The Philadelphia Water Department

1986 Annual Report

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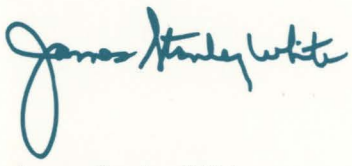
W. Wilson Goode
Mayor

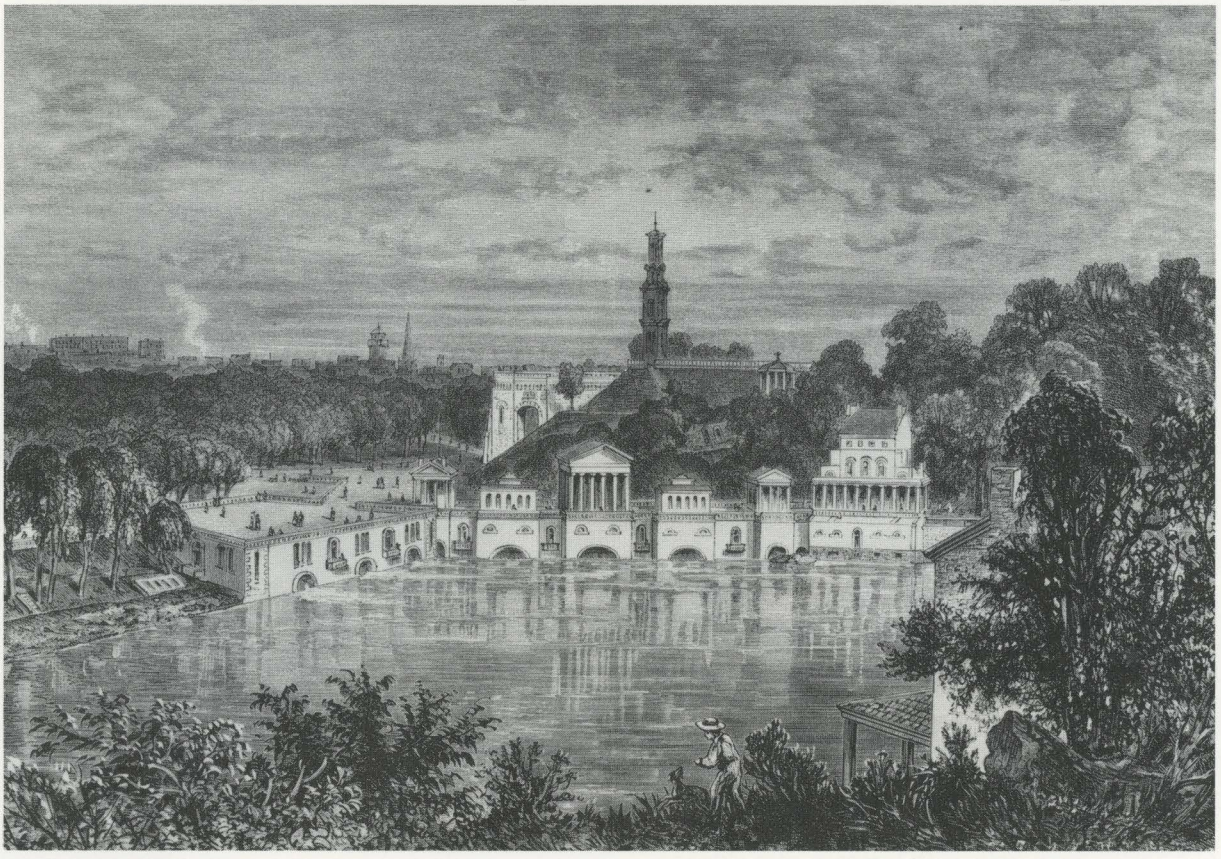


James Stanley White
Managing Director

William J. Marrazzo
Water Commissioner

On The Cover:
John Lewis Krimmel
Fourth of July In Centre Square
The Pennsylvania Academy of the Fine Arts

The Philadelphia Water Department: An Historical Perspective



When the Fairmount Water Works went into operation in 1815, steam engines were used to raise the water of the Schuylkill to the earthen reservoir on the hill now occupied by the Philadelphia Museum of Art.

History...a term which bestows respect upon the past. To have a history implies an acquiring of wisdom and experience, a revered trophy earned through the accumulation of years and some hard-taught lessons. History can only be inherited through the dreams and efforts of past generations. History offers its ancient structures, its faded photographs, its dust bound volumes, with a pride that only the living can emulate. History is a living entity, the essence of the past kept alive by the living spirit of the present.

It is 1987 and the United States is celebrating the 200th anniversary of its Constitution. The Constitution embodies the principles which have served as the foundation of our nation's growth and history.

> "We the People of the United States, in order to form a more perfect Union, establish Justice, insure domestic Tranquility, provide for the common Defense, promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this CONSTITUTION for the United States of America."

Construction of the Belmont filters, sedimentation reservoir and the clear water basin took place in 1903 to supply filtered water to sections of the City west of the Schuylkill River.

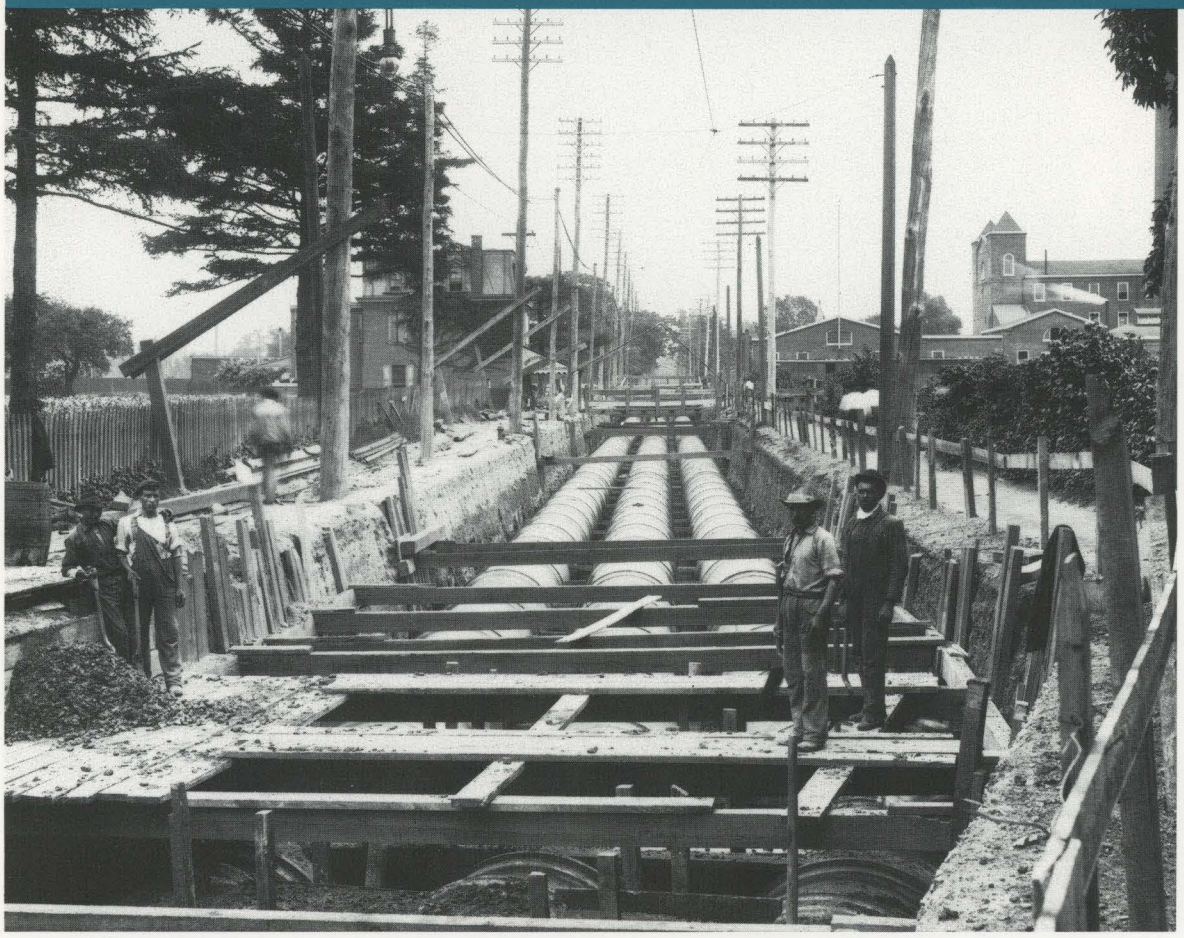
To promote the general Welfare, in simpler terms, referred to the general health, happiness and comfort of the nation's citizens. As early as 1787, health and welfare were prevalent issues. In Philadelphia, one of the larger concerns was the lack of a pure water source. Ben Franklin, one of Philadelphia's most prominent citizens and one of Pennsylvania's signers of the Constitution, urged our City's leaders to seek methods of purifying the City's water supply due to the frequent epidemics of yellow fever which seized our City. In 1790, at the time of Franklin's death, Franklin willed 100,000 pounds to Philadelphia for use in procuring an abundant supply of water to, "insure the health, comfort and preservation of the citizens."

