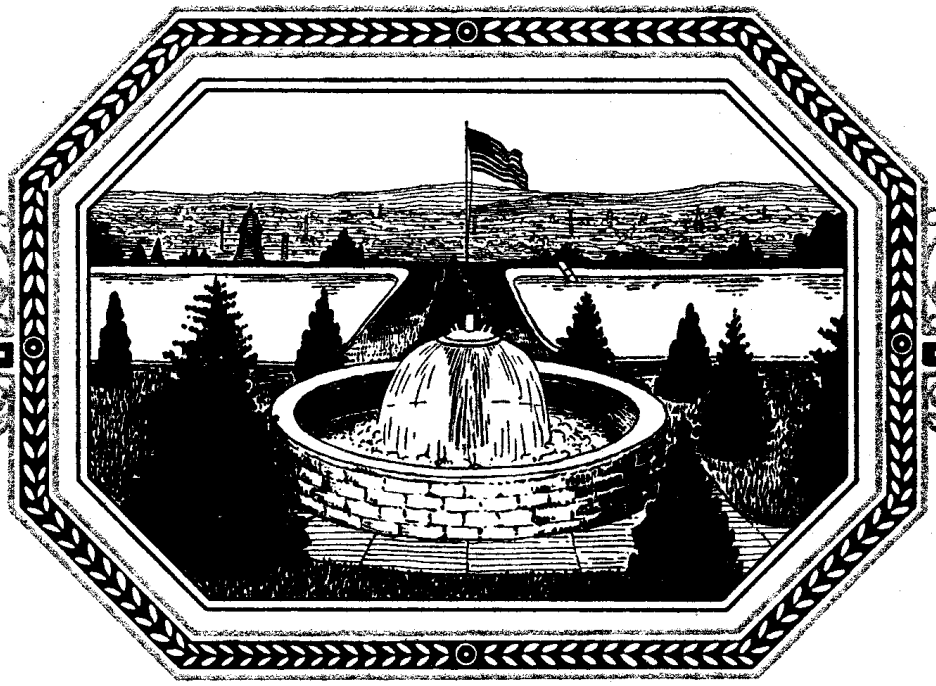

YORK'S WATER WORKS

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by EDGAR P. KABLE
General Manager

January 1, 1927

The YORK WATER COMPANY
INCORPORATED 1816
YORK SUBURBAN WATER COMPANY
INCORPORATED 1906

ILLUSTRATIONS

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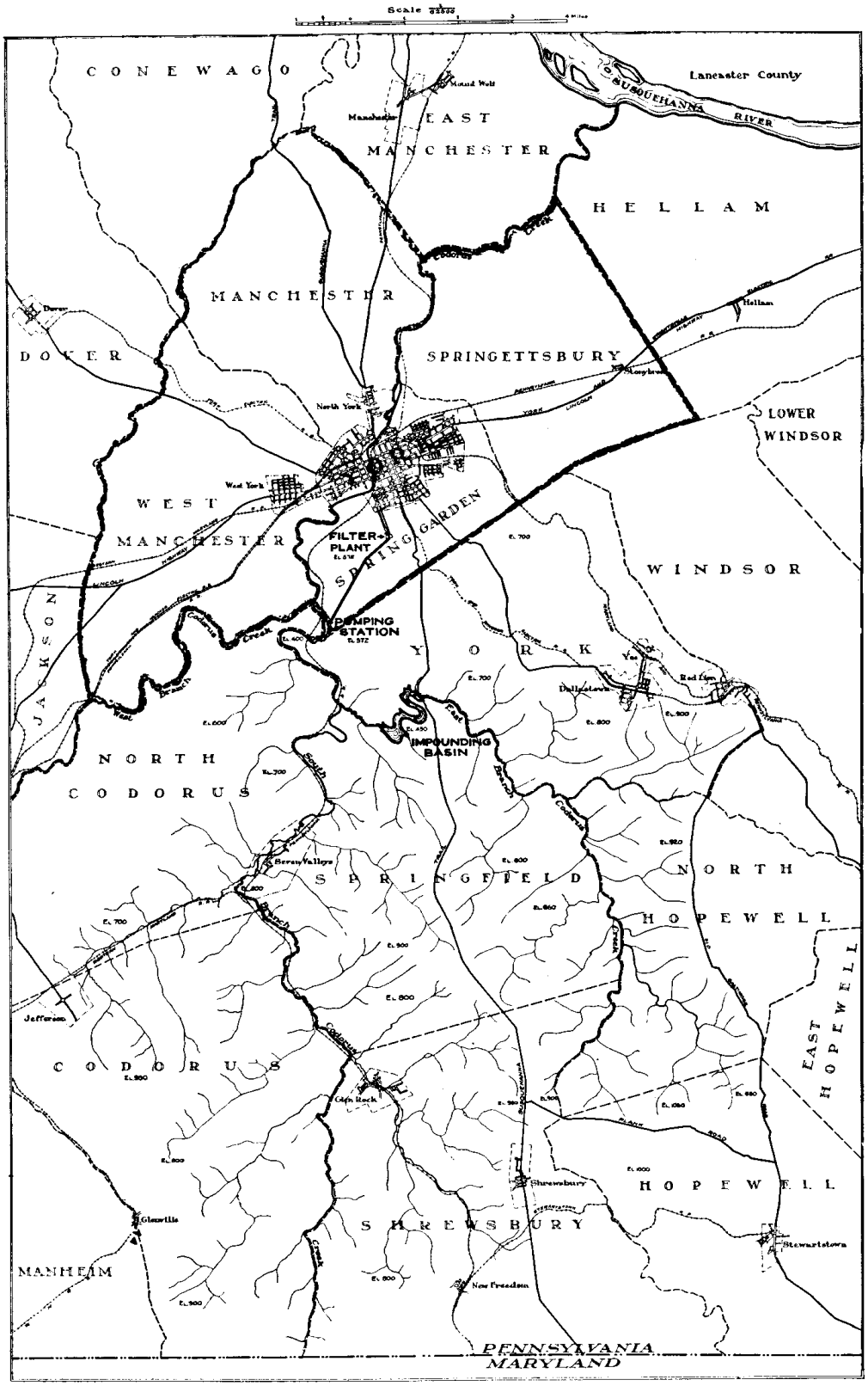
Preface

DURING the past year The York Water Company has added to its facilities two modern pumps, six filters, one boiler, has connected the third twenty inch supply main to the City, has constructed the first installment of a proposed second twenty-four inch force main which will ultimately connect the pumping station and sedimentation basins, has reconstructed eight of the oldest filters in order to prolong their useful life, and has added numerous main pipes to its Distribution System.

All these improvements, costing over $200,000.00, have been made with a view of more adequately and efficiently serving the consumers, and will greatly improve the water service for fire protection, bringing the plant to the point of its greatest efficiency and capacity.

In order to have a record of the condition of the plant as it exists upon the completion of these improvements, a description is herewith submitted and placed among the records of the Company.

Map Showing Water Shed and Territory Supplied



Introduction

ABOUT one hundred eleven years ago a number of public spirited citizens of York, having in mind the need of a public water supply for fire protection and domestic use, decided to incorporate. A special Act of Assembly of the Commonwealth of Pennsylvania approved February 8, 1816, was passed and under authority thereof on February 23, 1816, the Governor issued letters patent incorporating The York Water Company.

The water supply is the oldest public utility in existence and York's plant is the oldest privately owned plant in Pennsylvania. There were but sixteen plants in operation in the United States prior to the year 1800 and the first plant was built in Boston in 1652.

York's original works consisted mainly of wooden water mains, real estate surrounding springs, spring rights and small reservoirs, as well as some open trenches connecting the springs with the wooden mains. This equipment was from time to time enlarged and extended and in 1840 the wooden mains were supplanted with cast iron mains and during the next decade additional reservoirs were added and practically the entire works rebuilt. From time to time the Distribution System was extended, and additional pumping facilities were added, but it was not until 1895 that the foundation for the major part of the present plant was laid and the same was constructed during the succeeding four years.

The various departments are described in the order in which the water passes during the process of treatment. There are numerous auxiliaries to the various units which increase their efficiency but which are not considered of sufficient importance to discuss in this article.

In 1850 and in 1896 when major improvements were made to the plant the management was criticized by a number of the Company's stockholders for what they termed extravagance but this was not so during the construction of the last improvements when on several occasions a number of stockholders complimented the management for its forethought and wise judgment. A water works plant should be built in advance of actual needs and these needs must be anticipated, as to wait until the actual need occurs may lead to disaster and cause restricted uses of the supply resulting in hardship to the consumer.

Water Shed

The drainage area above the dam at the Pumping Station is calculated at one hundred sixteen square miles and two main streams drain this shed. The one known as the East or Dunkard Valley Branch of the Codorus Creek on which the Impounding Basin is located drains an area calculated at thirty eight square miles or twenty four thousand three hundred twenty acres. This shed comprises parts of the Townships of York, Springfield, Hopewell,

North Hopewell and Shrewsbury, the Borough of Loganville, about half of the Borough of Winterstown and the Village of Jacobus. The minimum flow from this branch was estimated by two engineers as two million six hundred sixty thousand and three million four hundred thousand gallons respectively and since the building of the dam and reforesting the slopes these figures have materially increased. This shed contains approximately four thousand inhabitants with eight hundred houses and there are no industries except cigar manufacturing plants and a few chopping mills.

