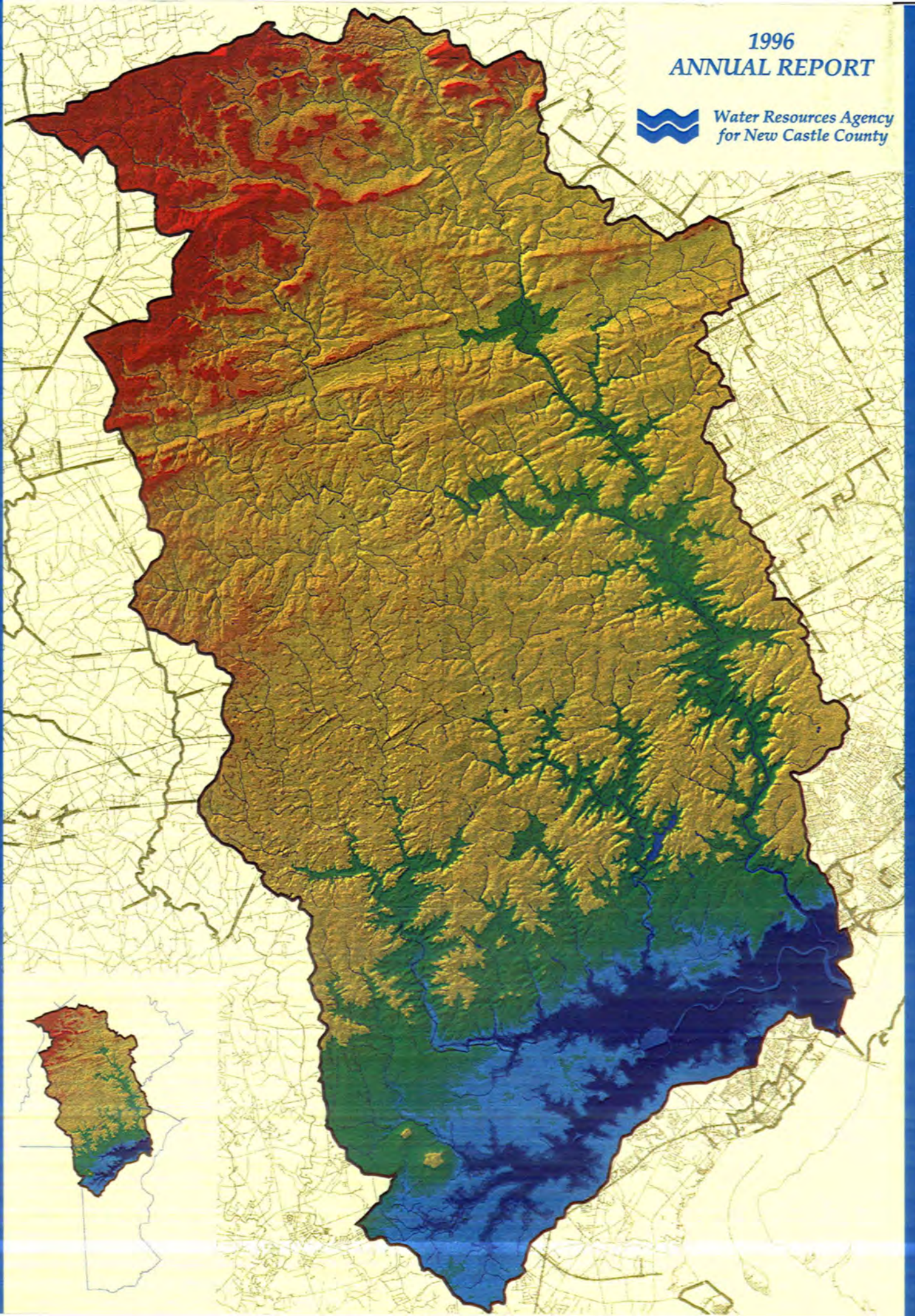


1996
ANNUAL REPORT



Water Resources Agency
for New Castle County



The Water Resources Agency for New Castle County (WRA) is a cooperative program by the City of Newark, the City of Wilmington, New Castle County, and the State of Delaware in water supply planning and management and water quality planning and management. The WRA originated with the establishment of a Water and Sewer Management Office by New Castle County in the late 1960's to address problems encountered with water supply (drainage, flooding, future water supply) and with the formation in 1974 of a Water Quality Management Program by Newark, Wilmington, and New Castle County under the U.S. Environmental Protection Agency auspices. In that year, New Castle County was designated by the Governor as an urban-industrial area confronted with existing and potential water quality problems and in need of an area-wide plan to address them. An inter-jurisdictional agreement signed by the three executives and concurrent resolutions passed by the respective councils established the planning program. Following the development and approval of a water quality plan in 1977, the separate County and regional activities were merged under the direction of a Policy Board for water resources planning and management. By amendment of the agreement in 1990, the State of Delaware was added as a voting member of the Policy Board. A member of the Water Resources Advisory Committee and a representative of the private water utilities serve as non-voting members of the Policy Board.

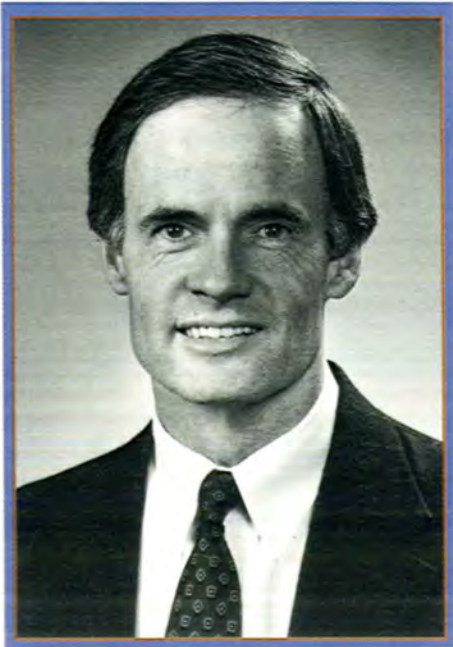
" You cannot step into the same river twice."

----- Heraclitus (500 B.C.)

About The Cover:

It is important to remember that our water resources know no jurisdictional boundaries. The cover displays a topographic representation of the Christina River Basin, the source for about 70% of the freshwater used in New Castle County. Its natural boundaries extend from Pennsylvania to Maryland to Delaware. The map was created using U.S.G.S. DEM files and ESRI ArcInfo Grid and ArcPlot software.

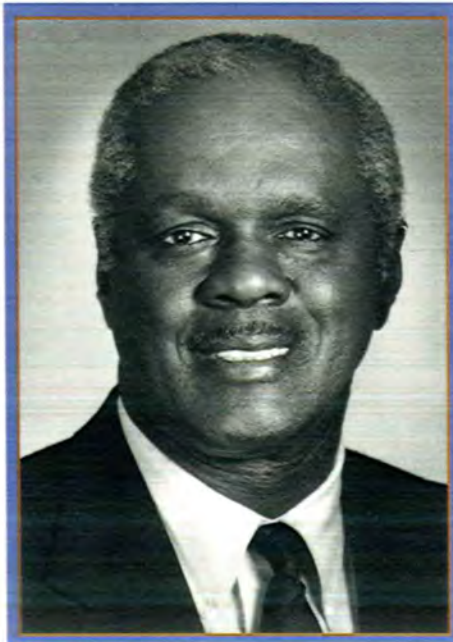
Policy Board



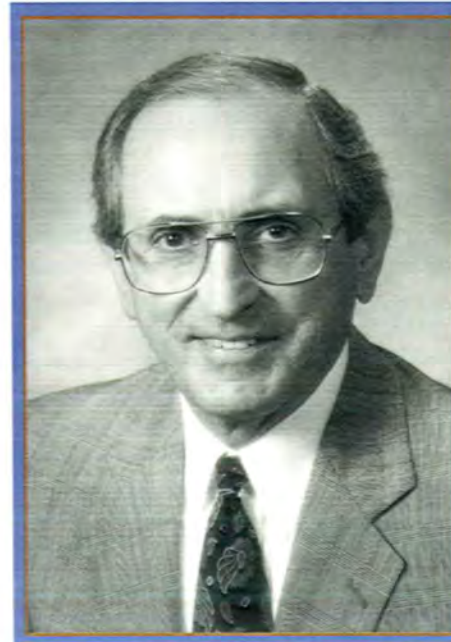
State of Delaware
Governor Thomas Carper



New Castle County
Executive Thomas Gordon



City of Wilmington
Mayor James Sills, Jr.



City of Newark
Mayor Ronald Gardner

Alternates

State

Gerard Esposito

New Castle County

J. Wayne Merritt

Newark

Carl Luft

Wilmington

Kash Srinivasan

Non-Voting Members

Water Resources
Advisory
Committee
Chair

Water Utility
Representative

The Agency is governed by a Policy Board that meets bimonthly and directs all program activities. Voting members are the chief elected officials of the three local governments and the Governor of the State of Delaware or their designees. The Administrator of the WRA serves as the Secretary. Non-voting members include a representative of the water utilities in New Castle County and the chair of the WRA's citizen advisory committee.

A Message from the Administrator...

