income	\$471,189
Net Increase in Fair Value of Investments	146,849
Interest Expense	(592,328)
TOTAL NONOPERATING REVENUE	\$25,710

Income Before Operating Transfers	1,381,726
Operating Transfers Out	(573,890)

NET INCOME	\$807,836
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Retained Earnings – Beginning of Year	\$3,250,717
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Retained Earnings – End of Year	\$4,058,553
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Effective July 1, 1997, the Commission changed the method of accounting and reporting activities relating to the Water Supply Storage Facilities Fund. These activities are accounted for as a Proprietary Fund Type. They were previously accounted for as a Governmental Fund Type. This change required the reclassification of certain assets and liabilities which had previously been reported in account groups. In addition, certain retroactive adjustments were required to account for the Fund's assets and liabilities on the accrual basis. As a result, the Fund's balance as of June 30, 1997, has been restated as Retained Earnings and adjusted for the above changes.

Schedule of Changes in Special Projects Advance/(Receivable) Balance—by Project

Project	Balances at July 1, 1997	Cash Receipts (A)	Transfers	Expenditures (B)	Balances at June 30, 1998
Advances					
USGS Monitors	—	\$125,639	\$81,929	(\$151,815)	\$ 55,753
Groundwater—PA Protected Area	\$18,556	265,000	(157,679)	(121,898)	3,979
Upper Delaware Ice Jam Project	209,187	19,681	4,362	(18,574)	214,656
Delaware Estuary Project—PA	951	16	—	—	967
Delaware Estuary Project—DE	32	—	—	—	32
Water Quality Models	8,227	70,471	—	(78,698)	—
Subtotal Advances	\$236,953	\$480,807	(\$71,388)	(\$370,985)	\$275,387
Accounts Receivable					
USGS Monitors	(\$39,001)	39,001	—	—	—
Delaware Estuary Project—EPA	(24,457)	\$190,426	(\$27,149)	(\$147,366)	(\$8,546)
Delaware Estuary (RIMS)—EPA	(4,671)	70,936	(11,633)	(61,152)	(6,520)
High Flow Management Objectives	(8,333)	—	1,648	(35,903)	(42,588)
Water Quality Models	—	—	—	(63,099)	(63,099)
Christina River Basin Study	(54,588)	151,358	—	(186,142)	(89,372)
Toxics Studies—EPA	(26,214)	68,926	27,978	(70,690)	—
Estuary Salinity Model	(4,974)	—	—	—	(4,974)
Subtotal Accounts Receivable	(\$162,238)	\$520,647	(\$9,156)	(\$564,352)	(\$215,099)
TOTALS	\$74,715	\$1,001,454	(\$80,544)	(\$935,337)	\$60,288

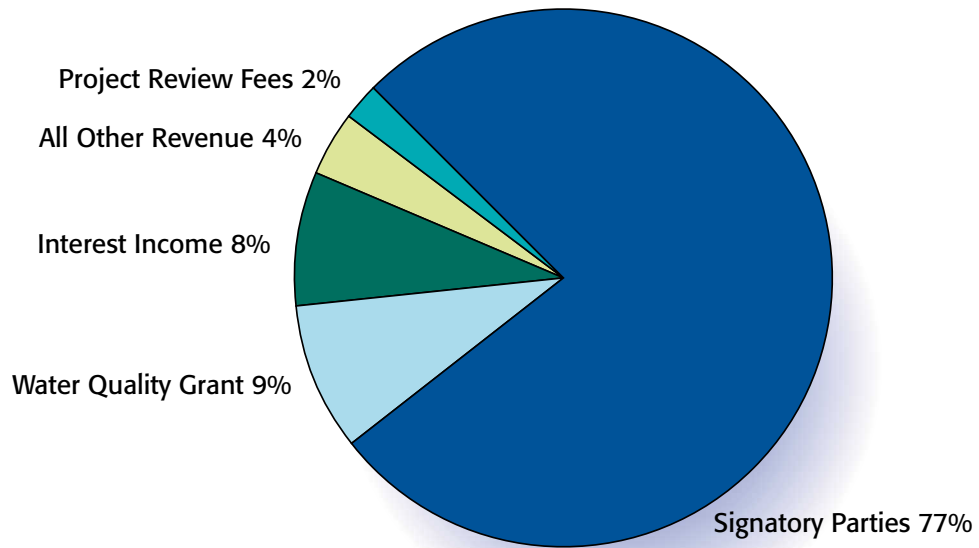
(A) Cash receipts were derived from:

United States Government	\$375,760
Commonwealth of Pennsylvania	416,358
State of New Jersey	25,000
Interest	4,696
Third-party fees for services	179,640
TOTAL	\$1,001,454

(B) Expenditures were primarily for payroll costs and contractual services.

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

DRBC FY98 Revenues



DRBC FY98 Expenses