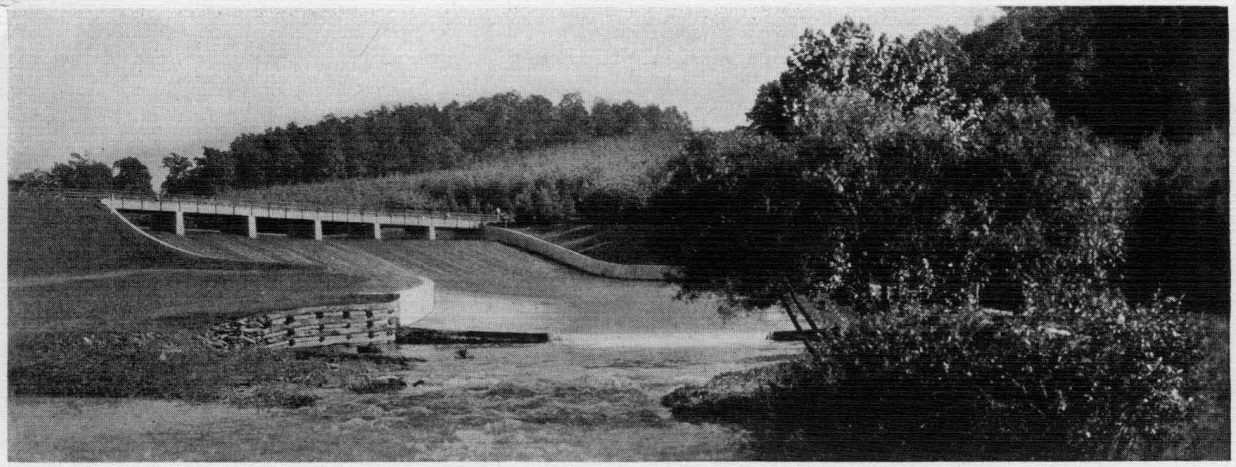
The other stream, known as the South branch of the Codorus Creek, has a drainage area of seventy-eight square miles or forty-nine thousand nine hundred twenty acres and drains parts of the Townships of North Codorus, Codorus, Shrewsbury, Springfield, York, the Boroughs of Seven Valleys and Glen Rock, about half of the Boroughs of Jefferson and Shrewsbury and about two-thirds of the Borough of New Freedom. The estimated population on this shed is eight thousand with sixteen hundred houses and there are several industrial plants including furniture, cigar and other light manufacturing.

The two streams described above traverse a very sparsely settled section of York County, made up principally of small farms and contain only two principal highways which are constructed mainly on the summits of the dividing lines between the water sheds. The other highways are in poor condition, are narrow and are not used extensively. Practically the entire sheds are owned by individual farmers and none of the boroughs or other municipalities included in these sheds has any means of disposing of its sewage and there are only a few having septic tanks. During the past year at the Company's request the Sanitary Water Board of Pennsylvania made a complete inspection under the personal direction of inspector W. E. Wounderly of Reading, Pennsylvania, and found eight sources of pollution on the South Branch which cases are now pending, being in the hands of District Engineer I. M. Glace. No cases were found on the East Branch.

Application has been made to the State Sanitary Water Board to have the East Branch placed with the class A streams in order to prevent future pollution by industries.

Impounding Basin

During the drought of 1910 it was necessary to close the Sprenkle flour mill up stream from the Pumping Station and let the water flow from that dam to help fill the one at the Pumping Station as on a number of occasions the water was so low at the Pumping Station that the pumps could not operate. This alarming situation was discussed at several Board meetings and George W. Fuller, of the firm of Hering and Fuller, Engineers, was called in consultation and inspected the available sites for an impounding basin. Philip A. Small, then President, called to his office John C. Dietz, the owner of a flour mill on the tract, which was the most valuable part of the site selected,



IMPOUNDING BASIN DAM—SHOWING SPILLWAY

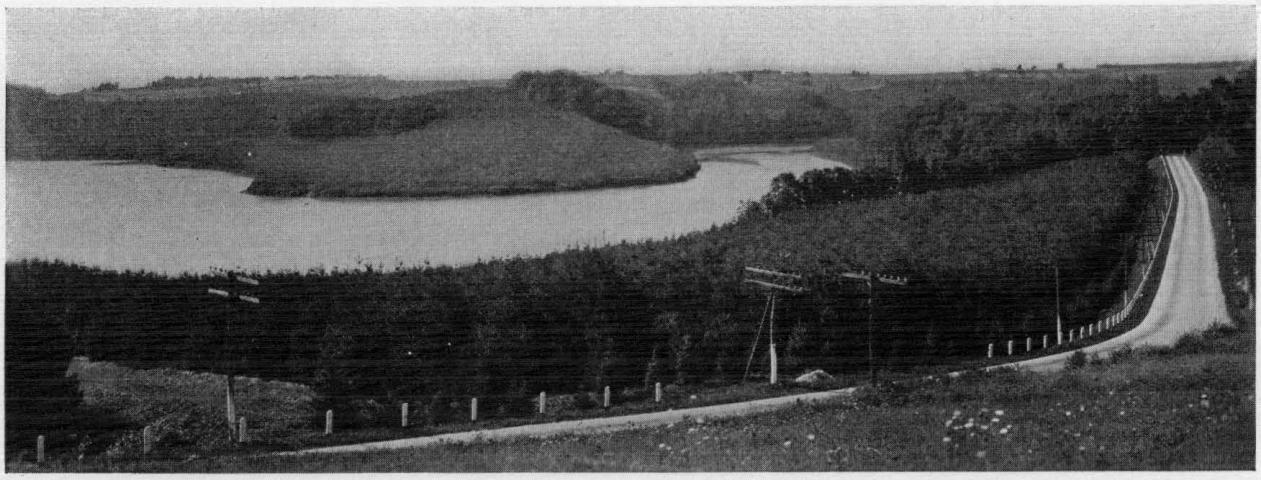
consumated the purchase of his property and engaged Mr. Dietz to act as agent in the purchase of the remaining necessary land, which he did with dispatch and at prices considered reasonable. Several surrounding tracts have since been acquired.

The land being purchased, consideration was given to the building of a dam. The plans were made public and immediately protests were heard of possibilities of the dam breaking during time of floods. The safest construction known with ample spillway to care for the flood waters and a concrete core wall to prevent the burrowing by animals was planned. The protests reached the Water Supply Commission of Pennsylvania which supervised the building of all dams in the state and at its suggestion there was included in the plans the building of a clay puddled cut-off wall at the end of the fill on the up-stream side of the dam.

The contract for building the dam was let to Stamper-Ragland & Co., Richmond, Virginia, and Ned H. Sayford represented Hering & Fuller as Resident Engineer. The one hundred seventy acres to be flooded were cleared of all growing timber, fences, and buildings of all descriptions, and all barn yards were carefully cleaned and large quantities of hypochloride of lime were used to disinfect the same. All stumps of trees and undergrowth were removed at and near the flow line. As a result of these precautions no complaints were received from the consumers of odors or taste in the supply.

It was also necessary to vacate some public roads and to construct new roads, which was accomplished without great difficulty.

The dam was completed January 7, 1913, the valve on the pipe line at the bottom of the dam was closed and the water turned in and the basin after twenty-eight days became completely filled February 4, 1913. At this time small jets of water spouted several inches high from the joints on the floor of the spillway and during the next few years there was fear of there being a leak through the dam. Rudolph Hering, who in the meantime had dis-



REFORESTING AND LAKE

solved partnership with Mr. Fuller, was retained to make an examination. Although he expressed the belief that there was no danger from this small seepage which was gradually lessening yet it was the spring of 1915 before the source of this trouble was determined as coming from the joint where the retaining wall sets on the spillway floor.

During the first winter the dam was filled, ice formed one and one-half to two feet thick and visions of a great ice flood destroying the dam were pictured in the minds of a number of those inside the Company as well as outside but when the ice remained intact until the late spring it was clearly shown that there was no swift current on any part of the water and this fear was quickly allayed.

The dam is forty-seven and one-half feet high and about seven hundred feet long, being built between two hill sides, and contains nine hundred million gallons. The greatest depth of the water is forty feet and the greatest width thirteen hundred five feet. The entire tract contains six hundred ninety-two acres which formerly consisted of eleven farms and three wood lots.

The elevation of the water when the dam is full is four hundred fifty feet above sea level. The highest water flowing over the dam was three feet two inches on March 5, 1920.

On the borders of the tract four sets of buildings have been permitted to remain with a view of furnishing better protection to the growing trees by having help at hand at all times. One tract (Williams Farm) contains twenty acres, another (Steigler Farm) contains ten acres, and the other two several perches each. One of the latter is being used as the home of the caretaker.

The caretaker resides in the large brick house near the iron bridge on the Susquehanna Trail. During the planting season and summer months, additional help is secured from the surrounding territory and the Charles S. White Detective Agency protects the tract from trespass and tree theft.

Reforestation

After the dam was filled another problem presented itself, that of preventing erosion of the soil from the slopes surrounding the basin. The planting of the slopes with grass was suggested. The planting of trees was also suggested and after consulting prominent authorities on picturesque planting, Professor J. W. Toomey, Director of Yale Forest School, was consulted, outlined a comprehensive program and was very reluctant to take any compensation for his services. Professor Toomey is consulted almost annually and takes a great pride in the success of the planting. The wooded tracts were allowed to remain, except that all chestnut and soft woods were cut down, and where the tracts of deciduous trees reached the flow lines a border of Norway Spruce was planted to check the leaves from entering the basin.