What a difference a year makes! 1996 was a turnabout year in many respects. It was a year of great contrast from the most obvious of weather - from drought to deluge - to the not-so-readily evident pace of progress in developing a new source of water supply for New Castle County residents and businesses. While our prior year's ANNUAL REPORT's sense of success and achievement was tempered by the torture of a drought and the snail's pace of an Environmental Impact Statement Project, this ANNUAL REPORT is a mixture of good news and better news.

The theme of this ANNUAL REPORT is the regional context of water resources and this Agency. Particularly, the interstate and interjurisdictional character of the work done by WRA. Water issues are ubiquitous and the ability to cross jurisdictional lines unfettered in addressing them in accordance with the natural jurisdiction of watersheds is a strength of the Agency. You will read of collaborative efforts for water quality improvements on the Christina River from bioengineering projects to exchange of data through geographic information systems. From drought response measures to standards on streams serving as drinking water sources in New Castle County, the interstate journey starts in New Castle County and goes from Elkton, to Harrisburg, to Trenton.

It is with the most satisfaction that we also share with you the milestone progress made on the Churchmans, now Thompson Station Reservoir Environmental Impact Statement - the cooperative project by WRA jurisdictions and area water utilities to follow-up on planning completed years ago to develop an additional, reliable, permanent source of water supply for New Castle County. Much credit goes to the State of Delaware, New Castle County, City of Wilmington, City of Newark, Artesian and United Water utilities for staying the course in a sometimes tedious, burdensome and expensive effort. The focus is now on the handful of remaining alternatives from which a difficult but necessary decision must be made.

The ANNUAL REPORT will recap the year's activity, highlight accomplishments, and set the strategy for continuing activity. You will not read of the quiet work being done to work out agreements on the Water Resource Protection Area ordinances, the review of plans and regulations and problem circumstances that are almost a daily pattern in WRA activity. Our philosophy and approach in the ANNUAL REPORT is as with our work - to under promote and overachieve.

Lastly, we want to recognize a change in one of our participating jurisdictions, New Castle County, and welcome Thomas P. Gordon as New Castle County Executive and Policy Board member. We look forward to his leadership and guidance.

"The older I get the better I used to be"

----William D. Keogh

B.L.D.

Water Resources Advisory Committee

The Agency's Water Resources Advisory Committee (WRAC) is comprised of citizens that represent a variety of organizations with an interest in water resources issues. Several of the WRAC members have been actively involved in water-related matters for over twenty years. The WRAC provides public input to the Agency, meeting four times a year in the evening. The 1996 members are: Dorothy Miller, Chair; M. Clayton Burgy; Robert Clemens; Catharine Kallal; Roland Leathrum; D. Preston Lee, Jr.; Jerome Lewis; Kathleen Lord; Glen Schmiesing; Victor Singer; and Christopher Wicks, Jr.



Water Resources Technical Coordinating Committee

The WRA regularly convenes a Technical Coordinating Committee (WRTCC) to exchange information on programs and issues of mutual interest. The WRTCC consists of representatives of the water utilities and local, State, and regional organizations that are involved in water resources management. The following are represented on the WRTCC:

Artesian Water Company
City of Newark
City of Wilmington
Delaware DNREC
Delaware Division of Public Health
Delaware Geological Survey
Delaware River Basin Commission

Natural Resource Conservation Service
New Castle Board of Water and Light
New Castle County Planning Department
Tidewater Utilities, Inc.
Town of Middletown
United Water Delaware
Water Resources Advisory Committee.



Interstate Cooperation - Hands Across the Watershed



Many of the Water Resources Agency's programs are implemented through cooperative relationships with our neighbors. New Castle County is unique in Delaware in that over 70% of our public water supply originates in watersheds of adjoining Pennsylvania and Maryland. Management of the water resources in the tri-state area require communication and collaboration to achieve water supply and water quality goals. In this the fourth annual report of the Water Resources Agency for New Castle County, we salute the people and organizations who make these cooperative relationships possible.

Given that water resources in New Castle County are managed in a regional, interstate context, the WRA participates in a series of working groups, committees, and task forces. The roles of these groups range over the full extent of the hydrologic cycle from drought to floodplain management. Water resources challenges are largely technical in nature, yet solutions are usually provided by people willing to set aside differences, overcome obstacles and solve common water supply and water quality problems.

The committees are usually watershed-based, that is, the watershed provides the common ground to express varying agendas and viewpoints. *Watersheds* know no political boundaries. Watersheds provide the natural boundaries for prudent water supply, wastewater, and stormwater management. These cooperative relationships provide examples of true watershed management in action.

Several of the working groups that provide an opportunity to work together and resolve water resources problems include the:

- Christina Basin Drought Management Committee
- Christina Basin Water Quality Management Committee
- Upper Christina River Interstate Watershed Committee
- Mason-Dixon Task Force
- White Clay Creek Wild and Scenic Project

Christina Basin Drought Management Committee

The Christina Basin Drought Management Committee (CBDMC) is one of the oldest and most enduring working groups. Its mission is to plan for and coordinate the activities of the water utilities during inevitable droughts in the Christina Basin. The Christina Basin provides over 70% of the water supply for New Castle



County, Delaware and 40% of the water supply for Chester County, Pennsylvania. Made up of public agencies and public/investor-owned water utilities in both states, this group meets twice annually and more frequently during drought or low flow periods. The group is chaired in alternating years by the states of Delaware and Pennsylvania. During 1996, Pennsylvania hosted the group at the headquarters of the West Chester Municipal Utilities Authority. The WRA's role with this group is to coordinate the activities of water suppliers and report on the status of hydrologic and water supply/demand conditions in Northern New Castle County.

Among the duties of the Christina Drought Committee are to administer the Drought Management Plan, negotiate water allocation policies, and resolve differences regarding water supply standards between the two states. During 1996, the CBDMC reflected and acted on the lessons of the drought of 1995. Water outages during the drought of 1995 were averted partially by the Committee's ability to mediate disputes and due to the goodwill between the two states to share water supplies. The two states acted after the drought to strike an agreement for Pennsylvania



to provide emergency releases from Marsh Creek Reservoir for capture in Wilmington in the event of future drought emergencies. Through the people and agencies represented on the Christina Basin Drought Management Committee (CBDMC), a complex network of reservoirs, intakes, and water treatment plants are managed to ensure equitable and adequate water supplies during drought and dry periods.

Christina Basin Water Quality Management Committee

At one time, both Delaware and Pennsylvania were reluctant to sit down and resolve their differences over disparate water quality standards. The Delaware River Basin Commission (DRBC) stepped in as a mediator and created the Christina Basin Water Quality Management Committee to address the water quality problems in the Basin. State, federal, and local agencies from Delaware and Pennsylvania were requested to join. The Water Resources Agency for New Castle County and Chester County Conservation District were designated as the local coordinators for Delaware and Pennsylvania, respectively. Now after the first phase of a five year strategy, the Committee has resolved their interstate differences and are working together for the benefit of water quality in the Christina Basin.

*"The people saw results,"
Lisa Senior of the USGS exclaimed.*

The Committee members reviewed some of the results of the program during a bus tour of water quality improvement projects in June 1996. The

Conservation District provided a bus and lunch for the tour. "The people saw results," Lisa Senior of the USGS exclaimed. This effort has resulted in a series of full-scale GIS maps for the Christina Basin along with the installation of four demonstration projects designed to control stormwater pollutants. In future phases, the group members look forward to identifying the sources of pollutants in the Christina Basin and improving the quality of the streams, which are used for drinking water in New Castle County. All agree that the Christina Basin group is a prime example of multiple agencies and groups coming together to set aside their differences and resolve common water quality problems.

Upper Christina River Interstate Watershed Committee

To address flooding and erosion problems along the Upper Christina River, the City of Newark requested that the Water Resources Agency establish an Interstate Watershed Committee consisting of local residents and water resource professionals. The WRA invited public and private groups from Maryland, Delaware and Pennsylvania to participate. Now over three years old, the Interstate Group meets two to three times a year at rotating sites within each of the three states. Every year the group meets at a local watering hole to review the status of the program and have lunch together. The group discusses, in a cooperative manner, the development patterns and watershed programs that affect flooding and erosion along the river. Since forming the group, several projects have



been implemented such as a stream restoration project, tightening up stormwater regulations, and removing debris and sediment from the river. The group provides an atmosphere that supports public review and comment by interested citizens. Partially through the Interstate Watershed Committee's efforts, the group has observed over the past three years that the frequency of flooding has not increased but has seemed to level off.