In 1793, Philadelphia suffered an epidemic of yellow fever, thought to be the result of the contamination of the city's drinking water supply. Residents' cesspools and drains had inadvertently leaked sewage into the City's underground wells. Dr. Benjamin Rush was the first to make the connection. He ardently advocated the seeking of an alternate source of drinking water, notably by means of a conduit to the Schuylkill River or Wissahickon Creek. Other suggestions included the digging of a canal, linking the Schuylkill and Delaware rivers, and tapping the water from this new connection.

Onlookers gaze into the 12 foot diameter bottom shaft of the Torresdale Conduit which was installed in 1904. The steel shaft connected the end section of the three mile concrete and brick-lined conduit and conducted the filtered water into the pump wells of the Engine House at Lardner's Point Pumping Station.

A Joint Watering Committee, established in 1798 by the City's Select and Common Councils, employed Benjamin Latrobe to investigate the possibility of obtaining a safe, sufficient water supply by means of water power. Latrobe suggested taking the water from the Schuylkill River by means of a steam engine at Chestnut Street wharf, and another at Broad and High (Market) streets. At this time, there were only three steam engines of this size in operation in America, large enough to pump 2,100,000 gallons in 24 hours. No other city in the nation was obtaining its water by means of steam pumping, but the Watering Committee was struck with the innovative application and commissioned Latrobe to design and supervise the resulting work.

The first pumping station, equipped with machinery to supply Philadelphia with river water was completed in January 1801. It was built on the Schuylkill at Chestnut Street, and from this station the water was pumped through a brick tunnel to Centre Square at Broad and High streets, where City Hall now stands.



New distribution mains were laid along State Road in 1904 to supply the Northeast section of the City with filtered water from the Lardner's Point Pumping Station.

The Centre Square engine house, on the cover of this Annual Report, was a graceful marble structure, with the lower story built in the form of a square and two porticos containing a committee room, an office and an engineer's room. The station was topped with a smaller dome in the center, lending the station the appearance of a "pepper box."

The engines and boilers in both buildings were made of wood. The firebox inside the boiler was wrought iron with vertical flues of cast iron. The engine at the Schuylkill station ran at 16 revolutions per minute and pumped 1,474,550 gallons of water in 24 hours, with a consumption of 70 bushels of coal. The Centre Square engine pumped 962,520 gallons in 24 hours with a consumption of 50 bushels of coal.

The water was pumped into wooden tanks on top of the Centre Square station. The engine could fill these in about 25 minutes but they were emptied in about the same time. Therefore, if the pumps were not constantly at work, the citizens of Philadelphia were without water.

The water from the tanks was conducted into a cast iron distributing chest, from which it was carried by two wooden 6-inch pipes down High Street to Front Street. A 4-inch wooden pipe ran down Arch Street to Front, and another of the same size ran down Chestnut to Front, from which the water was distributed in log pipes three to four inches in diameter. In 1801, 63 private homes, four breweries and one sugar refinery were supplied with water from the Schuylkill.

In 1805, Frederick Graff, who had been Latrobe's assistant in the erection of the Centre Square station, was made superintendent and engineer in charge of operations. Graff would serve Philadelphia for 42 years and was destined to become the leading American expert on hydraulic engineering.

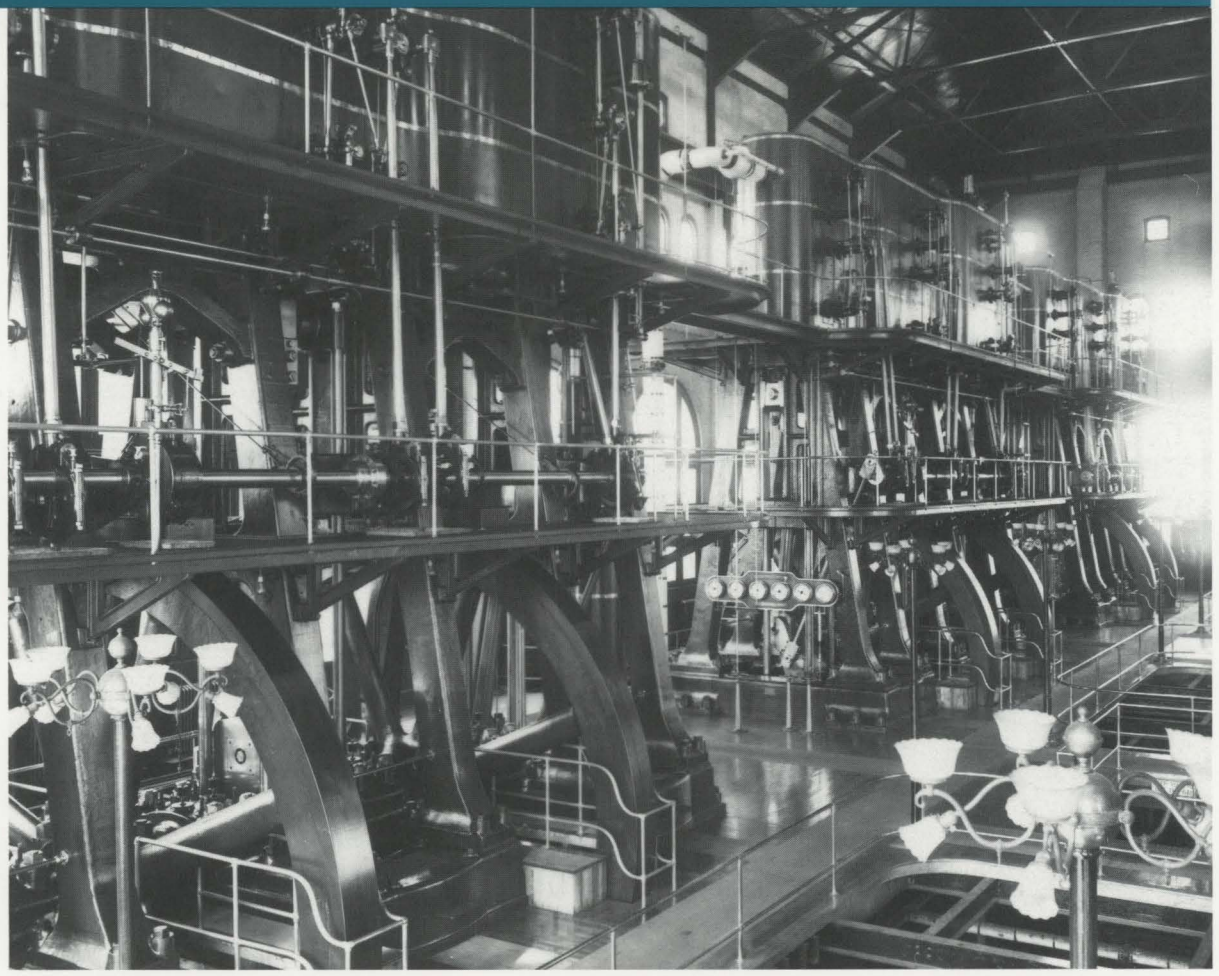
Graff spent five years attempting to make the low pressure steam engines at the Centre Square station pump to the designed capacity. When his efforts proved futile, Graff proposed utilizing high pressure steam engines to pump water to