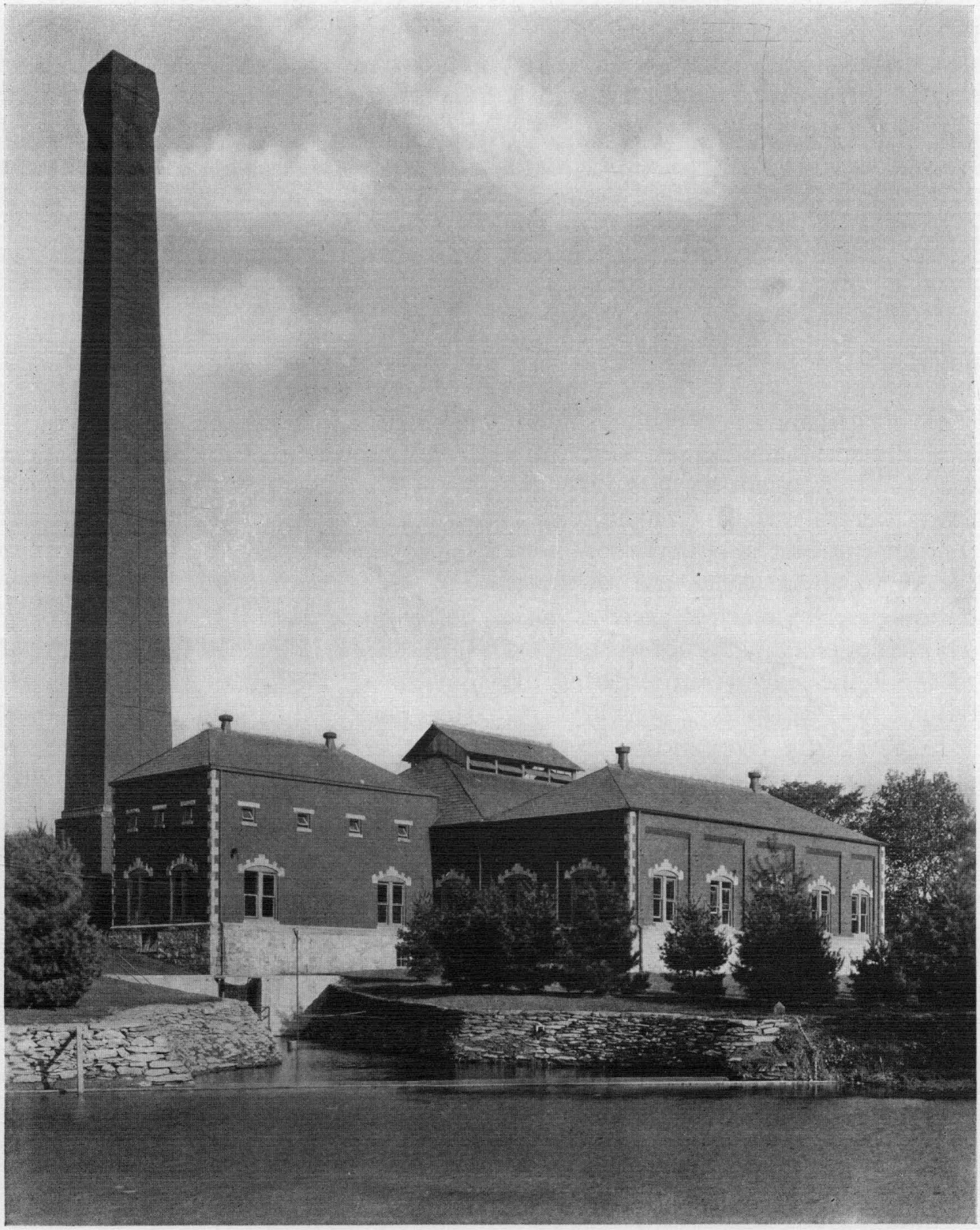
In 1913, fifty thousand white pines and five thousand Norway Spruce three year transplants were set out, followed by one hundred thirteen thousand, one hundred thousand three hundred and twenty-five thousand evergreens in the succeeding three years, and as additional tracts were purchased they were planted in the same manner until today there are planted on the tract over six hundred thirty thousand evergreens which are in a most flourishing condition.

On January 8, 1925, Dr. C. A. Schenck of Darmstadt, Germany, at one time Director of the Biltmore Forest School of Biltmore, North Carolina, and a forester of international reputation, visited the tract and made the statement that it was the best example of reforesting of evergreens in the world. Through the courtesy of the Pennsylvania Department of Forests and Water much publicity has been given this tract in the leading forestry magazines of America and Canada, and no less a personage than a President of The Pennsylvania Railroad Company as well as a number of other distinguished persons have been attracted to the planting by these articles.

The trees are inspected several times annually by the State Department of Forests and Waters, and the White Pine Weevil and Sun Scald, neither of which was serious, were the only ailments found; but the hazard causing the most concern is that of fire. Two fires occurred, one in 1915, caused by the Caretaker burning brush, which spread over about one acre of European Larch trees planted the previous summer, and the other in 1925 when a State Department of Highway workman was burning brush along the Susquehanna Trail. This spread over four acres of Red Pines about three feet high. The State made satisfactory settlement for this loss. Numerous fire fighting tools, including rakes, axes and liquid and dry chemical extinguishers, are kept for instant use and the local fire wardens are within call at all hours. The fire department of the village of Jacobus is also subject to call.

Pumping Station

The first source of supply requiring any mechanical pumping was the Codorus Creek and adjacent springs



PUMPING STATION

near King's Mill Road at the present pipe yard. This station augmented the supply from the original "Peter Small Spring Tract" to the Queen Street Reservoirs from 1849 to 1897, when the present pumping station located southwest of York and one mile north of Brillhart Station in Springgarden Township was erected. When this site was selected no consideration was given the matter of filtering the water as mechanical filtration was in its infancy and the controlling factors were:

(1) That the site be along the Codorus Creek at a location practically free from contamination.

(2) That it be near a Railroad.

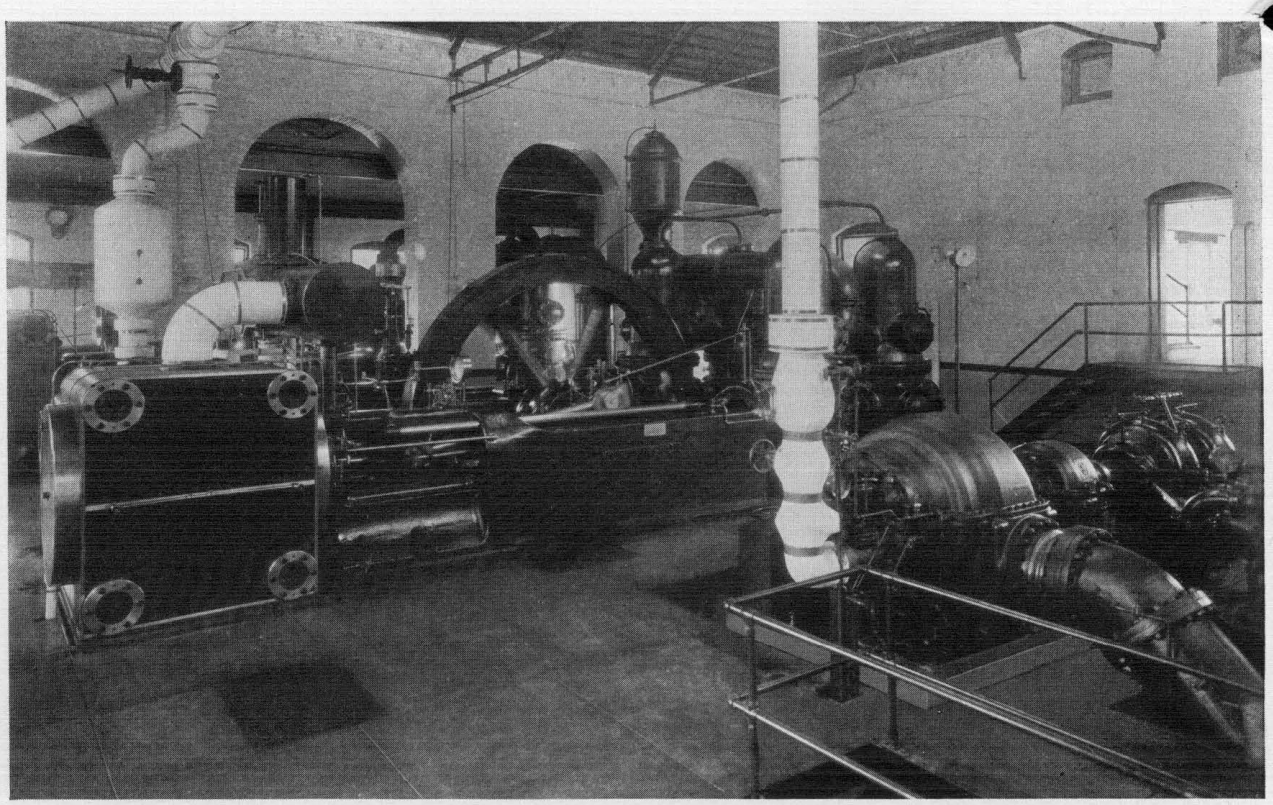
(3) That it be some distance from the built up section of the City but yet not too far from the proposed reservoir.

The tract contains eighteen acres, eight and two tenths perches, and was purchased from Leander Minnich on May 22, 1896.

The Sprenkle Mill located about one mile up stream, which had been purchased in 1895, was also considered as a probable site but due to its greater distance from the reservoirs, was abandoned, and held until 1918 when it was sold, the water rights, however, being retained.

Plans for the station were designed by Charles A. Hague, Engineer, and the dam as well as the building was erected mostly by local labor. The dam consists of a rock filled timber cribbing approximately six feet high and seventy-one feet wide. This dam was built in 1896 by Frederick Arnold at a cost of $375.00 and is in excellent state of preservation. During the thirty years of its life there has been very little maintenance required. The intake channel connecting the dam with the station wells is approximately ninety feet long and eight feet wide. On the outside, near the building, there is a twenty-four inch terra-cotta pipe connecting the channel to the by-pass around the dam to permit ease in cleaning this intake channel. The by-pass around the dam which is controlled through timber head gates permits of running off the water from the dam very rapidly in case of repairs or cleaning of the wells. Before the water enters the building all large floating substances are removed by two sets of wire screens which must be cleaned frequently in the Autumn season when the leaves are falling from the trees and floating on the stream.

Just inside the station the water from the intake flows into a circular brick lined well thirty feet in diameter and twenty feet high from which the water passes by gravity into the individual wells at the suction ends of the pumps. This large well removes a certain amount of turbidity from the water and is cleaned out annually when two or three feet of sediment is removed by a steam ejector. A water tight wall approximately four feet above the present engine room floor surrounding the entire building excludes the water from inside the station until the water rises in the dam to thirteen feet ten inches. The highest flood experienced



PUMPING STATION— INTERIOR VIEW

since the station was built was seven and two hundredths feet on March 5, 1920, and reached the ground level of one corner of the building. The brick stack which is designed to take care of six hundred horse power boiler capacity was built by Horace Epley, local contractor, and in its time was considered quite a feat, its height being one hundred fifty feet. It is fifteen feet square at the base.