Mason-Dixon Task Force

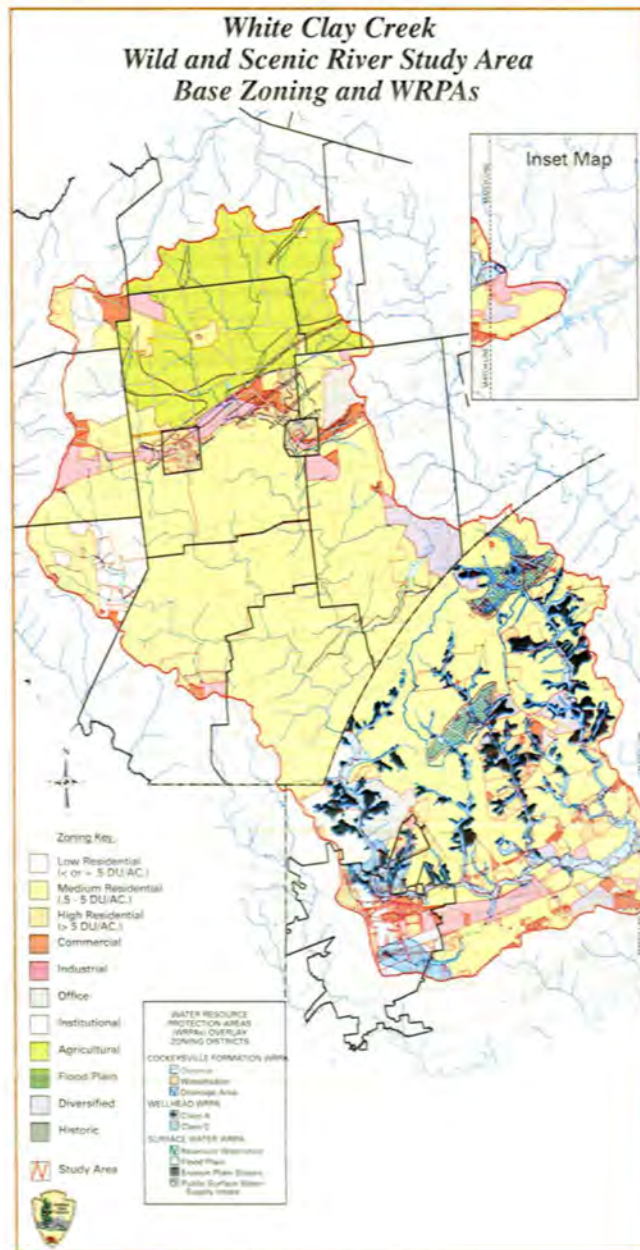
The oldest of the groups is the Mason-Dixon Task Force. Formed 31 years ago during discussions to transport water from the Susquehanna River along the Mason-Dixon line to Delaware, the Task Force thrives today as a

conduit for cooperation among counties in Pennsylvania, Maryland, and Delaware. Among the highlights of the Mason-Dixon Task Force are the annual forums to discuss common water resources interests. In 1996, a forum was hosted by Lancaster County focusing on growth and its impact on water resources. Following a workshop session, the group was treated to a first hand look at local water resource features on the steam-driven Strasburg Railroad. Staff from the WRA serve on the board of the Task Force. The Task Force is a group willing to provide ideas for sound water resources planning and management for governments on both sides of the Mason-Dixon Line.

White Clay Creek Wild and Scenic Project

The Water Resources Agency participates on a Management Committee set up by the U.S. National Park Service to evaluate the White Clay Creek for Wild and Scenic Status. The White Clay Creek is situated in Chester County, Pennsylvania and New Castle County, Delaware and includes 13 townships and five municipalities within its watershed boundaries. The purpose of the group is to study the White Clay Creek for possible protected status as a federally designated Wild and Scenic waters. Most of the committee members agree that certain segments of the White Clay Creek are appropriate for Wild and Scenic status. The Wild and Scenic program provides a forum for debate, particularly concerning potential conflicting uses of the water resource.

In New Castle County, water resources programs are accomplished largely through peer review and debate between interests that represent federal, state, county, and local jurisdictions. Through its unique composition as a multi-jurisdictional, and regional water supply and water quality management agency, the Water Resources Agency is able to provide unfettered technical analysis and policy review of complex water resources issues in New Castle County. The interstate and local relationships provide a way to recognize opinions and resolve conflicts, and provide sound water resources planning and management in this, the most populous county in Delaware.



EIS Focuses on Field Studies - Options Narrow

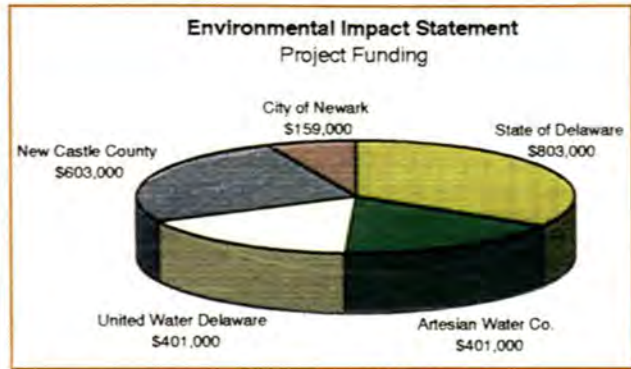
The Water Resources Agency has continually insisted that New Castle County needs additional water supply to improve the reliability of the currently developed sources. This belief originated during the 1980's when the WRA developed the WATER 2000 PLAN. WATER 2000 was a multi-year planning effort designed to serve as the foundation for water management activities in NCC. The PLAN was adopted at the local, State, and regional levels of government contingent upon the preparation of an Environmental Impact Statement for one of the primary recommendations of the PLAN, the development of a new reservoir in New Castle County.

The last time a reservoir was built in this County was 1932 when the City of Wilmington constructed the Hoopes Reservoir. Hoopes was built by Wilmington to provide it with a reliable source of water when the Brandywine Creek experienced natural or man-made problems. Reliance on Hoopes has increased through the years to the point where in 1995 during the drought Wilmington officials had to remind the other water suppliers that Hoopes was built for Wilmington's water needs, not New Castle County's.



The Project Management Committee tours the Thompson Station Reservoir Site.

Today, the development of a reservoir requires extensive studies to prove to the federal and state regulatory agencies that the project is needed and that it is the most practical and feasible action to meeting the need. This work is organized in a



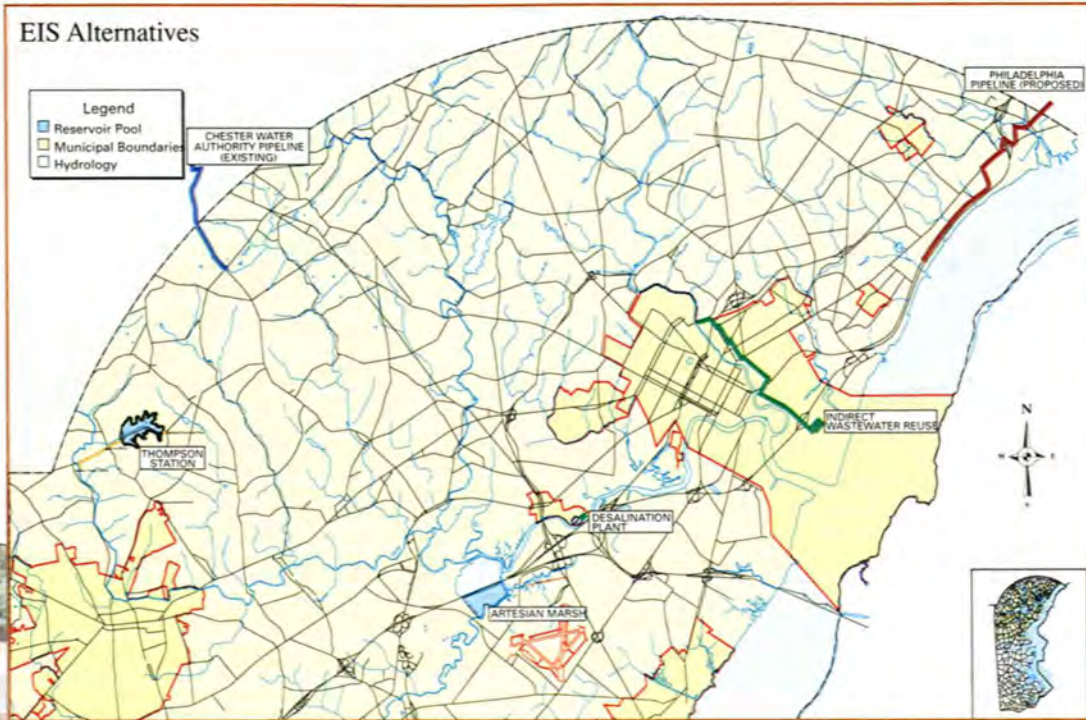
format known as an Environmental Impact Statement (EIS).

The EIS is a process mandated by Congress and directed by the U.S. Army Corps of Engineers. An EIS is required when the Corps determines that a proposed project would have significant environmental impacts. The EIS examines the need for and the alternatives to a project under the guidance of the Corps and its allied federal agencies. The WRA initiated the EIS process in 1988 by filing for the permits necessary to build the preferred alternative for future water supply resulting from the WATER 2000 PLAN, a two billion gallon reservoir at an area known as Churchmans Marsh.

To conduct the EIS, a Project Management Committee was formed and funding for the effort was assembled. In 1990, the PMC selected the consulting firm Metcalf & Eddy, Inc. to document the water needs of NCC to the year 2040 and to assess a listing of alternatives to meet this need. It took more than three years to reach unanimous agreement on the future water needs of NCC, which were then accepted by the Corps in October 1993.