A group poses for a portrait in front of the Fairmount Lock House in 1895. The Fairmount Locks were constructed in 1822 in conjunction with the Fairmount Dam by the Schuylkill Navigation Company, to form a pool for slack navigation.

The construction of the Lardner's Point Pumping Station in 1903 included the installation of six foot diameter cast iron pipe sections used to connect valve chambers for the distribution of filtered water.

an elevated reservoir on Fairmount Hill, the present site of the Art Museum. His proposal was approved and by 1815, the Fairmount Water Works, located on the east bank of the Schuylkill, was completed and placed into operation. However, the high pressure steam engines proved to be unreliable and dangerous, breaking down often and sometimes exploding. Graff realized the potential of water power and instigated the joint venture between the City and Schuylkill Navigation Company to build the Fairmount Dam. The dam, completed in 1822, served the double purpose of forming a pool for slack navigation in conjunction with river locks. The remainder of the water was used by the City to facilitate the pumping operation of the water wheels. For the first time, the Water Works became self-supporting, since water power was cheaper than coal or wood. The Water Works was hailed as a technological wonder, the first of its kind in America. But besides its efficient operation, the Water Works was also a scene of beauty. The Greek Revival buildings which housed the water wheels were breathtaking. Garden fountains and statues surrounded the structure, tranquilly nestled between the Schuylkill River and the Morris Hill slope.

By the year 1851, Frederick Graff, Jr. was in charge of the Water Works. At his recommendation, the first experimental Jonval turbine was installed. Graff had been keeping a keen eye on the development of the turbine in France, noting that the turbines were smaller, worked submerged, and could work within a wide range of water pressures. The Fairmount Water Works was often subjected to tidal flows which submerged the water wheels, bringing pumping operations to a halt. The Water Works soon operated with one small and six large turbines, and one breast wheel, and continued in this capacity until it was closed in 1911. With the inception of the Fairmount Water Works, the second half of the nineteenth century witnessed the building of additional pumping stations,



Over 17,400 tons of coal were burned in 1907 to pump 15 billion gallons of water at the Lardner's Point Pumping Station.

largely due to a growing population outside of the center city limits and the subsequent difficulty of obtaining a sufficient supply of affordable water. The Schuylkill Water Works, later the site of the Spring Garden Water Works, was built in 1845 just north of Girard Avenue, and served the citizens of Northern Liberties. The Delaware Works, placed in operation in 1851 on the site of today's Susquehanna Avenue, served the citizens of Kensington. The 24th Ward Works supplied the residents of West Philadelphia in 1855, and was located at the present site of the Zoological Gardens.

Before the end of the nineteenth century, the City constructed the Shawmont Pumping Station and a reservoir at Lower Roxborough in 1869. The Belmont Pumping Station, with a reservoir at George's Hill, supplanted the 24th Ward Works in 1872. On the Delaware at Lardner's Point, the Frankford Pumping Station was placed in operation in 1878, with a reservoir at Wentz Farm (Lardner and Oakley Streets), and supplanted the Delaware Works which were abandoned in 1890. A pumping station was built at Spring Garden with a reservoir at East Park in 1889, and a pumping station and reservoir at Queen Lane was constructed in 1895. Thus, within the first century of a public water system in Philadelphia, water supply technology evolved from a tiny steam pumping station to a series of five pumping stations with five large reservoirs.

Unfortunately, an adequate water supply did not necessarily signify a safe water supply. Although the City attempted to protect its watershed by purchasing most of the land within the City's limits along the banks of the Schuylkill, resulting in the formation of Fairmount Park, the waters of the Schuylkill were becoming increasingly polluted. Until the 1880's, Philadelphia's sewage was drained directly into the Schuylkill and Delaware, often above water intake locations. Interceptor sewers succeeded in diverting sewage flow below various station's drawing pools, but they could not prevent the emptying

Originally built in 1822 and modified in 1872, the "new" Fairmount Dam was badly damaged by flooding and melting ice in February 1904, necessitating repairs.

The water main being installed on Emerald and Albert streets was one section of the 21 miles of distribution mains laid in 1907, connecting the Lardner's Point Pumping Station with the existing distribution system.

The Roxborough Pumping Station, built in 1866, originally supplied the Roxborough, Manayunk and Germantown sections of the City with raw river water. It was later refurbished in 1903, as pictured here, and renamed the Shawmont Pumping Station.

of wastes from factories farther upstream from contaminating the water supply. Typhoid fever and other water borne diseases became a continual nightmare for the citizens of Philadelphia.

Philadelphia's leading citizens and Water Bureau authorities were convinced that something had to be done to improve the quality of the water. Their solution was filtration, although one of their tougher battles was convincing other city officials and citizens that it was well worth the cost. Action was finally taken in 1900, when City Council authorized construction of filters. Five filter plants were constructed and placed in service by 1911. These plants were all of the slow sand filter type, and were filtering the following quantities of water:

Schuylkill River

Lower Roxborough . . . . . 12 m.g.d.

Upper Roxborough . . . . . 20 m.g.d.

Belmont . . . . . 40 m.g.d.

Queen Lane . . . . . 70 m.g.d.

Delaware River

Torresdale . . . . . 240 m.g.d.

