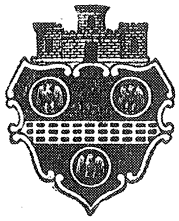
City of Pittsburgh, Pennsylvania

Its Water Works and Typhoid Fever Statistics

Erwin Eugene Lanpher and C. F. Drake

CITY OF PITTSBURGH

PENNSYLVANIA



ITS WATER WORKS

by

ERWIN E. LANPHER

and

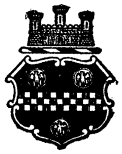
TYPHOID FEVER STATISTICS

by

C. F. DRAKE

PRINTED MAY, 1930

To Satisfy Public Demand for Water Works Treatises
by the late Erwin E. Lanpher
the City of Pittsburgh presents this pamphlet
in grateful recognition of the Author's
Twenty-six Years of Unselfish
Devotion to the
Development of its Water Works



Publication authorized by Resolution of Council approved March 22, 1930

ERWIN E. LANPHER
1875 - 1930

IN MEMORIAM

RESOLUTIONS

BY THE MAYOR AND COUNCIL OF THE CITY OF PITTSBURGH, PENNSYLVANIA

WHEREAS, On January 18th, 1930, as the day was spending itself and twilight coming on, ERWIN E. LANPHER fell asleep; and

WHEREAS, He first saw the light of day at Lowville, New York, January 28th, 1875, and was educated at Lowville Academy, Union College, Schenectady, New York, and Cornell University, Ithaca, New York; and,

WHEREAS, He joined the forces of the City of Pittsburgh as Assistant Engineer in the Bureau of Water on November 30th, 1904, and by his application and devotion to his work, was promoted to the position of Division Superintendent of said Bureau, and finally became its Managing Engineer, which position he held at the time he was taken from us; and,

WHEREAS, In his chosen profession he became a member of the Engineers' Society of Western Pennsylvania and the American Water Works Association; in his love for civic matters, he became a member of the Pittsburgh Chamber of Commerce, and in his fraternal life, became a member of Sojourners' Lodge No. 693, F. & A. M., Bellefield Royal Arch Chapter No. 229, and Tancred Commandery No. 48, Knights Templar; and likewise was a member of the Junta Club and Cornell Club; and,

WHEREAS, From his wide experience thus gained, he developed an enviable reputation in his profession; he became a valued and respected citizen; and by his affable manner and courteous treatment, he endeared himself to all with whom he had contact; Therefore, be it

RESOLVED, That in the death of Erwin E. Lanpher, the Council and the Mayor of the City of Pittsburgh have lost an efficient and faithful public servant and take this means of expressing their sincere regret, and hereby extend to the bereaved family their heartfelt sympathy in this hour of their great loss; and, be it further

RESOLVED, That this resolution be spread in full upon the record of Council and an engrossed copy sent to the family.

"We live in deeds, not years; in thoughts not breaths:
In feelings, not in figures on a dial.
We should count time by heart-throbs.
He most lives
Who thinks most, feels the noblest, acts the best."

George J. Kambach,
W. Y. English,
Robert Garland,
Committee

In Council, February 10th, 1930, read and adopted.

John S. Herron,
President of Council

Attest: Robert Clark,
Clerk of Council.

Mayor's Office, February 11th, 1930
Approved: Charles H. Kline,
Mayor.

Attest: F. L. Swaney,
Mayor's Secretary.

Recorded in Resolution Book, Vol. 7, page 469, the 11th day of February 1930.

INDEX

THE WATER WORKS*

of the

CITY OF PITTSBURGH, PENNSYLVANIA

By

ERWIN E. LANPHER**

A Description of the Pittsburgh Water Works Prepared to Meet The Requirements of the Students of the Schools of Pittsburgh

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The water supply of the City of Pittsburgh is furnished through three agencies:–

(a) The water works of Pittsburgh, owned by the City of Pittsburgh and operated by the Bureau of Water of the Department of Public Works, and supplying the major portion of the City. This water works plant is the subject of this paper.