Since then, the alternatives assessment task has been underway. The initial listing contained over seventy alternatives ranging from icebergs to pipelines to about a dozen potential reservoir locations. The consultant employed a variety of assessment methodolo-

EIS Alternatives



gies to determine which alternatives could actually be developed that would meet the projected needs using existing technology. As reported in our annual report for last year, 1995 ended with the listing reduced to 19 alternatives.

1996 was a very significant and productive year for the Environmental Impact Statement. During 1996, the EIS Project Management Com-

The year began with eight potential reservoir sites, an unwieldy number for funding site specific studies. Many of these sites had issues associated with them that would prevent them from ever being developed. These issues were researched and presented to the Corps and its allied agencies in several documents. This work resulted in the removal of five of these sites, leaving three potential reservoir sites to subject to field work. The three sites were Churchmans Marsh, Artesian Marsh, and Thompson Station.

Beginning in the Spring, these areas were intensely studied by a team of experts led by Metcalf & Eddy personnel. Field work included surveys for fish, birds, reptiles, amphibians, and mammals. In addition, sediments in the marshes and at potential water intake locations were collected and analyzed by the Delaware DNREC's labs. Water quality samples were also collected and analyzed. And, detailed maps were developed to quantify the existing wetland and upland cover conditions.

This work was organized and presented in a series of reports and technical memorandums. Additionally, preliminary cost estimates for all of the remaining alternatives were assembled. With this information, the EIS-PMC met in November and requested that the Corps, along with its allied agencies and the State, provide the PMC with an indication of the likelihood that the federal and State permits



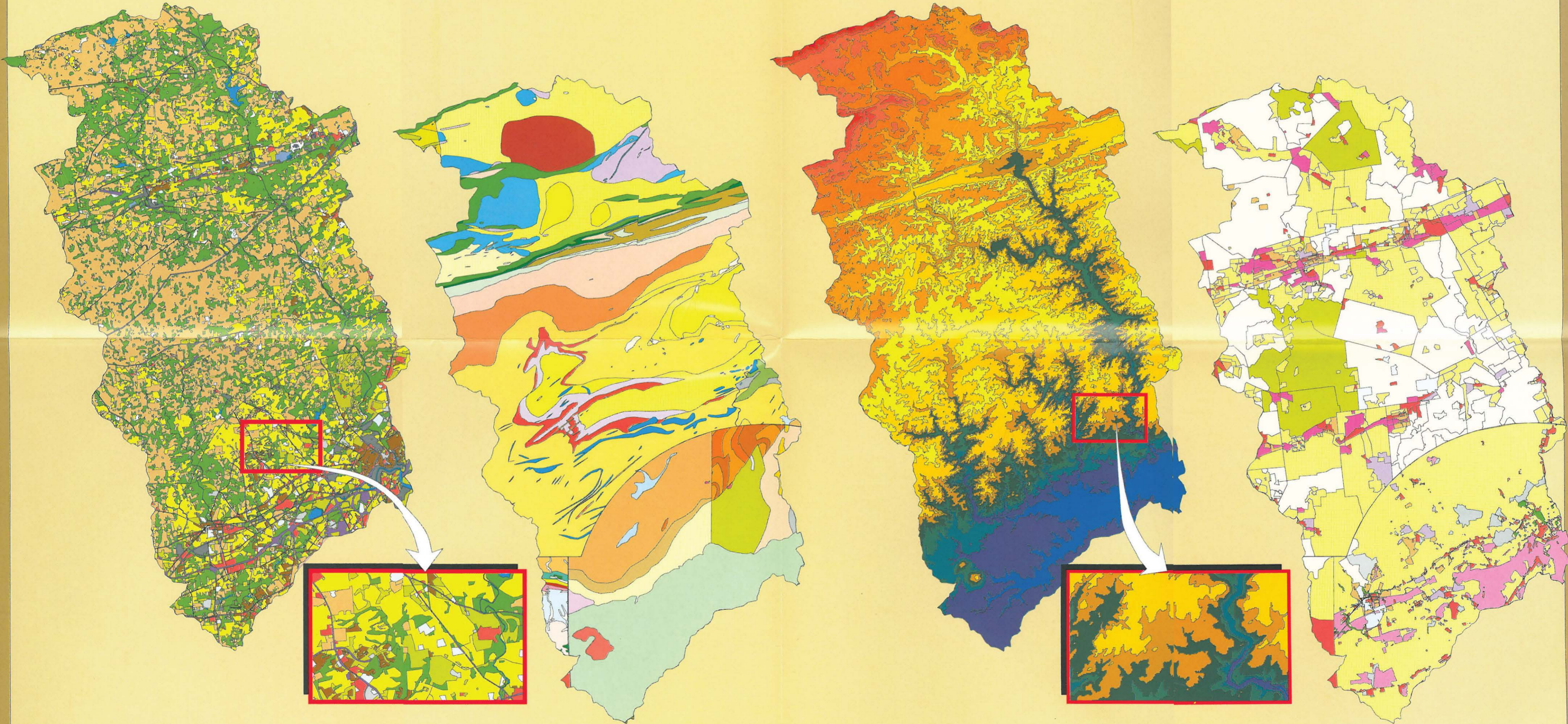
At the Artesian Marsh Reservoir Site, the field teams encountered a variety of species.

mittee authorized an extensive amount of work totaling about \$1.1 million. All of these funds were spent developing new information on the alternatives remaining as potential solutions to our water supply needs.



Christina River Basin NPS Strategy Plan

FOR NEW CASTLE COUNTY, DELAWARE, CECIL COUNTY, MARYLAND, AND CHESTER COUNTY, PENNSYLVANIA



Land Use

Land use is an important indicator of the health of watersheds and streams. Note that the state and county lines are de-emphasized on the map since watersheds know no jurisdictional boundaries.

Geology

Geology helps predict the impact of human activity on groundwater quality. Until recently, the three states in the Christina Basin mapped geologic layers according to different standards, thus the different colors on the map.

Topography

Topographic maps are used to predict the rate and flow of stormwater runoff, an indicator of pollutant loads entering waterways. Here, elevation rises from sea level in the southeast (blue) to over 1000 feet in the northwest (red), the Appalachian foothills.

Zoning

Zoning provides an indication of future land use and impacts on water quality. Industrial and commercial zoning (pink and red) usually produce higher pollutant loads than does low density residential zoning (yellow).

necessary for the application project, a reservoir at Churchmans Marsh, would be issued. Using the guidelines with which the Corps assesses permit applications involving wetlands, it was concluded that it was unlikely that a permit would be issued by either the State or the Corps for developing a reservoir at Churchmans Marsh.

Consequently, the EIS-PMC unanimously decided to eliminate Churchmans Marsh as the Corps and State permit application project. The permits were revised to name the secondary alternative on the application, a reservoir at Thompson Station, as the application project. As 1996 ended, work to assess the existing habitat, cultural resources, social-economic impacts, and geologic conditions at Thompson Station were being initiated.

In addition to the Thompson Station alternative, the five other remaining alternatives are being assessed. The alternatives include the Artesian Marsh Reservoir, a Pipeline from the City of Philadelphia, an existing Pipeline with the Chester Water Authority, the Desalination of Brackish Surface Water, and Indirect Wastewater Reuse involving the pumping of treated effluent to a discharge point upstream of the City of Wilmington's Brandywine intake.

The EIS-PMC also contracted with a consulting firm to study institutional and fiscal options for developing, operating, and funding the remaining alternatives. Included in this study are options for public entities, private entities, or a combination of the two. This work will be critical to building the water supply alternative resulting from the EIS work.

To date, over \$2 million has been spent on the EIS since it began in 1990. All of the materials developed to date are available for review at several New Castle County libraries and at the Water Resources Agency. Public meetings continue to be held to inform the public of the progress of this work and all of the technical and policy meetings have been open to the public.

If all goes according to schedule, a Draft EIS document should be released by mid-1997. After the federally mandated review period, the Final EIS document will be released and will form the basis of the Record of Decision by the Corps on the permit application.

— Martin W. Wollaston



Comments on the EIS were offered by many of the 180 people attending the April 1996 Corps Scoping meeting.

"Till taught by pain, Men really know not what good water's worth."

— Byron

Water, Water, Everywhere

When it came to predicting the weather, Benjamin Franklin advocated "persistence forecasting." What's involved in this sophisticated-sounding technique? Well, if you predict that tomorrow's weather will be just like today's, you've just used "persistence forecasting." Unbelievably simple yet surprisingly accurate on a daily basis, this prediction tool can fall well short when used on an annual basis. The past two years in Delaware are proof of that! Delaware receives an average of 41 inches of precipitation a year, as measured at the Wilmington weather station. Yet records for the 1995 and 1996 water years (October 1 - September 30) couldn't be more different. Precipitation during water year 95 (WY95) totalled only 31 inches, a ten-inch deficit and one of the lowest yearly tallies on record. Dubbed the "Year of the Drought", ten out of twelve months received below-average rainfall. Almost seven inches of the deficit occurred during June, July, and August, one of the hottest summers on record. Then it started to rain, and it seemed as if it would never stop. Precipitation for WY96 totalled 51 inches, a full ten inches above normal. Eight of twelve months received above-normal rainfalls and almost 5 inches of the surplus fell during those same summer months. What will next year's weather bring? Don't ask me - or Ben.