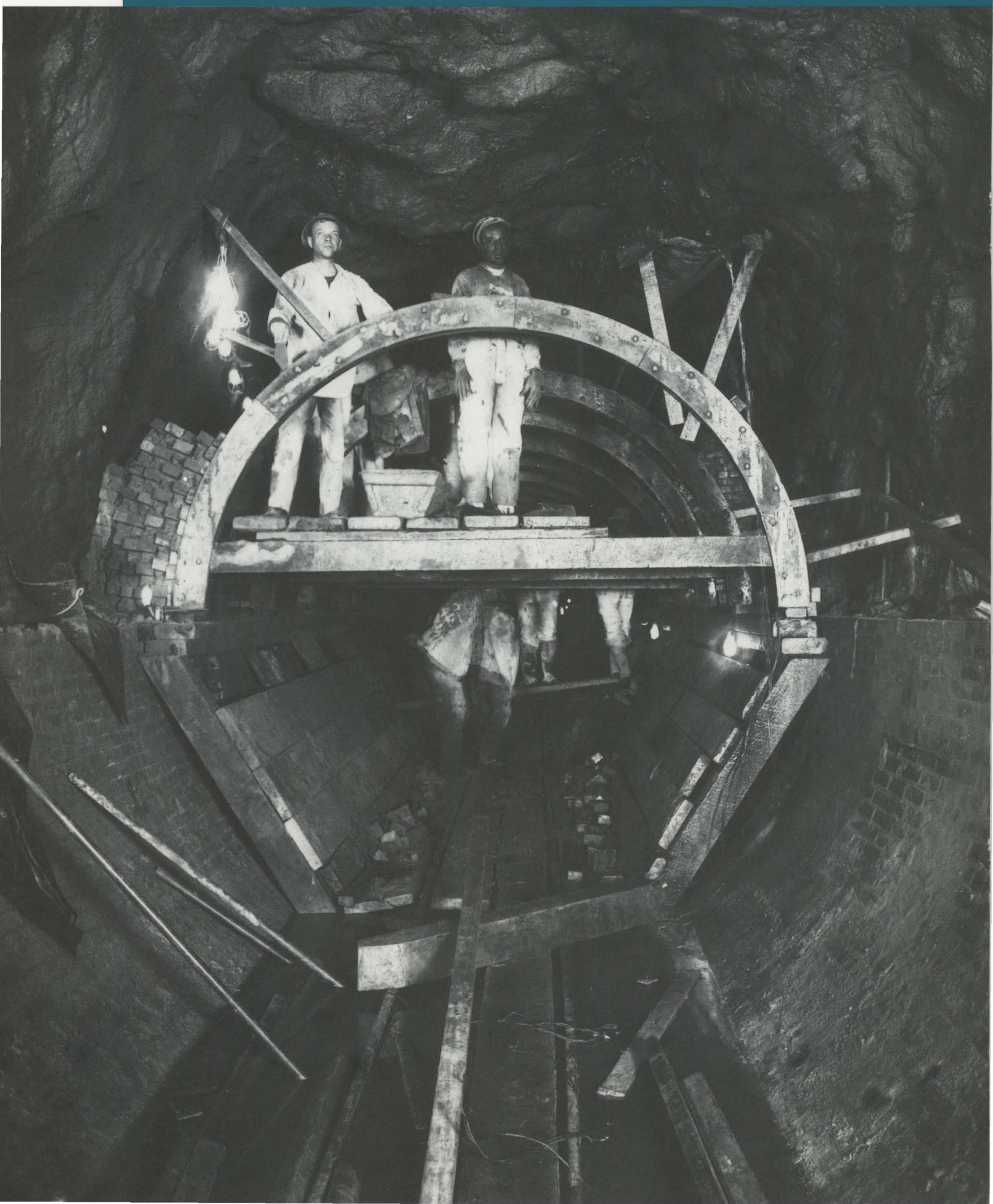
When completed, Philadelphia's filtration system was the largest in the world and cost the City some $26 million dollars. Chlorination of the filtered water began in 1913, and reduced

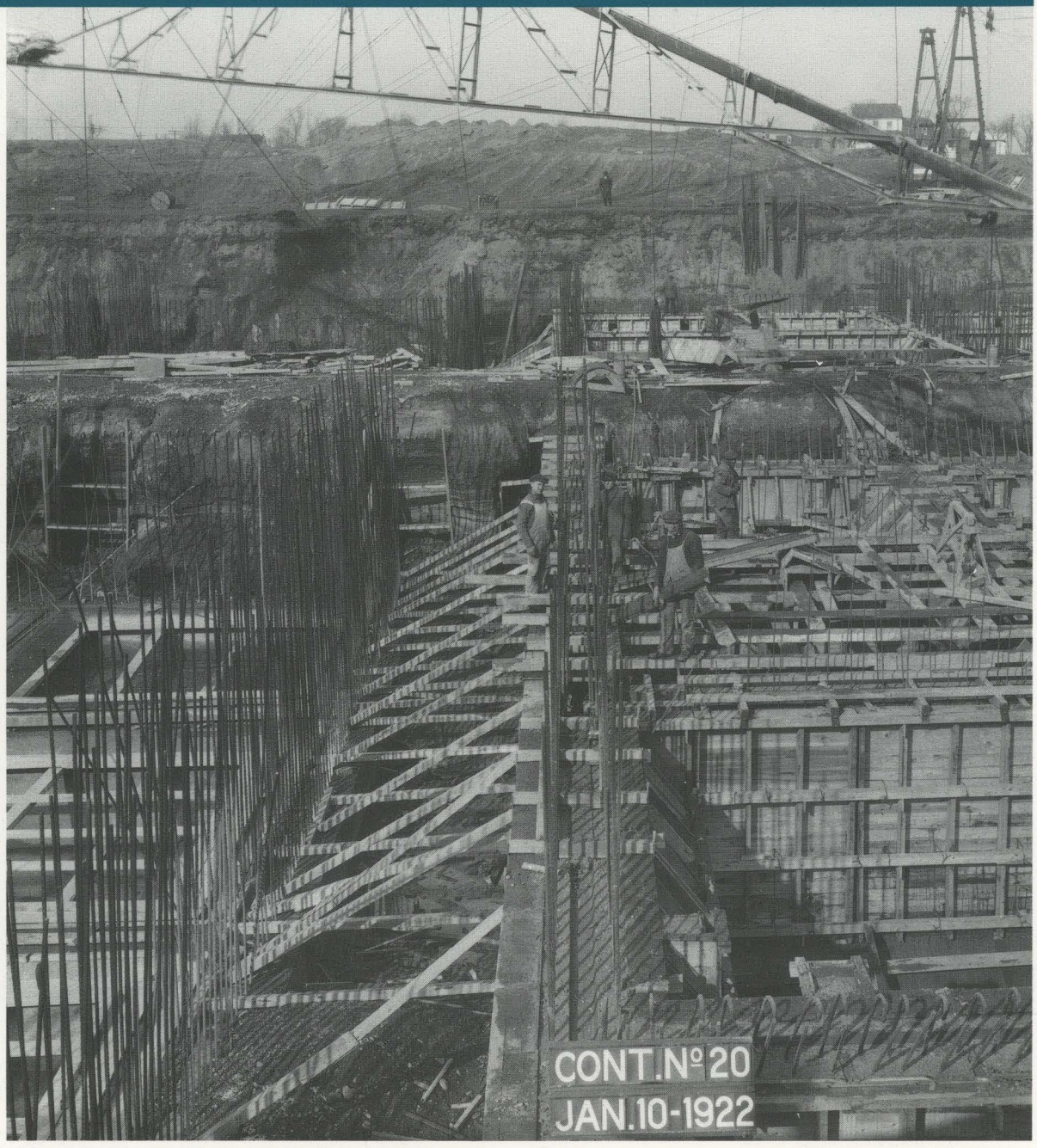
Preparing the for start-up of the Upper Roxborough Filter Beds in 1903 included the storage of large quantities of sand in the court area of the underground filter beds.

typhoid fever occurrences so that they were practically nil. Other treatment practices which have led to the development of our present day systems included the use of activated carbon, ozone, free chlorine residual treatment and chlorine dioxide.

Today, Philadelphia's water quality is superior to all quality standards as set by the U.S. Environmental Protection Agency's 1986 Safe Drinking Water Act. The three modern water treatment plants have all undergone reconstruction within the last three decades, converting the slow sand filters to rapid sand filters with semi-automatic controls. The Baxter Plant (formerly Torresdale) was completed in 1959; the Belmont Plant in 1965 and the Queen Lane Plant, overhauled in 1971, is again undergoing construction.