In 1912 the copper lightning rods extending from points above the top of the stack to the water level below its foundation were designed by C. E. Pim and erected by a Mr. Hassler. In 1921 the copper points were renewed and the top of the stack was plastered with cement mortar by Walter Bosswell.

In 1896 two Worthington triple expansion pumping units of two hundred fifty horse power each and with a capacity of five million gallons per twenty four hours each were installed by Henry R. Worthington, Incorporated. At the same time two Campbell and Zell boilers with a combined capacity of four hundred horse power were installed to furnish the power to operate these two pumping units. This equipment was first put in operation on April 23, 1897, and served all demands well until 1914 when an eight million gallon Snow cross compound pumping unit was added as well as a three hundred twenty horse power Sterling boiler. At this time it was necessary to enlarge both the engine and boiler rooms. The two original Worthington pumps were operated alternately each week until the Snow pump was installed, when they were used as standby units and

operated only at such times as repairs were made to the Snow unit.

As the output increased it became necessary that increased facilities be provided. After a study, Fuller & McClintock, Engineers, recommended the installation of a six million gallon Snow cross compound pumping unit similar, except as to size, to the present eight million gallon Snow pump, and an eight million gallon steam turbine driven centrifugal pump. These recommendations were not accepted until a complete study was made as to the relative cost of electrically operated pumps against steam driven units.

Before these two new pumping units were installed, the two original Worthington pumps were removed as well as the two original Campbell and Zell boilers, the latter being replaced with a Badenhausen Boiler with a capacity of two hundred eighty horse power. This new equipment, together with the eight million gallon Snow pumping unit and the Sterling boiler, now meets every need and slightly less than five hundred gallons of water is being pumped with each pound of coal consumed. It is necessary to pump the water to an elevation of three hundred eight feet and a distance of over two miles.

The grounds surrounding the buildings are planted in evergreens and other trees and the lawns are well maintained.

The railroad siding connecting the main tracks of The Pennsylvania Railroad Company with the coal trestle is about one thousand feet long and permits the handling of coal and other supplies to the best advantage. There is constantly maintained several months' supply of coal as a protection against strikes, car shortage or "run-a-way" markets, at least one of which occurs almost annually.

The buildings and stack are constructed of common red brick with lime stone trimmings, the roof of slate on steel trusses and all floors of concrete. Besides the window sash, frames and doors, all other construction material is fire proof.

The water leaving the station is measured through a Venturi meter manufactured by the Builders Iron Foundry and this meter consists of a Venturi tube with an eleven inch throat on the twenty-four inch force main. A similar type meter manufactured by the Simplex Valve and Meter Company is connected to the discharge end of the centrifugal pump.

There is a tradition that in 1849 a certain John McLaughlin, while sitting on a bench in the boiler room of the original Pumping Station along King's Mill Road, smoking his pipe, was approached by one of the engineers who was testing the new pump and boiler and asked to furnish fire from his clay pipe to start the fire beneath the new boiler.

This fire continued burning until the boilers in the present Pumping Station were completed in 1897, when some of the fuel was carried by the late Superintendent, Jacob L. Kuehn, in a plumber's furnace, from the old station to the new one, where the fires in the present boiler room were kindled and have never since been extinguished. If the story is true, the fire from the Com-

pany's first steam pumping unit in 1849 has been burning continuously for seventy-seven years.

Force Mains

While the Pumping Station and Sedimentation basins were being constructed, a force main connecting the two was laid. The necessary rights of way through a strip of land thirty feet wide and over the most direct route was purchased from the property owners, after a survey by James G. Durbin. This right-of-way is not restricted to the present main but also includes additional mains. It traverses some of the most valuable property surrounding the City of York, a considerable portion of which is the grounds of the Country Club of York, Pennsylvania. The line was constructed in 1896 of twenty-four inch coated cast iron pipe with lead joints and is eleven thousand three hundred nineteen feet long. At four summits on the line were placed vertical pipes to relieve the line of any air which might become entrapped. Experience has shown that this was not necessary and two have already been removed and the others plugged at the top.

During the life of this main, which is now thirty years old, not a single piece of broken pipe was found although numerous leaks occurred at the lead joints in years past.

A second force main, to insure uninterrupted service during the time of any necessary repairs to the original line, is under contemplation for construction during the next few years, and having this in mind, short pieces aggregating six hundred feet were placed beneath the several greens on the new country club grounds during the past summer. The highest point on the force main is six hundred sixty feet above sea level.

Stand Pipe

The construction of the sedimentation basins was delayed through litigation with the contractor, and shortage in the supply threatening, it was deemed necessary to erect a standpipe adjoining the force main in order to temporarily supply the City in case of necessity and therefore a steel riveted standpipe twenty-five feet in diameter and thirty feet high with a capacity of one hundred ten thousand gallons was erected in 1897 on the Reservoir tract. This unit is not in actual use although it is well maintained and in excellent condition in case of emergency. The elevation of the bottom is six hundred thirty-six feet above sea level.

Aerating Fountain

The water from the force main empties into a small circular basin directly south of the two sedimentation basins through a vertical pipe forty-eight inches in diameter and approximately thirteen feet high. The water flows over the top of this pipe to a rockery surrounding the same, breaking into a fine mist and liberating certain objectionable gases and odors from the water. The popular belief has been that this part of the plant was for ornamental purposes, whereas in fact it is serving one of the most useful pur-

poses in water purification,—that of aeration.

Sedimentation Basins

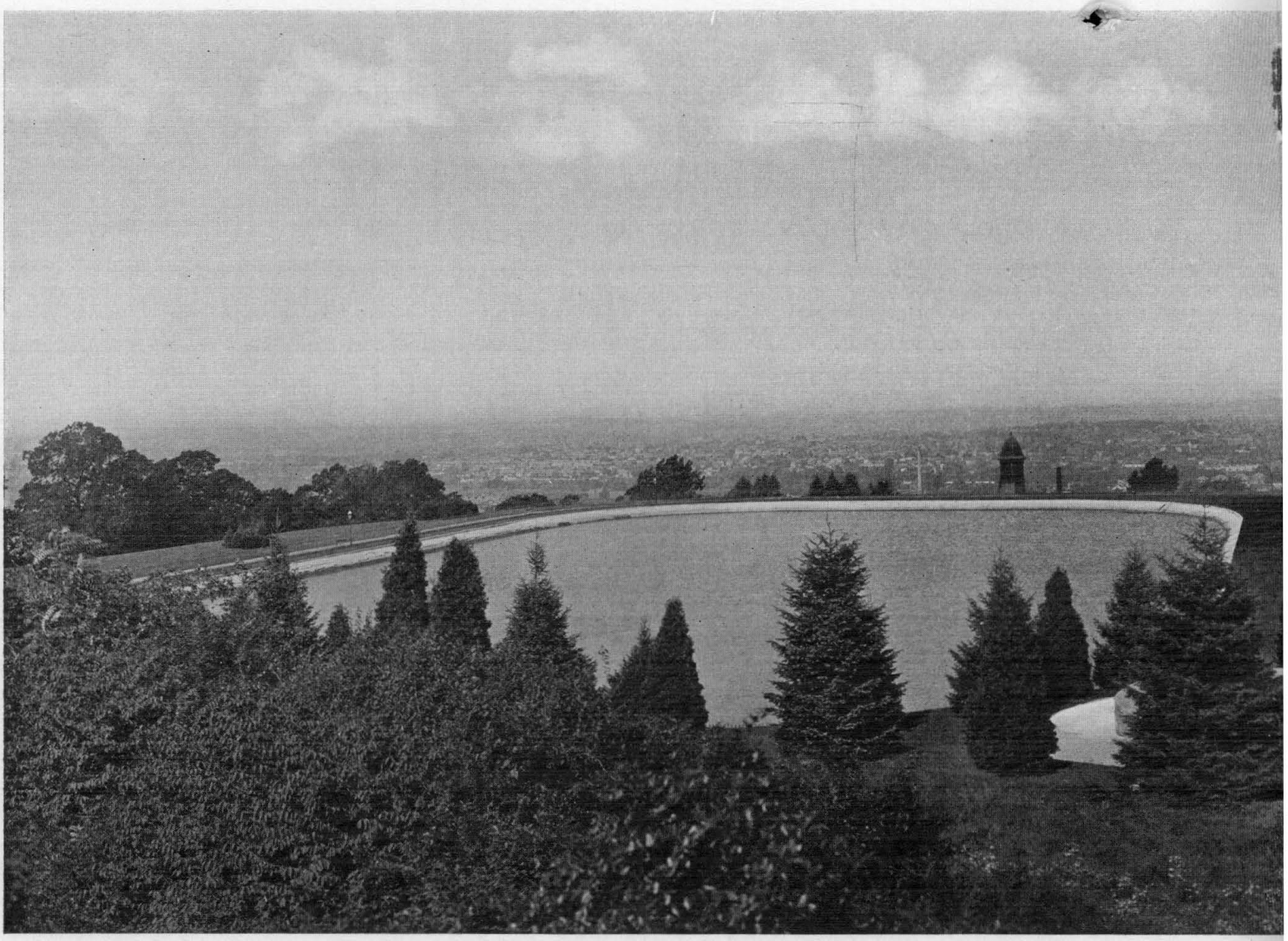
When the sedimentation basins were designed the matter of mechanical filtration was still undecided and it was hoped that the retention of the water in one of the two basins alternately would settle the water sufficiently to permit its delivery into the City, the basins being designed to settle all the heavy suspended matter in the water.

On April 16, 1896, a contract was let with John Berkery of New York, for the erection of two sedimentation basins in accordance with plans prepared by Charles A. Hague, Engineer, and after numerous delays, in the fall of 1897 the contractor discontinued further work and the contract was cancelled. On October 4, 1897, John Birkinbine, Engineer, of Philadelphia was employed to make plans for the completion of these basins and the strengthening of the wall separating them, and his brother, Henry Birkinbine, was selected as Resident Engineer. As the Queen Street reservoirs were leaking badly, causing considerable damage to adjoining properties and as the supply into the City was very uncertain, on the recommendation of John Birkinbine, the Company decided to build a partition wall in the west basin so that ten feet of water could be retained in one end while the other end was being constructed. A ten inch pipe line was laid in the bottom of this wall controlled by a gate valve. In the fall of 1899 an additional pipe twelve inches in diameter was laid parallel to the ten inch line.