— Deborah M. Mills



Christina Basin Water Quality Management Strategy

Over the last year the Water Resources Agency completed work on Phase I of the Christina Basin Water Quality Management Strategy. In September 1995, the WRA received a grant from the Delaware DNREC and the U.S. Environmental Protection Agency to conduct Phase I of the Christina Basin Non-Point Source Management Strategy. The objective of the five year program is to identify sources

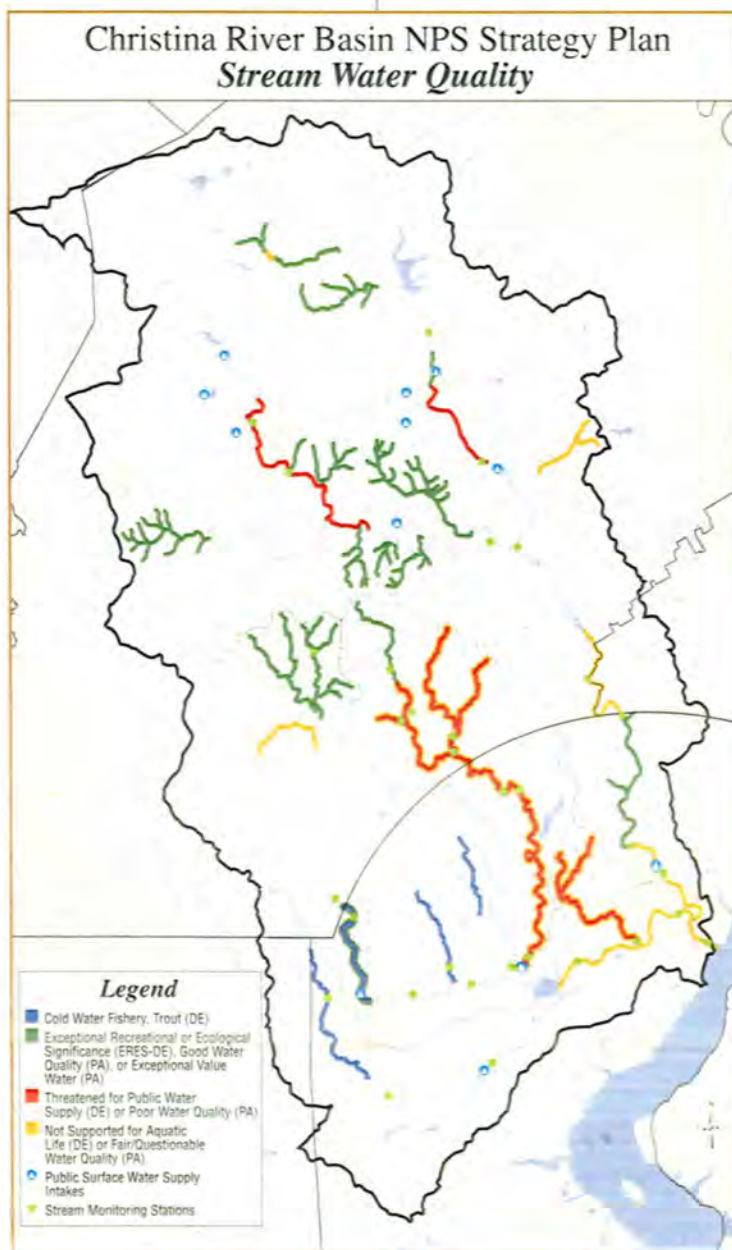
of non-point pollutants, assess existing water quality, prioritize subwatersheds for stormwater monitoring, and implement best management practices to reduce pollutants entering streams.

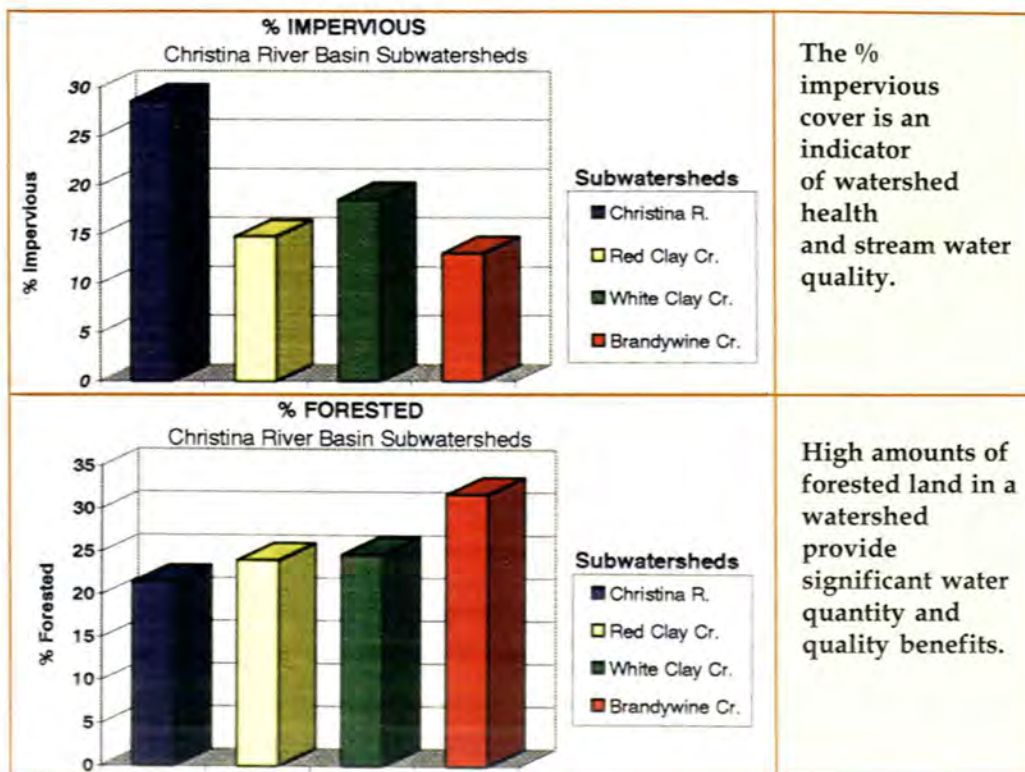
The 565-square mile Christina Basin contains four major subwatersheds - the Brandywine, Red Clay, and White Clay Creeks, and the Christina River. The majority of the watershed

is in the rolling hills of the Piedmont province. Surface water uses include water supply, recreation, fish and aquatic life, wildlife, and exceptional value designations in both states. The Christina water quality strategy is part of a multi-agency, watershed-based program designed to improve the quality of Christina Basin waters that provide 70% of the drinking water for New Castle County residents and businesses and 40% of the water supply for Chester County. Water quality problems include high levels of sediment, bacteria, nutrients, metals, and organics. Nonpoint pollutants are thought to come from construction, development, septic systems, erosion, agriculture, and industrial-commercial uses.

The Christina Basin includes parts of Pennsylvania, Delaware, and Maryland. Based on long-standing disagreements between Delaware and Pennsylvania on some of the water standards in the watershed, the Delaware River Basin Commission (DRBC) recommended establishing a committee of the two states and local agencies to manage the Christina Basin Water Quality Management Program. The committee includes DNREC, the Pennsylvania DEP, the Chester and New Castle Conservation Districts, the Chester County Water Resources Authority, U.S. Geological Survey, USEPA, U.S. Soil Conservation Service, and the DRBC.

The Water Resources Agency is serving as local coordinator for the Delaware portion of the basin and the Chester County Conservation District is serving as the coordinator for Pennsylvania. To date, the WRA has compiled a watershed inventory of a





The % impervious cover is an indicator of watershed health and stream water quality.

High amounts of forested land in a watershed provide significant water quantity and quality benefits.

dozen maps on the Agency's AERI II Geographic Information System (GIS) that depict geology, soils, land use, zoning, and other water quality data. Using the maps, the WRA has computed pollutant loads and percent impervious data that will be used to prioritize watersheds for clean-up implementation activities. Water quality assessment maps, prepared as part of the watershed inventory, indicate that many stream segments are stressed from pollution designated by fish consumption advisories. The attached fold-out provides excerpts of the WRA's mapping prepared for the watershed inventory.

The WRA has also assisted the City of Newark with the installation of a demonstration stream bioengineering project along the Upper Christina River in Rittenhouse Park. In Chester County, the program has funded a storm sewer stenciling program and water quality protection projects at a mushroom farm, a dairy farm, a reforestation effort, and an innovative stormwater recharge project at a new municipal building.

The WRA was recently awarded a second grant from the Pennsylvania DEP to assist with Phase II of the water quality strategy that includes a stormwater monitoring and watershed modeling effort to be conducted by the USGS, DNREC and PADEP. The stormwater monitoring effort will characterize the stormwater pollutant loads entering the streams. Once the water quality of stormwater is known, a computer model that houses stormwater loadings will be used to

evaluate the total impact of point and nonpoint pollutants on the streams and waterways of the Christina Basin.