Concern for a clean drinking water supply also forced the City to concentrate on the clean-up of its source. In October 1905, the City filed plans for a sewerage system with the Department of Health of the Commonwealth, and two years later Philadelphia was granted a permit to extend its sewer system. Engineers were sent to Europe to investigate the various techniques used. As a result, the Spring Garden experimental sewage treatment plant was placed in operation in 1909.





Construction of the original Imhoff tanks at the Northeast Sewage Treatment Plant was a result of the sewage treatment experiments at the Spring Garden Station and tours of European facilities. The 32 Imhoff tanks, which were 80 feet long and 40 feet wide, had separate compartments for sedimentation and sludge digestion, and treated an average of 30 mgd.

The Torresdale Conduit, connecting the Torresdale Filter Plant with Lardner's Point Pumping Station, was carved through rock 100 feet below the earth's surface. The gravity conduit was brick-lined and packed with concrete under pressure to insure water tightness.

The Spring Garden Pumping Station was originally built in 1846 and renovated in 1889 to supply a new reservoir in East Park. The Station, located on the present site of the Glenndinning Rock Garden on Kelly Drive, furnished the Spring Garden section of the City with raw river water and closed in 1909 when the new Torresdale Filters were completed.

All available processes were tried out on characteristic sewage and valuable data was collected on which systems seemed to work best for Philadelphia. In 1912, the Pennypack Treatment Works was placed in operation to protect the water intake of the Torresdale Filters and to conduct additional experiments to aid in the design of the contemplated larger works.

In 1915, the City submitted its findings to the Pennsylvania Department of Health, which approved the future design of Philadelphia's sewage treatment system. This report, amazing in its completeness and its accuracy of predictions, forms the basis of our present sewage collection system. It set up three main drainage divisions within the City: the Northeast, Southwest and Southeast, with treatment works for each.

Construction of the Northeast Works and its interceptors was given top priority in order to further protect the Torresdale intakes. The original Imhoff Plant was placed in operation in 1923 and was in service until 1951, when the Northeast Plant was rebuilt and renovated as a primary treatment system, one which employed a number of biological and mechanical processes to remove sewage solids and clean the wastewater. Construction began on the Southwest Plant in 1949 and was completed in

A Survey crew was pictured in 1903, during their assignment to survey the construction of the Torresdale Conduit, which was built through rock 100 feet below the surface. The conduit was approximately three miles long and 12 feet in outside diameter and connected the Torresdale Filtration Beds to the Lardner's Point Pumping Station.

1954. Southeast construction began in 1948 and the plant went into operation in 1955.

In 1975, the Water Department began a $900 million program to upgrade and reconstruct its three wastewater treatment plants. The Northeast, Southwest and Southeast all have been expanded to include secondary wastewater treatment, as well as primary. Secondary treatment involves the use of bacteria to consume the organic parts of the wastes in the activated sludge process. All three plants are meeting the standards set by the Clean Water Act and are successfully removing approximately 90% of the pollutants from its wastewater before the water is returned to the river. Philadelphia also was able to cease the ocean dumping of sludge by 1980 through its innovative sludge recycling program.

As a result of these environmental achievements, including an aggressive pretreatment program which monitors and limits the amounts of chemicals and contaminants emptied into the City's collecting sewers by major industries, Philadelphia has witnessed the remarkable revitalization of its rivers. Record-breaking numbers of shad populations and other fish species are being reported in both the Delaware and Schuylkill rivers. The rivers have embraced life again, an ample return for our investment.

A workman is seen riveting one of the large steel conduits connecting the Torresdale filtration beds to the Lardner's Point Pumping Station.

Building A Foundation For The Future

Operator checks one of the twelve final sedimentation tanks at the new Southeast Water Pollution Control Plant, which hold a total of 14.4 million gallons.

At the Philadelphia Water Department, the future is today. We are taking actions designed to meet the challenges of tomorrow which will allow us to provide high quality water and wastewater services to our customers into the 21st century, while at the same time adapting to changing environmental regulations.

Part of our preparation for the future is applying technological innovations to the way we provide service today. These technological advances are helping us improve customer service, meet future water needs, and maintain our equipment and facilities in a more cost-efficient manner.

The Wastewater System

Modernizing and Expanding Wastewater Facilities

While construction for the expansion and modernization program of our facilities was nearing completion, the three plants treated an average of 447.83 million gallons of wastewater per day.

Highlights of fiscal 1986 at the Northeast Water Pollution Control Plant included the start-up of the Preliminary Treatment Building, the new Final Sedimentation Tanks and the Sludge Thickener and Digestion Facilities. Despite various facility start-ups, the Northeast Plant was meeting effluent requirements of the Environmental Protection Agency (EPA) by the end of 1986. The City and regulatory agencies were also negotiating a time schedule for the renovation of the existing primary and final tanks, the last elements of the plant which require modernization.

The Southwest Water Pollution Control Plant has been in compliance with most prevailing regulations since August of 1985. Consistent compliance with disinfection requirements was achieved during 1986 by the repair and reconstruction of the existing chlorination system. Plans for 1987 include further improvements to this system.

By the end of 1986, the Southeast Water Pollution Control Plant was also in compliance with the final effluent requirements mandated by EPA. Installation of the computer center for process control was completed and operational in May

of 1986 and most systems were being controlled remotely. Initially, most operations will be controlled from the computer room by operators. In the future, plant processes that show a consistent and predictable pattern over time will be transferred to computer control.

Sludge Dewatering

Approximately 95 percent liquid after being extracted from the wastewater treatment process, the sludge is placed in anaerobic digestion tanks and kept at a temperature of 98° F for 30 days. This destroys most of the harmful bacteria and reduces volatile solids. The digested sludge must then be dewatered to obtain a "sludge cake" which can be mixed with wood chips for composting.

In 1984, the Department obtained funding approval from EPA to build a new centrally located Sludge Processing and Distribution Center in southwest Philadelphia. This facility qualified for 85 percent federal funds since it recycled material by converting sewage waste into an environmentally reuseable product. Construction of the $23.2 million dewatering facilities, which includes 10 large centrifuge units, began in November 1985 and is scheduled for completion in October of 1988.

Sludge from the Southeast Plant will continue to be pumped to the Southwest Treatment Plant for digestion and eventual dewatering. The Department plans to transport the liquid sludge from the Northeast Water Pollution Control Plant to the Sludge Processing and Distribution Center by barges which will travel down the Delaware River and up the Schuylkill River, a total distance of 12 miles. Construction of the $9.3 million sludge storage tanks at the Northeast Plant began in May of 1986. Work on the $11.8 million docking facilities, sludge pumping equipment and barges began early in 1987.

Compost Facility

The companion project to the centralized dewatering facility is a new expanded $32.7 million composting facility which will include an operations and maintenance center, sludge receiving and mixing complex, an 18-acre composting pad, a 5-acre curing area, a drying area, a compost screening system for wood chip recovery, 4 acres of wood chip storage, 3 acres of on-site screened compost storage and an 11-acre off-site screening and storage area. When completed in 1988, the facility will be one of the largest of its kind in the world.

With the onset of construction for the permanent facility, land available for current processing of sludge has been reduced by 50 percent. This

When the rotor is repaired and assembled with this stator, a 2,000 horsepower, 2,400 volt motor will turn a 30 million gallon per day pump at the Belmont Raw Water Pumping Station.

occurred as full operation of the three wastewater plants raised daily sludge quantities received at the existing compost site by 70 percent. The Department took several steps to assure that sludge processing continues smoothly while the new facility is built. Sludge and wood chip mixing operations have been increased by establishing a second shift and through the installation of portable lighting to illuminate the mixing areas.