The east basin measures at the top curb line four hundred thirty by two hundred seventy feet and the west four hundred seventy-five by two hundred forty feet, and each are approximately thirty feet deep. The sides are tapered and are lined with puddled clay and faced with hard brick set on ends supported on a cushion of two inches of sand which in turn rests on the clay.

The brick work above the flow line is treated to a cement washing annually to prevent the growth of grass between the bricks and the washing away of sand. For a number of years prior to 1917 these basins had been cleaned annually, usually in October, but at that time it was found that in washing down the slopes considerable sand was washed to the bottom and this practice has been discontinued without any bad effects and there is today an accumulation of not over one and one-half inches of finely dissolved clay on the bottoms. These basins have a maximum capacity of approximately forty million gallons. It is the practice to have the water delivered into the south end of the west basin and draw it out of the north end of the east basin. This method permits the greatest retention in the basins although there are some direct currents which deliver some of the water through the basins within a few hours.

At the outlet of the east basin is a steel flume with three slide gate valves which permits the water to be taken from the top, bottom or middle as may be found desirable.



SEDIMENTATIO

Filter Plant

The sanitary quality of public water supplies generally was considered only slightly prior to 1890 and appearance was all that was desired. If the source was from surface springs and streams, as in York's case, the supply would be turbid following rains. The epidemic of cholera in Hamburg, Germany, about 1892, when the medical profession attributed the cause to the public water supply, and about the same time, numerous epidemics of typhoid fever occuring in the United States, showed the necessity for improving the sanitary quality of public water supplies.

The results obtained in the reduction of typhoid fever death rate in several New England towns where filters had been installed was remarkable, causing a new impetus to this branch of water works practice.

In the early nineties infiltration galleries were constructed in the intake to the pumps beneath the present Penn

ON BASINS ON RESERVOIR HILL

Street bridge and consisted of passages filled with knacked stone through which the water flowed. This removed the heavier suspended matter but after each rain the turbidity was high in the supply to the City.

In 1898 it was decided to install filters and accordingly a contract was let on October 20, 1898, with New York Filter Manufacturing Company for the erection of eight mechanical high type Jewell rapid sand filters, which although the third mechanical filter plant in Pennsylvania, yet was the first successfully operated plant. A suitable building was erected at the same time to house these filters, with room for expansion.

Work was pursued during the winter of 1898-1899 and at ten a. m. March 13, 1899, the first filtered water was turned into the City. Each filter consists of a circular tank sixteen feet high and sixteen feet in diameter made of the best quality of red gulf cypress lumber three inches in thickness, and rests on

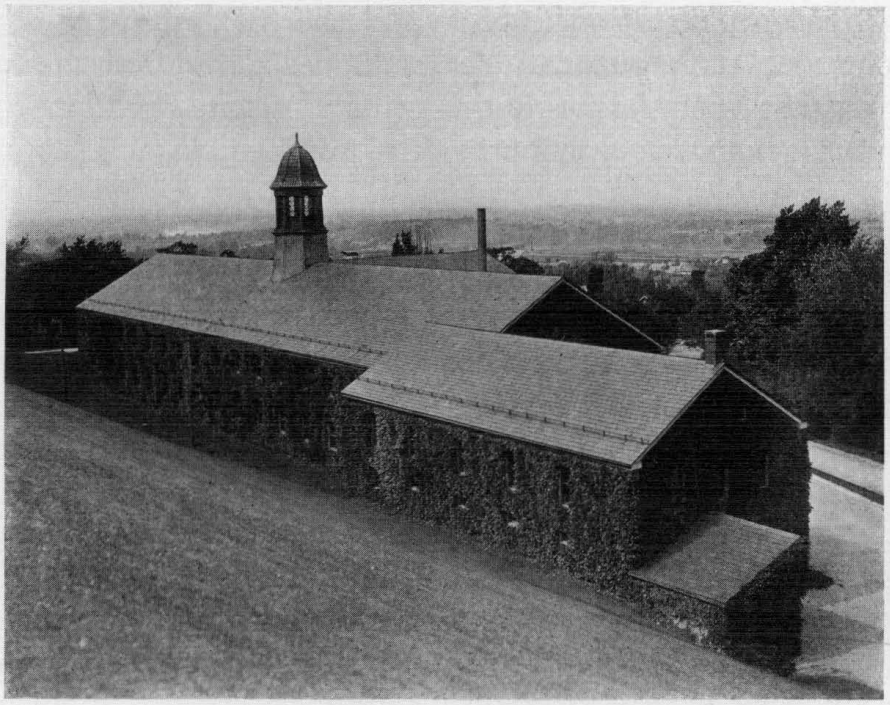
ten inch steel I-beams. Surrounding the staves are twelve round iron bands one and one-eighth inches thick and two flat bands one-fourth inch by four inches which are tightened with heavy bolts to prevent spreading. The lower half constitutes the coagulating chamber where the raw water enters after the coagulant known as sulphate of alumina is introduced at the rate of about one-half grain per gallon of water. The chamber is designed to retain the water for a period of twenty minutes. The coagulant is rapidly decomposed by the alkaline compounds and forms soluble sulphates of lime and magnesia, liberating equal amounts of carbonic acid and alumina. The latter unites with the water, forms the insoluble, white jelly like substance known as aluminum hydrate and has the property of drawing out of the solution dissolved color and suspended matters and massing them. As this mass is heavy it settles quickly to the bottom of the chamber and is washed to the sewer occasionally with the aid of the fire hose streams.

The upper half of each tank contains the sand and gravel beds, strainer system and wash water trough. The sand is thirty inches deep and is ocean sand carefully graded from one-half to one millimetre. The gravel is fifteen inches deep graded from three-sixteenth of an inch to one and one-fourth inches. The strainer system on which the gravel rests consists of galvanized iron pipes two inches in diameter containing small perforations through which the water passes.

The partially filtered water after leaving the coagulating chamber flows up through a ten inch vertical pipe located in the center of the upper half of the tank and overflows into the sand bed. It then percolates through the thirty inches of sand and fifteen inches of gravel, passes through the perforations in the lateral piping and out into the clear water basin. From the time the water enters the filters until it is tapped by the consumers it is not exposed to the air or sunlight. The coagulated matter will not pass beyond the top of the sand bed.

The filters are designed to remove all color and turbidity and ninety-seven percent of bacteria present, and the remaining three percent are removed by the use of chlorine gas introduced into the supply line to the filters.

After the filters are operated, the length of time depending on the quality of the water, the sand beds become clogged with the coagulated substance and it becomes necessary to remove it by washing. A Gould centrifugal pump with a capacity of seventeen hundred fifty gallons per minute operated by a fifty horse power Westinghouse electric motor is provided for this purpose. Filtered water is pumped through the strainer system up through the gravel and then through the sand to the upper compartment of the filters from which it overflows in a trough around the sides of the filters and is washed to a sewer. This reverse action causes the sand to become suspended in the water and with the aid of mechanically operated iron rakes, four feet long, which revolve in the filters, the sand bed is completely broken up and thoroughly cleansed of objectionable matter. This



FILTER PLANT—EXTERIOR VIEW

does not mean however, that the individual grains of sand are free from the film of a jelly-like substance which forms after being in use for some time and which is very essential to proper filtration.

The time required to clean a filter is normally five minutes and the rake agitators are operated about four minutes of that time. The water consumed in washing is about three percent of all water filtered. A filter will require washing after being in service from two to forty-eight hours depending on the condition of the water and rate of filtration. The wash water from the filters enters sewer lines, is conveyed to the ravine on the western side of the reservoir property and flows to Tyler's Run.

Four additional units of the same type and made by the same manufacturers were installed in 1907 and two more in 1922. In 1925, six more were installed by the Roberts Filter Manufacturing Company. These have several minor improvements, including rate controllers by which the rate of filtration can be changed by merely moving a weight on a beam, whereas in the case of the remaining fourteen it is necessary to remove metal discs bolted in a funnel shaped flume.

The type of filters in use has several advantages over a number of the so-called modern types in that the sand beds are thoroughly washed and any "sand balls" which may form are promptly torn to pieces by the positive mechanical rake agitators. The agitators, which revolve at the rate of seven times per minute, are connected with a belt to a pulley on a shaft and two seven and one-half horse power General Electric Motors furnish the power for operation.

The normal rate of filtration is ten million gallons per day, but can be doubled with success when the turbidity of the raw water is not over forty parts per million.

Mechanical filtration, which undoubtedly is the greatest improvement in water works practice in many years, was received by the average consumer in the beginning with distrust due to the use of chemicals and the doors of the rooms containing the chemicals were locked to all but employees. Numerous complaints were received from all classes of consumers that the water contained alum. To support their contention they exhibited water taken directly from the faucet which had a white or milky appearance. This was nothing more than air which occasionally entrapped in the pipes, although it was a number of years before this complaint was allayed through a patient and persistent campaign of education, thanks largely to the efforts of the medical profession. All parts of the plant are now open to the public which is taking a greater interest by inquiring about the numerous operations required to properly prepare its water supply.

Three Venturi meters manufactured by the Simplex Valve and Meter Company, register the water passing through the three supply mains into the City and it is interesting to note on the charts the variation in the output at different times during the day, it being low during the night and high during the day.

The average daily output is six million three hundred thousand gallons and the maximum for 1926 was eight million six hundred thousand and the minimum three million eight hundred thousand gallons.

Laboratory

A room in the filter building houses the high and low temperature incubators, refrigerator, microscope, still, color standards, potential hydrogen comparator, autoclave, chemicals and numerous other apparatus used in the bacteriological and chemical examination of water.

Samples of the water before and after filtration are collected daily and the regular practice of analysis is that laid down by the American Public Health Association. Samples are taken from two points on the distribution system and also just before entering the system.