The Christina Basin Water Quality Management Program has provided several benefits. High schools, civic associations, and environmental organizations are using the watershed maps for water quality education programs. Residents



of New Castle County utilize the maps to further understand the impact of contamination on their water supplies. Public and investor-owned utilities can identify contamination sources to protect the quality of water supplies and comply with the Safe Drinking Water Act. Overall, these beneficial results point toward the need to continue this effort to protect the quality of Christina Basin streams, which ultimately provide drinking water for New Castle County residents and businesses.

—Gerald J. Kauffman

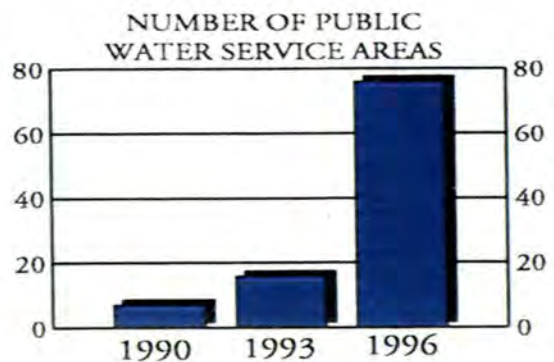
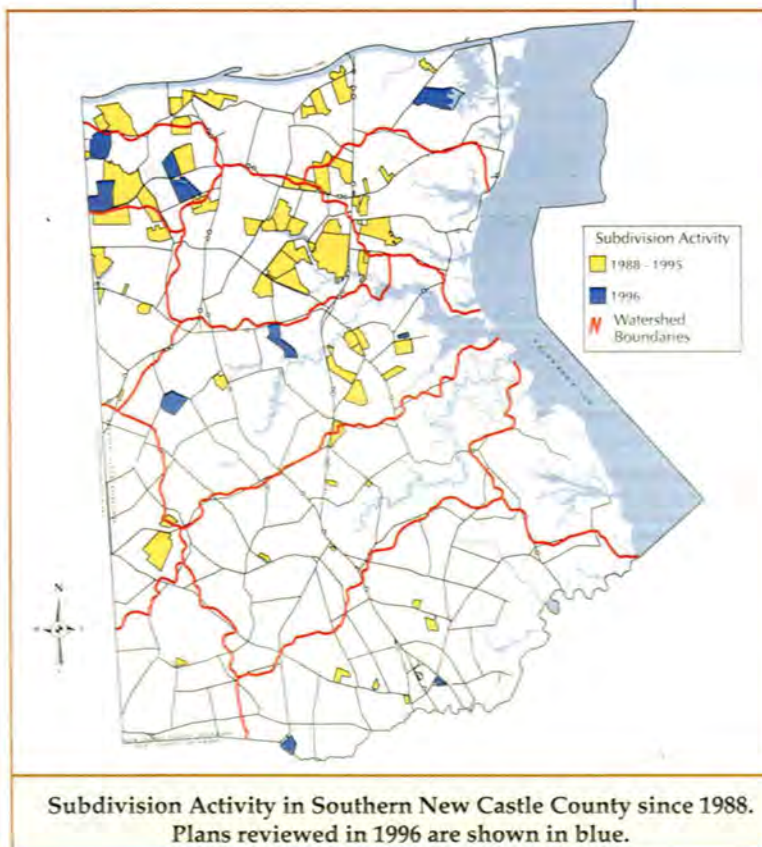


New Developments in Southern New Castle County

Land use activity in Southern New Castle County continued to be an important planning issue for the Water Resources Agency this year. Since the early 1990s, the pace of development has held steady in Southern New Castle County. Since 1994, plans to convert an average of 1000 acres of farmland to residential communities have been reviewed by the County annually. In 1996, the WRA reviewed development plans covering over 1400 acres south of the Chesapeake & Delaware Canal. The map below shows the locations of all plans submitted since 1988, with 1996 plans highlighted in blue.

The nature of these developments has a significant impact on water resources planning. Until the late 1980's, most communities built outside the communities of Middletown, Odessa, and Townsend consisted of a small number of homes. For water, homeowners relied on individual wells drilled 20 to 30 feet into the shallow aquifer. Today, however, a typical subdivision in Southern New Castle County occupies about 140 acres and has 70 single-family houses on lots ranging from one to two acres.

Water purveyors supply water to these large developments through centralized, community



water systems. A single well, drilled hundreds of feet and pumping groundwater from deep aquifers, serves an entire subdivision. This change in water supply and demand from individual to community wells focuses attention on the special needs of Southern New Castle County. Since groundwater is the sole source of drinking water south of the C&D Canal, it is critical for us to understand its distribution.

In 1994, as part of a long-range planning effort, the WRA initiated a multi-year project in cooperation with the New Castle County Department of Public Works and the Delaware Geological Survey (DGS). The goals of the project are to refine

previous estimates of groundwater quality and quantity in Southern New Castle County and to establish a permanent groundwater monitoring network in this region. Results of the project will provide thorough baseline information regarding water resources. In addition, establishing an ongoing monitoring network will help us understand the effect of changing land use on the quantity and quality of groundwater. Phase I: Data Collection Analysis was completed in 1995. Existing water quality data were collected and analyzed from more than 200 wells, providing an assessment of groundwater quality.

In 1996, Phase II: Groundwater Availability was completed. Through extensive aquifer testing and computerized groundwater modeling techniques, the DGS accomplished several objectives. A better understanding of the nature and extent of the underlying aquifers was gained. Maps and

cross-sections, based on the most recent scientific data, depict the aquifers in three dimensions. But most importantly, estimates of groundwater availability are provided for each of the five aquifers and 11 watersheds in Southern New Castle County. Knowing where water is available is as valuable as knowing how much water is available. This spatial information is an important planning tool when considering future development in Southern New Castle County.

The estimates reveal that there are approximately 20 million gallons a day (mgd) of groundwater available from high-production wells in the deep aquifers. About one-half of that amount is available in the area between the C&D Canal and Townsend. Currently, an average of 7 mgd of groundwater are used. Irrigation for agricultural uses accounts for almost 5 mgd of that total. Projections indicate that while agricultural demands will remain relatively stable, average daily demands will be about 12 mgd by the year 2040.

Data are now available on locations, depths, and size of all community wells in Southern New Castle County. In addition, all land development activity is tracked on a map prepared in conjunction with the New Castle County Department of Planning. Using the well inventory with this map, the WRA has improved its ability to monitor water resources. The WRA also continues to map water franchising activity to anticipate the location of future development. When development of a parcel of land is planned, a water supplier is chosen. The supplier applies to DNREC for a Certificate of Public Convenience and Necessity (CPCN), which grants the exclusive right to serve that parcel. In essence, a map of CPCN locations is a snapshot of potential, future development.

Based on parcel boundaries two adjacent communities can, and often do, have two different water suppliers along with a complex infrastructure. The total number of CPCNs has grown dramatically over the last 6 years (see graph of



In 1996, the DGS also completed Phase III: Design, Development and Implementation of a Groundwater Monitoring Network. More than 60 wells were chosen from a possible 200 wells for inclusion into the monitoring network. The DGS also drilled 14 new wells into the shallow aquifer where data are scarce or where development is projected. All wells in the shallow aquifer will be tested every quarter for several indicators of water quality, including chlorides, nitrates, and iron. Once a year, all wells will be tested for approximately 25 components. One complete round of sampling was completed late in 1996 and a report is expected in early 1997.

Armed with this new information, the WRA will update Volume VIII of the WATER 2000 PLAN in 1997. This volume outlines water supplies and demand in Southern New Castle County. An inventory of community public water supply wells was compiled this year with cooperation by the water purveyors, the DGS, DNREC and the State Office of Drinking Water.

number of service areas). In 1996 alone, approximately 20 new CPCNs were granted.

As development continues and the demand for water increases, it is critical to establish an efficient infrastructure. The WRA has suggested the resource could be more effectively managed if regional service areas were based on watershed boundaries, not on parcel boundaries. A second recommendation is to lift the County's moratorium on spray irrigation as a wastewater strategy. This action will provide a much-needed alternative to the proliferation of septic systems, which have the potential of contaminating the groundwater.

By all accounts, 1996 was an active year for water resources management and planning in Southern New Castle County. Still relatively undeveloped compared to the rest of the County, there is an opportunity to "do the right thing" for water. No doubt, 1997 will prove to be just as challenging!

—Deborah M. Mills



Connecting with WRA

During 1996, the Water Resources Agency's AERIGeographic Information System (GIS) continued to evolve as a tool for analyzing and displaying data and as a repository of spatial data. AERI is a combination of computer hardware and software designed specifically for manipulating and analyzing spatial data. Its components include a SUN Microsystems SPARC 10 workstation with six gigabytes of disk storage capacity, three plotters, a digitizer and a scanner. The SUN functions as a network server for four peripheral PCs. The GIS software application running on the SUN is ARC/INFO while ArcView runs on the PCs.

A new hardware addition this past year was a Hewlett Packard 750C large format inkjet plotter. This is a state-of-the-art device with significant advantages to the older Calcomp Electrostatic plotter.

The HP is much easier to operate, cleaner, more reliable, and more efficient.