Cogeneration Facilities

To emphasize conservation and efficient use of energy resources, the Water Department capital program includes $13.2 million for construction of new facilities at the Northeast and Southwest Plants to recover the methane gas produced as a result of sludge digestion, and use it to generate electrical energy in sufficient volume to satisfy plant operating needs.

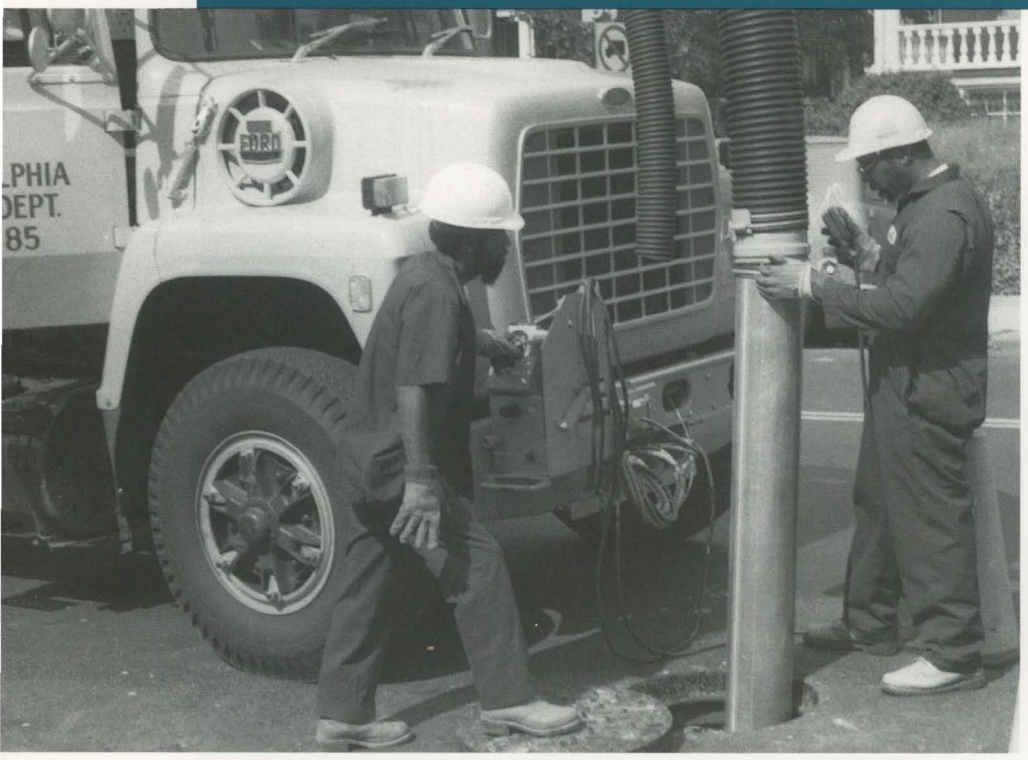
With natural gas used as a supplement for the methane generated from sludge digestion, the cogeneration facilities at both plants promise an ability to supply all the plants' energy needs, saving $6 million per year in electrical power costs. As innovative technology under EPA policies, these projects have qualified for an additional 10 percent of federal funding. Options for design, construction, operation and maintenance for the new cogeneration facilities are currently under development.

Industrial Waste Regulation

Under the National Pollution Discharge Elimination System (NPDES) administered by EPA, the Water Department is required to function as the regulator of industrial waste handling practices within the wastewater collection territories serviced by the Department's facilities.

The Industrial Waste Unit, created in 1966 for the purpose of regulating industrial waste and reducing the discharge of toxic substances into city sewers, was enlarged and modernized in 1977 to meet NPDES effluent requirements, to protect the wastewater plants from treatment upsets, and to improve the sludge quality for recycling.

Pretreatment regulations are enforced by the Department through routine sampling of flows discharging into the sewer collection system from industries and suburban townships. On the basis of monitoring experience, the Department standards for discharges to the City sewers will eventually be established for each industrial category. The latest EPA audit found that the City is continuing to make excellent progress in the development of this pretreatment program.



The city's 75,000 inlets are a constant challenge to clean-up crews. A special vacuum truck is needed for the most difficult jobs.

Collection System

The sewer system consists of approximately 2,943 miles of sewers, 174 regulating chambers, 75,000 stormwater inlets, 12 wastewater pumping stations, 4 stormwater pumping stations, and 28 metering chambers to monitor flows from surrounding townships that have contracted to have wastewater treated by the City.

Ten of the wastewater and three of the stormwater pumping stations have been automated. Work is also being performed to automate the metering chambers. Over the last 10 years an active pump rehabilitation program has been in progress under which pumps have been rehabilitated at nine pumping stations.

During 1986, the Department modernized many of its regulating chambers and installed instrumentation which alerts a central office if malfunctions result in discharges to the rivers. Repair crews are then dispatched to problem areas.

The Water System

Extending the Life of Plant Facilities

Although the current modernization of our new wastewater treatment plants is almost complete, the three water plants have been in service for an average of 26 years. As a result of a life extension program which began in 1980, the water plants will operate safely beyond the turn of the century. A few examples of life extension work include: repairing leaking filters, installing new filter tiles, and replacing the sand filters with a mixed media to increase filter capacity by 50 percent. In 1983, the life extension program was augmented by a master maintenance program to schedule inspections of all the Department's buildings and equipment and budget for their repair or replacement.