Tastes and odors cannot be determined mechanically and personal observation with the microscope is required to determine their origin, usually due to small microscopic vegetable growths which thrive in the sunlight. The organisms most common in York's water are from the protozoa group which cause a fishy odor. As soon as there is evidence of their presence, a solution of copper sulphate in the proportion of one pound to three hundred thousand gallons of water is applied at the Pumping Station. These organisms then die, throwing off an oily substance from which an odor arises which is mostly released by aeration.

The amount of coagulant (sulphate of alumina) depends upon the amount

of turbidity in the water and the experience has been that one-half grain per gallon is the minimum amount which will produce a satisfactory "flock" to properly coagulate the suspended matter. The amount of chlorine gas required is dependent on the bacteria present and the temperature of the water. A larger amount is required when the temperature is low. The average is two to three pounds per million gallons.

MINERAL ANALYSIS

of

Sample of water taken from the mains of The York Water Company

by

Department of Interior—
U. S. Geological Survey
June 10, 1922

	P. P. M.
Silica (SiO_2)	6.0
Iron (Fe)	.18
Calcium (Ca)	6.8
Magnesium (Mg)	3.2
Sodium (Na)	2.0
Potassium (K)	1.0
Bicarbonate radicle ($H.CO_3$)	15.
Sulphate radicle (SO_4)	11.
Chloride radicle (Cl)	4.0
Nitrate radicle (NO_3)	5.3
Total dissolved solids at 180° C	50.
Total Hardness as $CaCO_3$ (Calculated)	30.

Only slight changes have been found in the mineral content of the supply during the past twenty-five years.

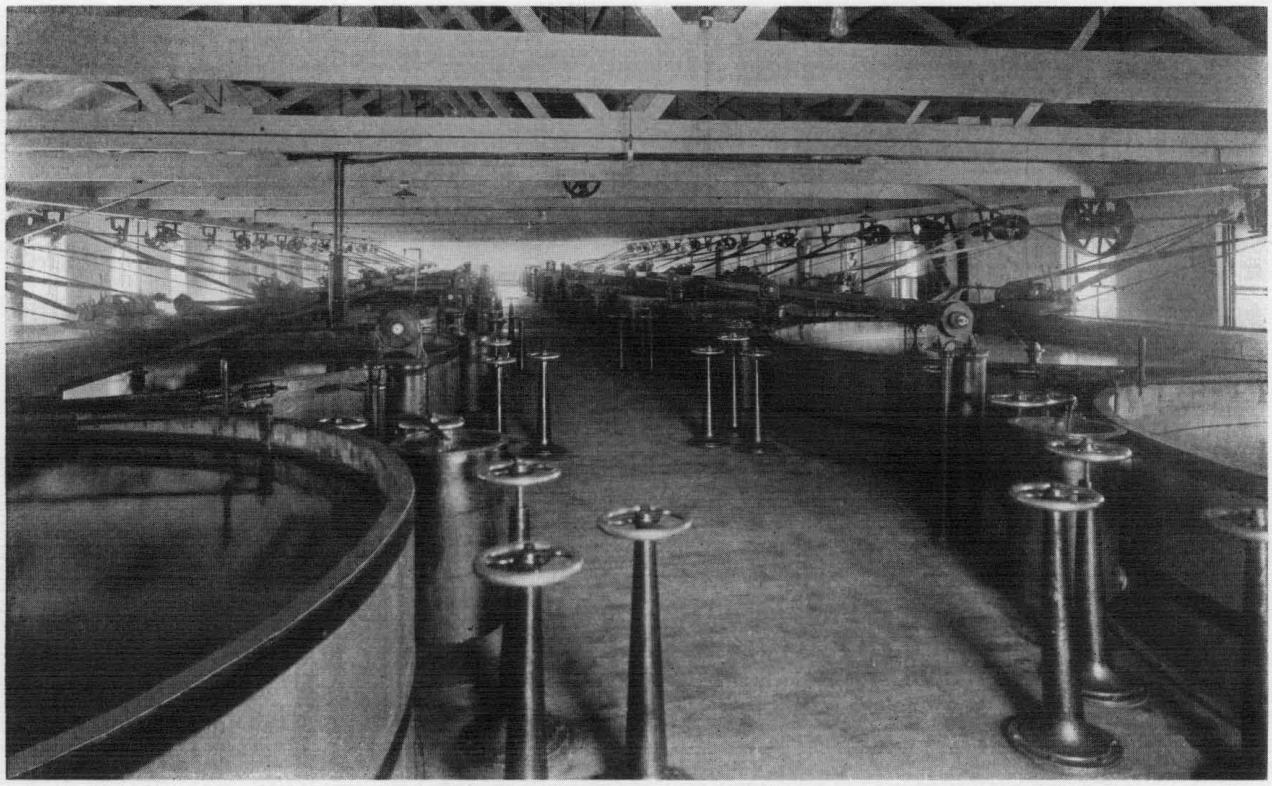
Water is naturally a corrosive substance and considerable development has been made in the past three years in the treatment to protect the metals used in conveying it. It has been found that all waters are positive or active, or negative or inactive, in action. A measurement of such activity has been devised and is called Hydrogen Ion Concentration.

The Company has caused studies to be made of its supply and has installed temporary apparatus, so that if at any time the water is found to be "active" such condition is corrected by the addition in the filtered water of a small amount of soda-ash (sodium carbonate), of which a supply is constantly maintained. No change is produced either in taste or appearance by this addition but it does retard the corrosive action of the water.

Clear Water Basins

In connection with the building of the Filter Plant a small clear water basin with a capacity of two hundred thousand gallons was built in the basement of the filter building beneath the eight original filters. This was soon found inadequate and in 1901 a clear water basin of brick arch construction covered with about three feet of earth was constructed to the east of the filter building having a capacity of about two million gallons. By reason of this basin being covered the temperature of the water delivered into the City is several degrees lower during the warm weather than otherwise would be.

Both basins are normally kept filled to capacity and the water used in washing the filters is drawn from the small basin. The object of the clear water basins is to have at all times a



FILTER PLANT—INTERIOR VIEW

supply of water under gravity pressure connected to the Distribution System, which requires no further attention, for use in emergency such as a large fire.

Reservoir Grounds

The grounds surrounding the sedimentation basins and filter plant contain seventy-two acres, are appropriately planted in evergreens, deciduous trees and shrubbery, and contain excellent lawns and well laid out drives and walks. This entire acreage is open to public use and during the summer months is used extensively by Sunday School classes and others as a picnic grounds. The hillside during snowy weather affords an excellent play ground for the folks who enjoy coasting or skiing and it is common to see hundreds of persons on a Sunday afternoon enjoying these sports. It being the highest place easy of access, surrounding the City, visitors are usually taken to the top of the hill in order to get a view of the City. There is a frontage along the Country Club Road of approximately twelve hundred feet, and the neighborhood is a very desirable residential section.

Supply Mains

In 1897 and 1898 two twenty inch supply mains were constructed connecting the force main, sedimentation basins and filter plant with the Distribution System. Each is about twenty-five hundred feet long and laid in line with Jessop Place and Newberry Street as projected to the south.

A third supply main was put in operation during the past year when

the twenty inch line which had been conveying the wash water from the filter plant to the creek since 1901 was utilized for supply purposes. This addition added six pounds to the average pressure on the Distribution System during the peak loads of the day as recorded on the gauge in the general office, and was one of the most important improvements in recent years as it greatly improves the water service for fire protection.

Distribution System

The original pipes used to convey the water from the reservoir through the highways were made from trunks of trees with a hole bored through the center. These trunks were joined together with a small "barrel" made of iron by local blacksmiths and an iron ring was driven into the body of the trunk at each end near the surface to prevent splitting. These trunks were purchased at the different river landings for as low as seven cents per lineal foot and were required to be ten inches in diameter at the smallest end.

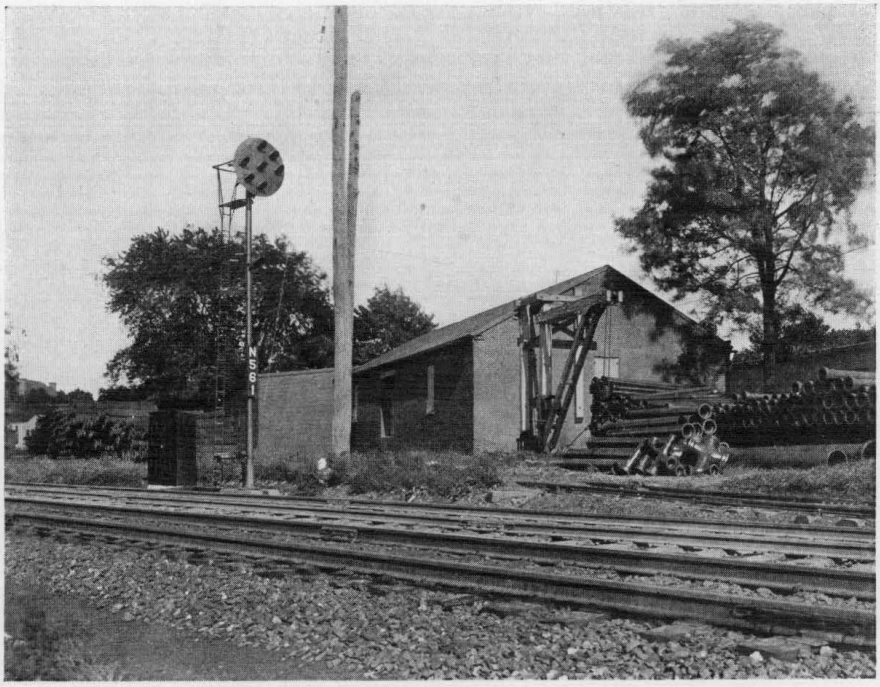
After twenty years use considerable leakage of water occurred in the wooden mains and when a greater supply was necessary to meet the growing demands, cast iron mains were adopted in 1840. Prices on the necessary pipe were secured and a contract made with Small and Geiger, now Smyser-Royer Company, North Beaver Street as follows:

7	inch	calibre	$1.10	per foot
6	"	"	.80	" "
5	"	"	.65	" "
4	"	"	.50	" "
3	"	"	.37½	" "

The first valves to control the water in the pipes were purchased at the same time and the pipes were ordered to be laid at a depth of three and one-half feet. The first cast iron mains were laid on Queen, High (now Market), Duke, George, Beaver, Water, Philadelphia, King and Princess Streets. This required eleven thousand four hundred thirty-six feet and was the foundation for the present Distribution System. A small amount of this original iron pipe has not been disturbed since originally laid in 1840, being the main on West Market Street just west of Water Street still in use and giving good service after eighty-six years. Some of the three inch pipe laid on Water Street in 1840 or 1841 just north of Market Street was replaced during the past year with an eight inch main. It may be of interest to note that when laying this eight inch line on November 19, 1926, the original wooden main laid in 1816 was encountered and a section removed. Thus we see that at this location the consumers were served through but two different pipe lines in one hundred eleven years, and the new eight inch main should last indefinitely.