The Agency also purchased two new PC workstations. While offering the usual word processing and database software, these PCs will also run ArcView, a desktop GIS. Presently, we create many hardcopy maps with ArcInfo, but to view, edit and analyze the data behind these maps requires significant ArcInfo experience. With ArcView, however, a user with little ArcInfo expertise can view the data and maps created in ArcInfo. While ArcView does require some training, the learning curve is quite short, and users may quickly begin to query, analyze and map available geographic data. These products, ArcInfo and ArcView, will be used together to provide geographic information to decision makers.

In the effort to stay current, a number of software upgrades were made during 1996. ARC/INFO on the SUN station was upgraded and ArcView was upgraded on the PCs. Also, new versions of eXceed X-Window emulation software were installed on two PCs to enable them to use ARC/INFO on the SUN.

Projects

These technological tools were applied to more than 40 projects during the year. One major effort was directed to the first phase of the Christina Basin Non-

Point Source Management Strategy, a cooperative effort between agencies in the State of Delaware and the State of Pennsylvania. This project entailed huge data collection and subsequent mapping efforts. To complete the first phase required the preparation of thirteen separate basin maps.

Other major projects reached various stages of completion. To support the designation of the White Clay Creek Basin as a Wild and Scenic Area, additional refinements were made to maps originally prepared during 1995. As a result of the drought that occurred in 1995, the WRA created a map depicting a drought management plan for the Christina Basin. The endeavor to develop and map data required for compliance with the National Pollutant Discharge Elimination System regulations culminated this past year. Using data provided by consultants, we used our GIS to update locations of major outfalls in the County and provided acreage summaries of land use for major watersheds in the County.

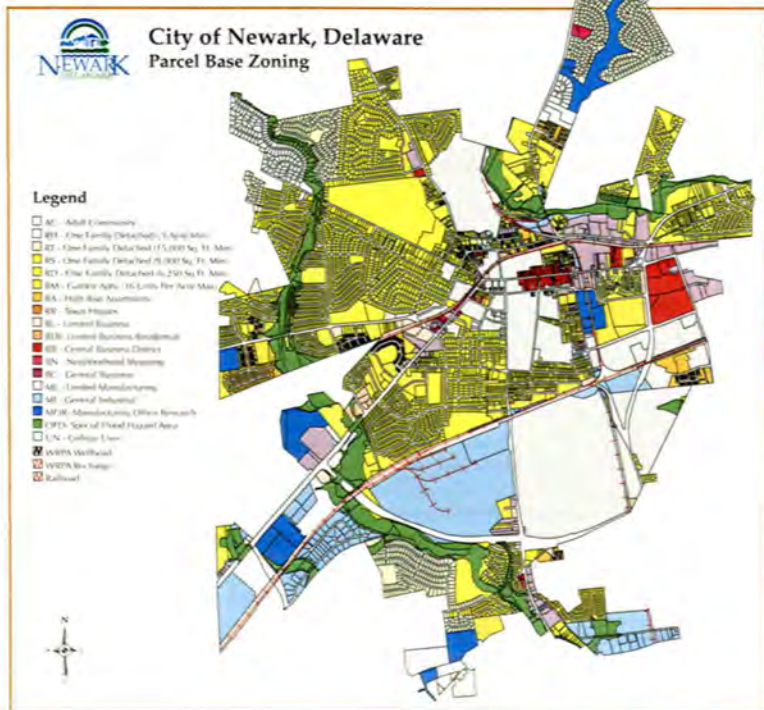
Newer projects required that we supply ARC/INFO formatted data and several maps to Metcalf and Eddy, the consultants preparing the environmental impact studies of options for future water supplies for New Castle County. Because of flooding problems, and at the request of State legislators, we began to create a land use map of both the Delaware and Pennsylvania portions of the Naamans Creek basin. For the City of Newark, we responded to its request to create a City map showing both property parcels and zoning at a scale of 1:2400. At this scale, the map will cover two walls in the City's Municipal Building.

Projects with a lower profile were also completed during 1996. We have integrated data



Map of land use in the Naamans Creek basin. This map is one tool that will be used by citizens and legislators in the analysis of basinwide flooding problems.





Research Center, Wik Associates of Delaware, Burns & McDonnell of Kansas City, Missouri, Vanasse, Hangen, Brustlin of Watertown, Massachusetts, and the Earth Satellite Corporation of Rockville, Maryland.

As more and more agencies start to use GIS, we have begun to share data. This past year, we exchanged data with the staff of the state DNREC Piedmont Project, with the DNREC Department of Parks and Recreation and with the DNREC Wetlands section. Also providing us with data were the Chester County, Pennsylvania, Planning Commission, the Delaware Valley Regional Planning Commission, and Region 3 of the Environmental Protection Agency.

Education

On a closing note, a less publicized function that the WRA performs is that of granting internships and providing part-time work for students interested in careers in geographic information systems, engineering, and planning. We receive assistance on less-sophisticated aspects of ArcInfo projects, while they gain the hands-on GIS experience employers seek. During the recent past, we have had interns accept employment with the University of Delaware; the State Department of Natural Resources and Environmental Control; Roy F. Weston (a consulting firm in West Chester); Lockheed-Martin in Washington, DC; and Environmental Systems Research Institute in Redlands, California. The downside for us, of course, is that the more valuable they

become to us, the closer they are to departing. During 1996, we had two interns. One left for full-time employment, and the other, a senior at the University of Delaware, will be with us at least through May. We hope to bring on a new intern early in 1997 to start the cycle again.



— Vern C. Svatos

created with the CYBERNET water supply model in AutoCad with parcel and elevation data created in ARCINFO and then mapped this composite. This is the first step in analyzing water supply and flow rates for the suppliers. The City of Newark water system was selected as the pilot study area for this work. For the Delaware River Basin Commission, we created a demonstration project using ArcView to show how the software can be used in water resource planning. Using data provided by the DNREC, we created for its Division of Soil and Water, an ARCINFO point coverage of sites where Best Management Practices for pollution control have been instituted.

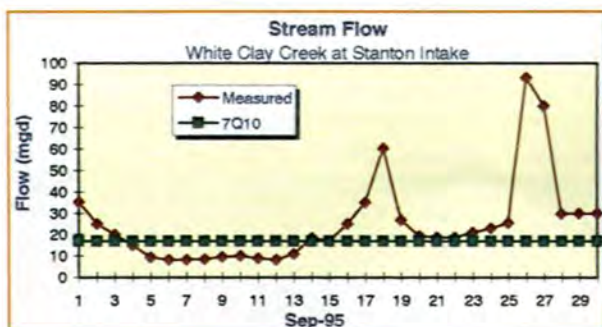
The Data Exchange

Requests for data created by the Agency or gathered by WRA continued to be addressed. Those wanting data included small citizen groups, local and regional public agencies, and local and national consultants. Among those we served were the White Clay Watershed Association, the Council of Civic Organizations of Brandywine Hundred, the Brandywine Valley Association, the Environmental Protection Agency, various divisions of the State Department of Natural Resources and Environmental Control, the New Castle County Department of Planning, the New Castle County Executive Office, the New Castle County Council, the University of Delaware Department of Agricultural Engineering, the University of Delaware Research Data Management Services, West Chester University, the Stroud Water



In-Stream Flow Study: Balancing Habitat and Supply Needs

During 1996 the WRA provided technical assistance to a Joint Task Force charged with identifying the minimum in-stream flows necessary for water supply and aquatic habitat protection purposes in New Castle County. The streams of the Christina River Basin provide flow for often conflicting uses - water supply, recreation, fish, and wildlife. During the hot dry periods of summer and early fall when flows are usually low, the streams in the Christina Basin commonly provide insufficient water for both water supply and habitat protection purposes. These streams include the Brandywine, Red Clay and White Clay Creeks, and the Christina River. The mission of the Joint Task Force set up by the Delaware DNREC was to determine the minimum stream flows necessary to protect habitat while providing sufficient flow for water supply purposes.



The Water Resources Agency supported the Joint Task Force by providing hydraulic modeling, water quality analyses, and GIS mapping assistance. Computer models were developed to ascertain stream flow, depth, and velocity during the various low flow periods of the drought of 1995. The professionals in the group determined the minimum flow levels desired by the fishery. Water quality measurements such as temperature, chlorides, bacteria, and dissolved oxygen were taken to determine the effects of low stream flows on fish and wildlife habitat. During the drought of 1995, along the tidal White Clay Creek, the Task Force determined that the chloride and the sodium levels were appreciably above the Delaware Drinking Water Standards when the stream flows declined below a level likely to occur for seven days in a row every 10 years (7Q10).

The results of the instream flow analysis were compiled in a report, which will be issued in early 1997. The Joint Task Force concluded that the 7Q10 flow is adequate to protect fishery and wildlife habitat while maintaining adequate water supply uses. The 7Q10 provides protection to the survivability of the fish species that are commonly stressed during droughts and low stream periods. Recommendations from the 7Q10 Instream Flow Needs report will be considered through reauthorization of the water supply allocations and dockets for the public and investor owned water suppliers. The report concludes that minimum stream flows could be maintained by developing an operating plan for Hoopes Reservoir and the Christina River Basin. Furthermore, the Joint Task Force stressed that the development of additional water supply storage is needed to provide sufficient stream flow for all uses including water supply and aquatic habitat.