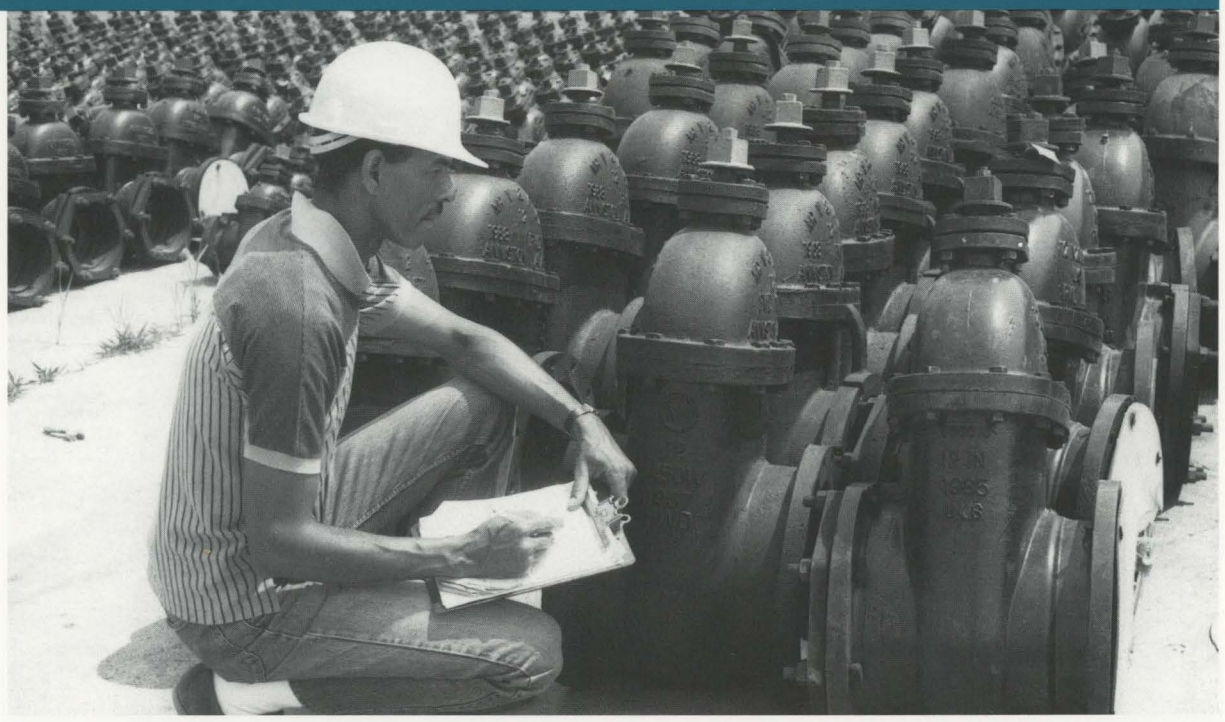
Modernizing the Water Treatment Plants

The three main features of the new $10 million facilities at the Queen Lane Water Treatment Plant are a new automation system, the use of sodium hypochlorite (NAH) as a primary disinfectant, and the replacement of the other chemical feed systems. NAH is easier and safer to handle than gaseous chlorine because it is used in a liquid form. Scheduled to become operational early in 1987, the new microprocessor-based automation system will be able to flow-pace chemical feeds, automatically backwash filters, and provide extensive alarm and monitoring capabilities.

Similar process control systems and new chemical feed systems are being installed in the Samuel S. Baxter and Belmont Water Treatment Plants. Scrubber systems to prevent the escape of any gaseous chlorine in the event of a leak are also being built at these two plants.

Reducing Pumping Costs

Pumping strategies have been refined to maximize cost savings by taking advantage of reduced electric rates during off-peak hours. The



Foreman checks inventory of the 15,000 valves, ranging in size from three to forty-eight inches in diameter, ensuring that emergency repairs can be made to the water distribution system.

Department's Distribution System Control Center has been able to reduce electrical cost to $30,000 below fiscal 1985 while delivering an additional 3.3 billion gallons of water in fiscal 1986. Power costs for water have remained essentially constant over the last five years, despite electric rate increases totaling more than 20 percent.

The automation of the Fairhill High Pressure Fire Pumping Station will generate annual savings of $100,000 in operating costs. Scheduled to become operational in May of 1987, the pay back period will be less than one year because all of the design and installation work was done internally by the Water Department.

East Park Reservoir

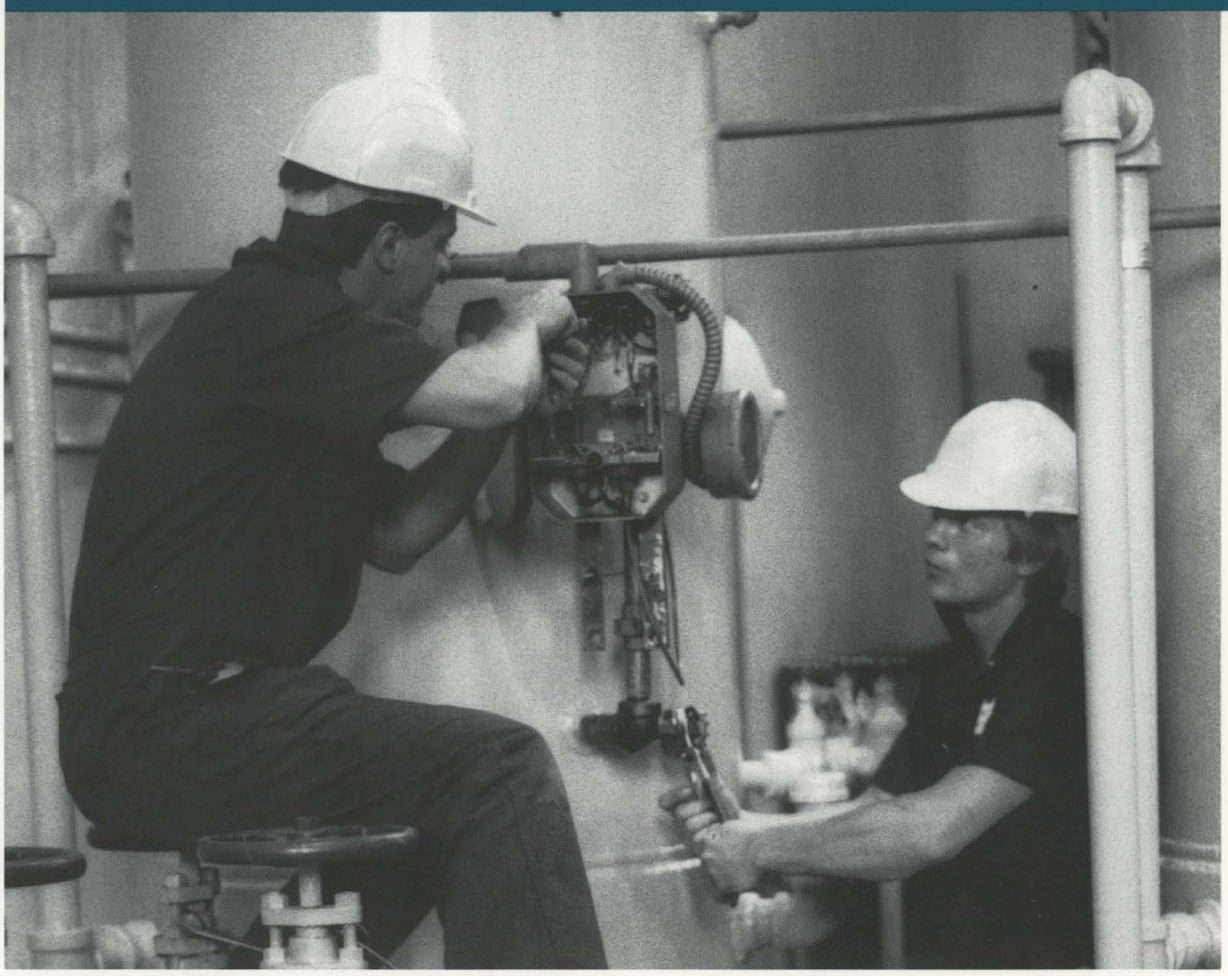
Over the past six years, improvements have been made at the East Park Reservoir to allow the Northeast and Northwest Basins to be used for covered storage of finished water from the Queen Lane or Baxter Plants and to provide a high quality reserve water for periods of high consumption. New 48-inch intake lines were completed at each basin more than five years ago, after which the liners and covers were installed.

The failure of a dike wall at the Northeast Basin prevented the Department from activating both basins in 1986. Engineering investigations of the cause of failure concluded that it was caused by the percolation of water through the enbankment soil mass adjacent to the new intake pipe. Corrective design has been completed for reinstallation of both intake conduits, with protective features to prevent future percolation of water and to hold enbankment soil in place. Additional soil mass will also be placed on the outside of the entire reservoir embankment to assure future stability. While both covered basins were removed from service in 1986, the South Basin at East Park was used to provide reservoir storage.

Controlling Water Loss

On May 13, 1985, the Delaware River Basin Commission (DRBC) declared a drought emergency. That summer, the Customer Affairs Division developed an effective public relations campaign including press releases, flyers, letters to 8,000 block captains, radio and television appearances, and public service messages. "Slow the Flow" and "Play Smart, Philadelphia" were chosen as the core messages for the water conservation and hydrant abuse programs. The DRBC lifted mandatory water restrictions on October 31, 1985 after Hurricane Gloria helped to end the drought.