In years past it was the custom where a main became inadequate to salvage the pipe when laying the new main and to lay the old pipe in the alleys or short streets.

The Distribtuion System consists of one hundred four miles of cast iron pipe from twenty-four inches to two inches in diameter laid below the maximum frost line, viz., thirty-six inches, and except about seven hundred feet in which "leadite," a joint compound was used,



WAREHOUSE AND PIPE YARD

all pipe is jointed with a soft quality virgin lead.

Approximately twenty-five percent of the present distribution pipe system is laid on a rock foundation and it was necessary to blast through the stone in order to lay the pipe to a proper depth.

The first pipe line crossing the creek was that at Market Street under the present bridge, which consisted of a five inch pipe purchased from S. Bechtel and Company for fifty-nine cents per foot "delivered on the line of the works." The coffer dam was built by John Kerr, contractor, at a cost of $175.00, and the line was completed to the western side of the creek on July 4, 1851. As described in the report of the Committee having this line in charge it was completed three fourths of a century after the Declaration of Independence of the Unites States, and although on July 4, 1926, just a few months back, we celebrated the Sesquicentennial of this memorable event, the pipe line continues to give good service and has not been disturbed since it was laid seventy-five years ago.

Since that time five additional pipe lines were laid under the Codorus Creek as follows: a ten inch main at North George Street, a twelve inch main on West King Street, a fourteen inch main on West Newton Alley, a twenty inch main at Newberry Street and a twelve inch main on South Richland Avenue.

The specifications for all pipe used in recent years conform to the American Water Works Association standard as to grade and thickness of metal, method of casting, material for and method of coating. The pipe is tested to three hundred pounds pressure and each length has cast near the end, on the outside, the Company's initials "Y. W. C.,"

date of manufacture and serial number of pipe as cast.

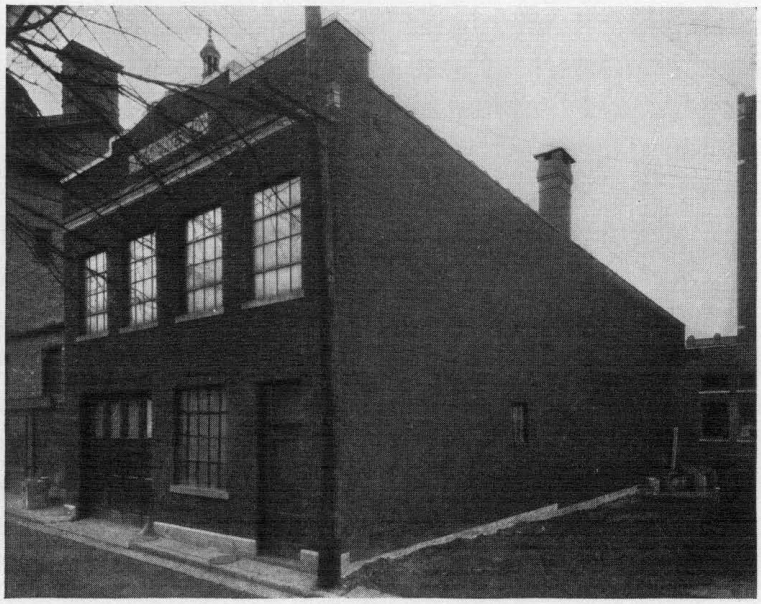
Static pressures on the system range from forty-five to ninety pounds with an average of seventy-five and the variation normally is less than ten pounds.

At an average distance of three hundred eighty-seven feet there is a stop valve, to control the flow, which is turned off in case of leaks or replacement in the system. There are fourteen hundred forty-five such valves varying from five-eighth inches to twenty-four inches and over the valves are placed boxes or vaults which extend to the surface of the street to permit of the insertion of a key to operate the valve.

In replacing a main or repairing a broken main or extending a pipe line in the outlying districts, it is necessary to turn off a small section of the system, but rarely for any other cause, as this department is equipped with machines which will insert a connection of sizes one-half inch to six inches in any existing mains while the water is flowing through the pipe.

The warehouse and pipe yard located on King's Mill Road adjoining the tracks of and connected by a siding with the main line of The Pennsylvania Railroad is ideally located and equipped for the receipt and distribution of all pipe, fittings, boxes and other heavy supplies. All pipe is purchased in carload lots and by means of a derrick is removed from the car to trucks and delivered to the point of operation or stored on piles in the yard. When the pipe laying operation is of sufficient size a nearby siding is rented and a portable derrick is used to unload, thus shortening the hauling distance.

Since 1923 all new service pipes between the main and curb line, including the curb cock and box, have been installed and all existing services have been maintained by the Company.



SHOP

The high cost of resurfacing paved streets after the laying of service pipes has resulted in the use of a pipe pushing machine whereby small openings at the curb and over the main pipe permit of the pushing of the pipe from the one excavation to the other.

The standard service pipe of sizes five-eighth to two inches is of extra heavy lead pipe with brass corporation cock inserted in the main and a brass round-way curb cock set at the curb line. The lead is joined to the cock in the main and the cock at the curb by means of a brass flanged union sealed with a set screw to prevent turning, caused often by vibration on the surface. The service connections for larger than two inches are made with a tapping sleeve with valve attached at the main and continue into the curb line with cast iron pipe like the pipe used for the mains.

All water sold to the Commercial and Industrial consumers is by meter and there are today in use seven hundred thirty-two meters ranging in size from five-eighth to eight inches. These meters are usually placed in vaults in the street or sidewalk with a cover at the surface to permit the meter to be read or exchanged. Where practicable, however, the meter is placed in the basement of the building supplied.

A testing machine is provided to permit the accurate testing of all meters by weight of the water and all meters are tested before setting. Only minor repairs are made by the Company as it has been found that it is not economical to make repairs and the defective meters are returned to the manufacturer who renews all worn parts so that the meters are in first class condition at all times. An ample stock of the various sized meters is maintained for exchange purposes.

One large and two small automobile trucks furnish the means of hauling the various supplies and workmen to the point of operation.

The two-story shop with basement, in the rear of the general office, containing approximately nine thousand square feet of floor space, was built in 1923 and is entirely fire proof. This building was designed to care for the service pipe, meter, fire hydrant maintenance and distribution maintenance departments and has proven conveniently located and well adapted for this branch of the work. It is of heavy construction and safely houses the supplies which are carried in large quantities.

In 1925 the existing public fire hydrants were purchased from the several municipalities in the Company's territory and since that time they are inspected periodically and maintained by the Company which also installs new hydrants when ordered. This has brought about a marked improvement in the condition of this public equipment. The slide gate fire hydrant with six inch hub inlet and with four and one-half inch steamer connection and two two and one-half inch hose connections as manufactured by the Ludlow Valve Company has been adopted as the standard hydrant by the Company.

The Company has on hand interchangeable hose and fire hydrant connections which permit of the use of the fire engines from Harrisburg, Lancaster,

Columbia, Hanover and Baltimore in case of a large conflagration.

A representative of this department answers each fire alarm and each hydrant used is inspected after being turned off.

The number of fire hydrants in each of the several districts is as follows:

City of York	342
Borough of West York	32
Borough of North York	20
Springgarden Township	27
West Manchester Township	7
Total	428

The National Board of Fire Underwriters recommends that there be at least one hydrant to every seventy thousand square feet in the high value districts and to one hundred thousand square feet in residential districts.

Quality of the Supply

The water is extremely soft which makes it highly desirable for domestic and laundry purposes. Its non-corrosive properties make it highly desirable for use in boilers and other industrial purposes, including locomotives. The Pennsylvania Railroad, Western Maryland Railway and Maryland and Pennsylvania Railroad Companies use large quantities and pronounce it very satisfactory. The temperature being lower in summer than the average supply has recommended it to the candy and other manufacturers who use it for cooling purposes. About twenty-five years ago numerous wells and streams were used for domestic and industrial purposes. One by one these consumers have changed over to the Company supply and today there are very few uses to which unfiltered water is put.

After an exhaustive study by several of the leading storage battery manufacturers in the United States, they recommend York's water supply as being equal to distilled water for the purposes of maintaining their batteries. This discovery although not increasing the revenue of the Company has saved the automobile owners and others using storage batteries many thousand dollars.

Not a single case of typhoid fever or other water borne disease has been traced to the supply and the local Health Director has on numerous occasions attributed the low infant mortality and the general good health of the community in large measure to the purity of the water supply.

Weather Observations

In 1915 George S. Bliss, now weather observer for Philadelphia, installed the present United States Government rain gauge, thermometers and other appliances used in the accurate recording of rainfall, temperature, direction of wind, etc. These instruments are located on the grounds at the Pumping Station and Clayton L. Bott, Superintendent of the Station, has been designated as official observer. These records are of vital interest to the Company and are frequently sought by industrial plants and others where temperature and rainfall affect their products.

The rainfall is accurately measured and this record is now complete for a great number of years. The tempera-

ture plays a great part in the quantity of water consumed. High temperatures are invariably followed by increased uses of water by the consumer for cooling and irrigating purposes and this is especially true during times of extended drought. A low temperature gives warning that some of the applied chemicals must be increased in quantity in order to get the same results, also that a watchful eye must be kept on the stream for fear of slush ice getting into the screens and pipe lines which might result in considerable damage.