—Gerald J. Kauffman



Urban Watershed Management

Watersheds form the natural boundaries for water resources management. Water officials are adopting watershed management efforts such as the ones advocated by the U.S. EPA Safe Drinking Water Act and the DNREC Whole Basin Program to address water problems. Citing this approach, residents and elected officials invited the WRA to initiate a watershed program toward resolving stormwater and flooding problems in the Shellpot Creek and Naamans Creek watersheds.

The Shellpot Creek and Naamans Creek watersheds drain 24 square miles in the mature suburban neighborhoods of the Brandywine Hundred of New Castle County. Flooding results from the combination of dense land uses, steep topography, and poorly drained soils. Flooding problems are compounded by development that occurred before the advent of stormwater regulations in the 1970's.

The WRA compiled a series of Shellpot Creek and Naamans Creek maps to advance the watershed program. The maps include watershed boundaries, land use, floodplain, open space, and wetlands. The maps will be used to prepare an overall watershed management plan and identify existing flooding problems and solutions. Resolutions to the problems could include acquisition of open space, retrofitting stormwater facilities, greenways, and replacing drainage culverts. Utilizing these techniques, the WRA hopes to assist with a watershed program to resolve stormwater problems in two of the more floodprone watersheds of New Castle County.

White Clay Creek Wild and Scenic

The WRA continued its cooperative effort on the White Clay Creek Wild and Scenic Study this year. The purpose of the study, headed by the National Park Service, is to evaluate the White Clay Creek watershed for possible inclusion into the National Wild and Scenic Rivers System (NWSRS). The U.S. Congress established the NWSRS to protect streams with outstanding natural, recreational, and cultural features.

WRA has been involved since the study's inception in 1991, serving on the Study Task Force and chairing the Water Resources Subcommittee. In 1996, after numerous meetings with other study participants, the WRA produced a draft "Recommended Designated Areas" map. This map is a composite of several natural resource features, previously mapped separately. These features include watershed hydrology, wetlands, floodplains, woodlands, zoning, land use, and parklands.

Also during 1996, members of a Land Use Committee drafted a Watershed Management Plan for the White Clay Creek watershed. Participating on the committee developing the Plan, the WRA continued to emphasize the importance of the White Clay Creek as a public water supply. The City of Newark and United Water Delaware both utilize the White Clay Creek for drinking water supply.

Other participants on this project include local government agencies, planning and research organizations, and interested citizens throughout the watershed in Chester County, Pennsylvania and New Castle County, Delaware.

Riparian Buffer Areas

During 1996, the WRA served on a Riparian Buffer Area Ordinance subcommittee. The purpose of the group, which was spearheaded by the New Castle County Department of Planning, was to draft an ordinance to provide protection along all stream corridors and lakes within the County.

Riparian buffer areas serve as the transition zones between aquatic and terrestrial environments and perform a variety of important functions. A well-designed and managed forest buffer provides shade, food, and passage for wildlife. Tree and shrub roots also provide streambanks with stability, thereby reducing erosion and sediment transport. A forested buffer also acts as a water-quality filter as vegetation converts excess nitrogen and phosphorous in stormwater runoff to fuel for growth. These features of a buffer, taken together, act to enhance the quality of water and streamside habitats.

The draft ordinance, completed in December, calls for preservation and protection of these valuable natural resource areas by limiting allowable uses and disturbances within a designated corridor along a waterbody during land development. In addition, the ordinance would require developers to evaluate and, if necessary, enhance the buffer area with plantings of native trees and shrubs to improve its performance. After thorough review by interested parties, the ordinance will be brought before the New Castle County Council for its consideration.



FINANCIAL SUMMARY

FISCAL YEAR 1997

Operating Budget Overview

Estimated Expenditures

Personnel	\$396,013
Fringe Benefits	\$120,263
Travel / Civic	\$7,000
Communication / Utilities	\$5,000
Materials / Supplies	\$6,500
Contractual Services:	
Data Management	\$43,289
Automobiles	9,000
Stream Gage	4,500
Printing	17,000
Total Contractual Services	\$73,789
Equipment (AERI)	\$15,000
TOTAL	\$623,565

Revenues

Source:

New Castle County	\$388,557
City of Wilmington	38,000
City of Newark	38,000
State of Delaware	88,000
New Castle Board of Water & Light	6,000
Carry-Over	15,000
Income	15,000
EIS Reimbursement	20,540
Grant	14,500
Contribution	0
TOTAL	\$623,597

FINANCIAL SUMMARY

FISCAL YEAR 1991 - 2002

Capital Budget Overview

Capital Projects	Authorized FY'91 - FY'96	Approved FY'97	Proposed FY'98 - 2002
<u>Water Supply</u>			
Cockeysville Formation Analysis	130 [33]	0	0
Churchmans EIS Phase II	398 [975]	205 [789]	1200
Thompson Station Reservoir Land	0	0	7080
<u>Water Quality</u>			
WRPA Phase III	0	0	150
Groundwater Monitoring/Preserves	140*	100*	3200
Water Resources Monuments	0	0	150
TOTAL	\$668 [1008]	\$305 [789]	\$11780

(Funding in Thousands)

Notes: [] Denotes funding from non-New Castle County Sources

* Approved in New Castle County Public Works Budget





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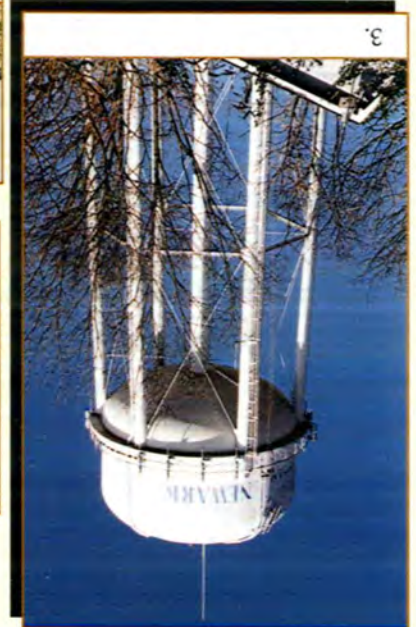
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Information for this report was developed by the staff of the Water Resources Agency for New Castle County. The layout and design of this report was prepared by Nicole M. Minni and Marcia Horner; and was edited by Martin W. Wollaston. For more information contact the Water Resources Agency: 2701 Capitol Trail, Newark, DE 19711, (302) 731-7670.

1. City of Wilmington Wills Pump Station; located on the Brandywine Creek, this pump station withdraws water from the Brandywine and pumps it to either Hoopes Reservoir or its Porter Filter Plant located near Route 202 and I-95.
2. City of Wilmington Edgar M. Hoopes Reservoir; located off Old Mill Road, Hoopes is the only major raw water storage facility in New Castle County (2 billion gallons).
3. City of Newark Windy Hills Storage Tank; with a capacity of 300,000 gallons, this elevated tank provides treated water to the eastern portion of Newark's service area.
4. Artesian Water Company Old County Road Treatment Facility; with a production capability of up to 3 million gallons a day, this facility pumps groundwater and removes iron and manganese.
5. Tidewater Utilities Dickerson Farm Production Plant; located on Churchtown Road, this facility includes a 125,000 gallon storage tank and provides water to several subdivisions near the Summit Airport.
6. Town of Middletown Greenlawn Tower; this new tank will provide 1.5 million gallons of storage for the growing Middletown area.
7. United Water Delaware Christiana Filter Plant; located on Smalleys Pond, this facility has a treatment capacity of 6 million gallons a day.
8. New Castle Board of Water & Light Gray Street Storage Tank; with a capacity of 600,000 gallons, this elevated tank provides treated water to the City of New Castle.



**Do You Know Your
Public Water Supply
Features?**

Do You Know Your Public Water Supply Features?



1.



2.



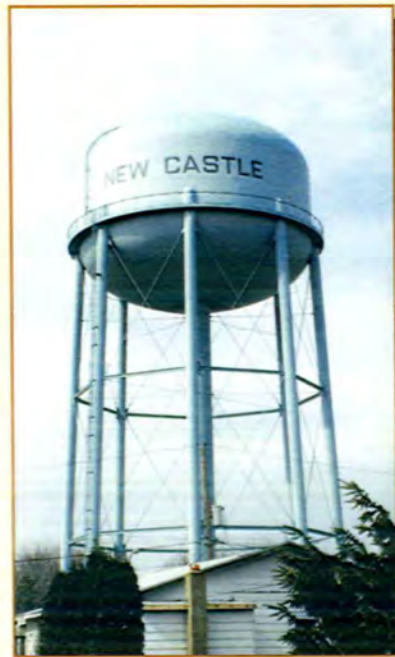
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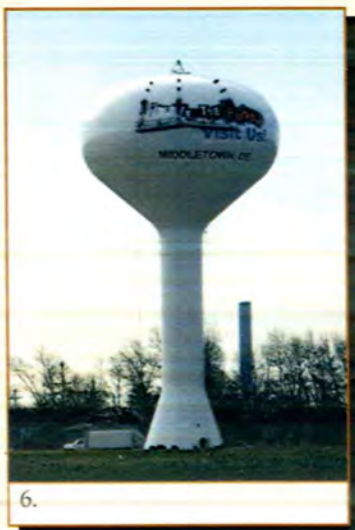
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