The Department has sought in recent years to achieve better use of existing capacity through programs to improve metering and reduce the loss of finished water from the distribution system. Under a program initiated in 1978 to reduce customer meter underregistration, more than 308,000 small meters and 14,000 large meters have been replaced. Leakage detection, distribution main repair and replacement pro-



Scheduled pump maintenance has enabled the department to take advanage of reduced utility rates during off-peak hours.

grams saved approximately 22 million gallons daily (MGD) of water loss from the system in 1986. The installation of locks on 14,000 fire hydrants, to prevent their unauthorized use, was especially important during the drought of 1985.

Water Quality

In June of 1986, President Ronald Reagan signed into law amendments to the Safe Drinking Water Act of 1974 (SDWA). These amendments are the most significant changes in the history of the public water supply field. They require that EPA establish maximum contaminant levels (MCL) for 83 additional substances found in ground and surface waters by 1989 and at least 25 additional contaminants by 1991. The amendments also ban the use of lead solder and pipe in drinking water systems.

Currently, Philadelphia water meets or exceeds all physical, chemical, radiological, and bacteriological water quality standards established by EPA under the Safe Drinking Water Act. Three modern laboratories monitor water quality to assure compliance and conduct research in matters of concern to the Department.

The City of Philadelphia requires by ordinance the fluoridation of finished water. In early 1986, a national shortage of hydrofluosilicic acid exhausted all City reserves and there was no fluoridation for several weeks at some locations. The Water Department has taken actions to avoid a recurrence by increasing reserve storage and making alternate arrangements with suppliers.

The Capital Budget

The Water Department has for many years used a formal capital budgeting process, where capital programs are projected over a six year period and a detailed budget is adopted for the first year of the six. Both program and budget commitments are reviewed each year and modified. The six year program proposed for 1987 through 1992 projects total expenditures in excess of $293 million.

To appreciate the magnitude of the capital program, consider that in fiscal 1986 the Water Department Construction Branch supervised contractors working on 238 projects with a combined value of $131 million. Of these, 113 were completed for $42.4 million; 151 projects valued

Operator checks 50 ton per day cryogenic fractional distillation units that supply oxygen to the covered aeration tanks at the Southeast Water Pollution Control Plant.

at $82.3 million remained active. The projects included reconstruction of old sewers, new water mains, storm flood relief sewers, and improvements to pumping stations, treatment plants and reservoirs.

The Design Branch of the Water Department designs and evaluates both capital and operations budget projects, in addition to coordinating the work of the Department's consulting engineers. In 1986, drawings and specifications for 124 future contracts worth over $26 million were completed by Design and its consultants.

Reduction in Debt Service Costs

Debt service for the Capital Programs is a major portion of the Department's Operating Budget — about 35 percent in fiscal 1988. Innovative financing and other initiatives which have helped reduce debt service costs by $154 million since fiscal 1982 include:

- Avoiding expenditures for facilities in excess of those required to meet Philadelphia's projected needs, except where required by law or where economically justified by operating costs decreases. This has reduced the capital improvement program by $279 million since 1982.
- Performance of "value engineering" analysis in all major projects.
- Advanced bond refundings have substantially reduced capital requirements. An example of this occurred in December of 1985 when the Department refinanced its outstanding Sixth and Eighth Series Revenue Bonds with a $248 million issue at lower interest rates. At the same time, a July 1984 tax-exempt commercial paper issue was replaced by a tax-exempt variable rate demand obligation issue.
- Creation of a Renewal and Replacement Fund to lessen dependence on long-term, high-cost debt markets.

Rate Decision

After extensive public hearings during July and August of 1985, revised charges for water and wastewater service were approved and implemented on January 10, 1986. The new rates are expected to generate additional revenue of $45.6 million over the period of January 10, 1986 through June 30, 1987.

In preparation for the planned conversion to monthly water and sewer billing on July 1, 1988, the Department, in cooperation with the Water Revenue Bureau, plans to:

- Use hand held computers for electronic meter reading to cut processing time and increase accuracy.
- Begin construction of a new Customer Billing Information Computer Center at the Water Department Headquarters in the ARA Tower at Reading Center.
- Install remote reading devices where it is cost efficient.
- Conduct an in-depth audit of the customer service functions of the Water Department.

Consolidated Supplemental Schedule Of Rate Covenant Compliance For The Fiscal Year Ended June 30, 1986 (Amounts in Thousands of Dollars) (Legally Enacted Basis)

Line No.		
1	Total Operating Revenue	$212,610
2	Net Operating Expense	120,560
3	Bond Anticipation Notes	4,621
4	Net Operating Revenue After Notes	$ 87,429
Debt Service:		
5	Revenue Bonds Outstanding	71,132
6	General Obligation Bonds Outstanding	18,050
7	Total Debt Service on Bonds	$ 89,182
8	Net Operating Revenue after Bonds	$ (1,753)
Nonoperating Income:		
9	Interest Income	$ 16,863
10	Grant Income	3,456
11	Total Nonoperating Income	$ 20,319
Other Obligations:		
12	Direct Interdepartmental Charges	$ 20,670
13	Transfer of Interest Income to General Fund	2,003
14	Renewal and Replacement Fund	4,410
15	Repairs and Maintenance Financed from Revenues	670
16	Engineering and Administration Financed from Revenue	1,400
17	Total Other Obligations	$ 29,153
18	Net Operating Balance for Current Year	$ (10,587)
19	Net Balance at Beginning of Fiscal Year	52,723
20	Net Balance at End of Fiscal Year	$ 42,136

Consolidated Supplemental Schedule Of Rate Covenant Compliance For The Fiscal Year Ended June 30, 1986 (Amounts in Thousands of Dollars)(Legally Enacted Basis)

Pursuant to Secton 4.03(b) of the General Water and Sewer Revenue Bond Ordinance of 1974 (Bill No. 1263), the City is required to impose, charge and collect in each Fiscal Year rates and charges at least sufficient, together with that portion of the unencumbered amount of the operating funds balances available and reserved for appropriation for the payment of Operating Expenses at the commencement of such Fiscal Year, which together with all other project revenues to be received in such Fiscal Year, shall equal not less than the greater of:

A. The sum of:
- (i) all Net Operating Expenses payable during such Fiscal Year;
- (ii) 150% of the amount required to pay the principal of and interest on all Bonds issued and outstanding hereunder which will become due and payable during such Fiscal Year; and
- (iii) the amount, if any, required to be paid into the Sinking Fund Reserve during such Fiscal Year; or

B. The sum of:
- (i) all Operating Expenses payable during such Fiscal Year; and
- (ii) all Sinking Fund deposits required during such Fiscal Year in respect of all outstanding Bonds and in respect of all outstanding general obligation bonds issued for improvements to the water or sewer systems and all amounts, if any, required during such Fiscal Year to be paid into the Sinking Fund Reserve.

Coverage is computed as follows:

Coverage A

Line 4	87,429
+ Line 11	20,319
+ Line 19	52,723
	160,471
÷ Line 5	71,132
	2.26

Coverage B

Line 4	87,429
+ Line 11	20,319
– Line 12	(20,670)
+ Line 19	52,723
	139,801
÷ Line 7	89,182
= Coverage B	1.57

Water And Sewer Funds

Assets Fiscal Years Ended June 30, 1986 and 1985 (In Thousands)

	1986	1985
Current Assets	$ 164,706	$ 158,258
Restricted Assets	139,608	204,319
Property, Plant and Equipment	$1,632,775	$1,632,416

	1986	1985
Current Liabilities	$ 97,194	$ 96,605
Long Term Liabilities	929,824	939,026
Fund Equity	605,757	596,785
	$1,632,775	$1,632,416

The Fairmount Water-Works

Philadelphia Water Department
ARA Tower At One Reading Center
1101 Market Street
Philadelphia, PA 19107