The temperature of the water supply is very close to the atmospheric temperature with the exception of the extremes and varies from thirty-three degrees to sixty-six degrees. During the past ten years the rainfall has averaged two and ninety-five hundredth inches per month with a minimum total of nothing in October, 1924, and a maximum total of seven and eighty-two hundredth inches in July, 1916.

Insurance and Protection Facilities

Adequate insurance of various kinds is carried which protects the Company from fire and other liabilities.

In addition to carrying the various forms of insurance, protection against fires and other accidents is provided in the form of fire hydrants with ample hose connections at the Pumping Station and Filter Plant, one hydrant at the former and three at the latter plant. In addition three hand chemical extinguishers are at the Pumping Station and nine at the Filter Plant. In addition at the Filter Plant there are numerous hose reels which can be used instantly, fed from the water from the Sedimentation Basins as well as from the wash water pump of the filters, which develops a very high pressure and can be started by throwing an electric switch. The filter building can be flooded in a few moments by closing the overflow ports in the filters. In the shop and office are continuously maintained a number of hand chemical extinguishers.

The most approved lightning rods protect the cupola of the Filter buildings and the smoke stack at the pumping station. These rods are periodically inspected and are buried in the earth to the water line.

Purchase of Materials

Practically all supplies are ordered on a competitive basis and pipe and other materials used in the construction of the mains and services are purchased about the first of January of each year in sufficient quantity to last the following season, which insures ample supply while the work is being constructed. There is the added advantage that the men are able to store this material when they are unable to do construction work.

General Office

From 1816 to 1899 the Company had no permanent office. The Board of Directors met in the early days at the public Inns and later in the office of one of the officers or directors. Shortly prior to 1899 they shared the same

room with The York Gas Company. In 1899 the first permanent office was established jointly with The York Gas Company at what is now 45 West Market Street and these quarters were maintained until May 10, 1906, when the office at the present location, No. 42-44 East Market Street, was established. Its central location makes it very convenient for the public.

Subsidiary Company

The Water Company of Springgettsbury Township was organized in 1906 as a subsidiary to The York Water Company for the purpose of supplying the East York tract, then under development, with water. In 1926 the name of the Company was changed to York Suburban Water Company. Its assets consist entirely of pipe lines and franchise rights and from the beginning it secured its supply from the parent Company through the latter's Distribution System.

The territory supplied is in Springgettsbury Township along and near the Lincoln Highway east and includes the tracts of East York, Heistand, Yorkshire, Keesey Estates and a number of individual homes. This Company at present supplies one commercial, one industrial, two public and one hundred twenty-four domestic consumers, including one public fire hydrant for fire protection. The population supplied is six hundred twenty and the Distribution System consists of five miles of main pipe from twelve to six inches in diameter.

This Company's records are kept independent of the parent Company although the entire capital stock issued ($50,000.00) is owned by The York Water Company.

The Board of Directors, officers and employees of The York Water Company serve in the same capacities with York Suburban Water Company.

Service

Water, being a vital necessity, it is important that the service be uninterrupted, the supply be uniform in quality and purity and that a constant pressure be maintained. In order to accomplish this, it is necessary to have the plant so constructed that in case of a failure of an important unit, a duplicate can be started immediately.

There are three pumps at the Pumping Station, the clear water basins, sedimentation basins and chemical feeding devices are all in duplicate and three supply mains extend to the City,—all of which permits one unit to be out of service without interrupting the supply. The twenty filters can be operated singly or in batteries as desired and the arrangement of the pipe lines connected to the force main is such that the water can be pumped direct to the supply mains, or to the standpipe thus bypassing the aerator, sedimentation basins and filter building or any one of these units. The Company makes an effort to have the clear water and sedimentation basins filled at all times so that without any further regard to the stream, pumps or force main, a sufficient amount of water is stored and ready to flow to the filters or supply mains as desired.

Planning to care for the natural growth in population and industrial expansion, which is always accompanied with increased requirements due to a higher standard of living is not all, but it is necessary to be prepared for the demand which comes without warning, such as large fires, large leaks, or a long drought accompanied with the demands of the consumer for water for cooling and irrigation. The latter service has always been unrestricted in York but some of the neighboring Communities have been less fortunate.

There is one asset which does not appear on the Company's balance sheet, that is the good will of its entire organization. The operation of a water utility is affected largely by the elements and must be adjusted to the weather which is constantly changing. There are certain processes of purification which cannot be determined mechanically and a constant personal watch is necessary. The men who are the closest to the operation are men who have given their entire time for years in order to become proficient in the work. These are the plant men whom the Company commends for their faithfullness to duty and the success with which they have handled the work under their care.

It is necessary to have a certain number of men within call for duty at all times,—day, night or Sundays, in order that there may be no interruption to service, and it is interesting to note that these men on different occasions leave their warm beds in the middle of the night in winter or even leave their dinner table on Christmas day and start to repair a breakdown without a murmur and usually with a smile.

As a pressure, with very little variation, is maintained and as the supply is practically constant, numerous appliances in industrial plants are operated by water pressure, and this use is constantly increasing.

Unused Real Estate

The Company acquired considerable real estate, which was later abandoned, in the development of its plant. When the Pumping Station was along King's Mill Road, a considerable amount was purchased in this vicinity with a view of expanding the works and protecting the supply. Later the Bender and Sprenkle mill properties were purchased with a view of using them as Pumping Station sites. The abandonment of the Queen Street reservoirs added that property to the unused real estate. After holding some of the property for a number of years, most of it has since been sold to good advantage and all that remains is a four acre tract on West College Avenue west of Grantley Street and two small tracts at the north end of the Penn Street bridge, which are now for sale.

Conclusion

Thus the water is stored in the stream, is pumped through the force main to the aerator, after which it flows by gravity to the sedimentation basins, thence to the filter building where the chemicals are applied and it is filtered. After leaving the filters, it flows to the clear water basins and thence to the

supply mains and distribution system where it passes through the many miles of pipes to the houses and other buildings of the consumer.

The fact that the Company has been successfully and conservatively managed for more than a century has earned for it unlimited credit and the mercantile agencies have given it the highest rating. In addition to this the service of a water utility is fundamental to the life of every community and its service is necessarily constant and is unaffected by changes of business conditions. This is especially so in York where the industries are so diversified. These facts probably account for the eagerness with which the investing public acquire the Company's stock when there is any on the market.

The water works of a growing community is never complete and this familiar statement is applicable to York's plant as the value of the initial plant of $13,000.00 has steadily grown over a period of one hundred eleven years to over $4,000,000.00.

The Capital stock outstanding has a par value of $2,000,000.00 and the capital as authorized by the stockholders is $3,000,000.00.

The number of consumers in 1816, fifty-five, has grown until in 1926 there are seventeen thousand seven hundred.

Often stockholders or consumers offer suggestions with a view of improving the service and it is hoped that the interest may continue.

The harmonious relations existing between the stockholders and the management and employees of the Company have contributed in large measure to its prosperity, to the upbuilding of its plant and equipment and to the continued maintenance of its high standard of service.

THE YORK WATER COMPANY
York Suburban Water Company

DIRECTORS

Charles Kurtz 35
Grier Hersh 31
W. F. O. Rosenmiller 26
Theodore R. Helb 18
James H. Schall 16
Samuel Small, Jr. 14
George Hay Kain 11
Charles M. Kerr 11
John E. Baker 10

OFFICERS

President ..... Charles Kurtz 15
Vice President ..... Samuel Small, Jr. 10
Secretary ..... Grier Hersh 6
Treasurer ..... Charles M. Kerr 2
Counsel ..... Cochran, Williams & Kain 27
General Manager ..... Edgar P. Kable 29
Comptroller ..... William J. Perry 3

EMPLOYEES

Office

Frank B. Seeman 28 ..... *Chief Inspector*
Lester W. Rauhouser 8 ..... *Bookkeeper*
David Brenneman 4 ..... *Cashier*
Mary P. Campbell 2 ..... *Stenographer*
Charles G. Kirk 7 ..... *Inspector*
Luther Doll 3 ..... *Inspector*
John Redman 2 ..... *Inspector*
Hyman H. Fake 21 ..... *Messenger*

Pumping Station

Clayton L. Bott 19 ..... *Superintendent*
Harry C. Arnold 29 ..... *Assist. Superintendent*
Arthur Weiser 19 ..... *Engine Man*
Archie Illyes 2 ..... *Engine Man*
Charles Mersberger 9 ..... *Fireman*
Charles Stough 1 ..... *Fireman*
Harry E. Stough 1 ..... *Fireman*
Paul Jacobs 1 ..... *Fireman*

Reservoirs

Harry J. Gates 8 ..... *Gardener*
Robert Ness 2 ..... *Assistant Gardener*
Lafair Harget 1 ..... *Assistant Gardener*
Grant Dessinger 1 ..... *Assistant Gardener*

Filtering Plant

Charles W. Graff 24
Superintendent and Analyst
*Charles E. Myers 16
Charles A. Crone 1
Operators and Assistant Analysts
Alvin P. Rohrbaugh 23 ..... *Operator*
William Vanasdale 1 ..... *Watchman*

Distribution

William R. Smith 9 ..... *Superintendent*
Charles Bolton 4 ..... *Foreman—Service Pipes*
John Creep 3 ..... *Foreman—Meters*
James Heisey 6 ..... *Foreman—Fire Hydrants*
Orphey Gintling 4 ..... *Foreman—Mains*
John Witman 2 ..... *Foreman—Mains*
Oscar Bolton 4 ..... *Mechanic*
Nelson Finney 2 ..... *Mechanic*
William Dittenhafer 4 ..... *Laborer*
Cleveland Stewart 2 ..... *Laborer*
Claude Fake 26 ..... *Laborer*
David Fry 2 ..... *Laborer*

Impounding Basin

*Jacob D. Bolton 4 ..... *Caretaker*

Number to right of name indicates years of service with the company.
*Commissioned by the Governor as Water Company policemen.