(b) The Pennsylvania Water Company, supplying a small portion of the easterly section of the City.

(c) The South Pittsburgh Water Company, supplying the somewhat recently annexed portion of the City in the high hills of the South Side.

ORGANIZATION

The City of Pittsburgh is governed by a Council of nine members, elected at large, whose functions are legislative, and by a Mayor, also elected at large, who is the chief administrative officer. The Mayor appoints the several Directors of Departments. The Director of the Department of Public Works is the chief administrative officer in charge of the several bureaus that construct and operate the public works of the City,—among which is the Bureau of Water.

*Prepared February 1, 1929.
**Managing Engineer, Bureau of Water, Pittsburgh, Pa.

The Bureau of Water is presided over by a Managing Engineer, who, as the title indicates, is the Manager and Chief Engineer in charge of the water works. The Bureau is operated through three divisions, in charge of Superintendents, as follows:

The Filtration Division, presided over by a Division Superintendent, who is practically the sanitary engineer of the Bureau, in charge of the Filtration Plant, including the chemical and bacteriological laboratory.

The Mechanical Division, presided over by a Division Superintendent, who is practically the mechanical engineer of the Bureau, in charge of the several pumping stations.

The Distribution Division, presided over by a Division Superintendent, who is practically the civil engineer of the Bureau, in charge of the Distribution Division, including the distribution reservoirs, tanks, pipe lines and domestic service.

It will be noted that the line of demarcation of the functions of the divisions is defined by the progress of the water, and is such that each division operates as an entity with no confusion as to duties and responsibilities. Each Division is charged with the design, construction, operation and maintenance of its portion of the water system.

The assessment and collection of water rents are not functions of the Bureau of Water. The assessment is in charge of the Board of Water Assessors of three members appointed by, and reporting to the Mayor; while the collection of water rents is in charge of the City Treasurer and collector of Delinquent Taxes, a departmental officer holding the dual position appointed by, and reporting to the Mayor.

DESCRIPTION OF PLANT

Topographically, the City is separated into three parts:—Central City, or Peninsular Pittsburgh, between the Allegheny and Monongahela Rivers; North Side (formerly Allegheny and Spring Garden Borough) north of the Allegheny and Ohio Rivers; and the South Side, south of the Ohio and Monongahela Rivers.

The first general water works in the Central City was authorized in 1824, and placed in operation in September, 1828. In Allegheny, the first general water works was authorized in 1847, and placed in operation in 1849. The water works of the Central City and Allegheny were merged in 1907 when the two cities were consolidated.

The South Side was first supplied by the Monongahela Water Company whose plant was constructed in 1865, and which was purchased and consolidated with the Pittsburgh plant in 1908.

The Pittsburgh water plant, as it exists today, consists primarily of two river intakes, a low lift pumping station, a filter plant with its sedimentation, filtration

and water storage facilities, two primary pumping stations, four secondary pumping stations, two primary distribution systems and six secondary, or high service, distribution systems. The plant represents an outlay of about $36,000,000.00, and a replacement valuation of nearly $70,000,000.00. The yearly operating cost averages about $1,500,000.00.

The unusual features of the water distribution systems are due almost entirely to the rugged topography of the City, the outstanding features of which are many hills, separated by deep ravines and wide rivers, with few level spaces. This topographical condition results in a complicated system of water distribution districts, requiring a large amount of secondary pumpage to the high hills, the highest of which is nearly 700 feet above the level of the rivers at the "Point". The necessity of delivering water through a vertical range of nearly 700 feet is a very unusual condition.

The major features of the Pittsburgh Water Works are discussed in the following paragraphs as the course of the water through the plant is traced from the Allegheny River to the ultimate consumer.

Three plates have been inserted as an aid in tracing the course of the water through the plant. These plates are:—

(a) An Isometric view of the Filter Plant, showing also the location of Ross, Aspinwall and Brilliant Pumping Stations.

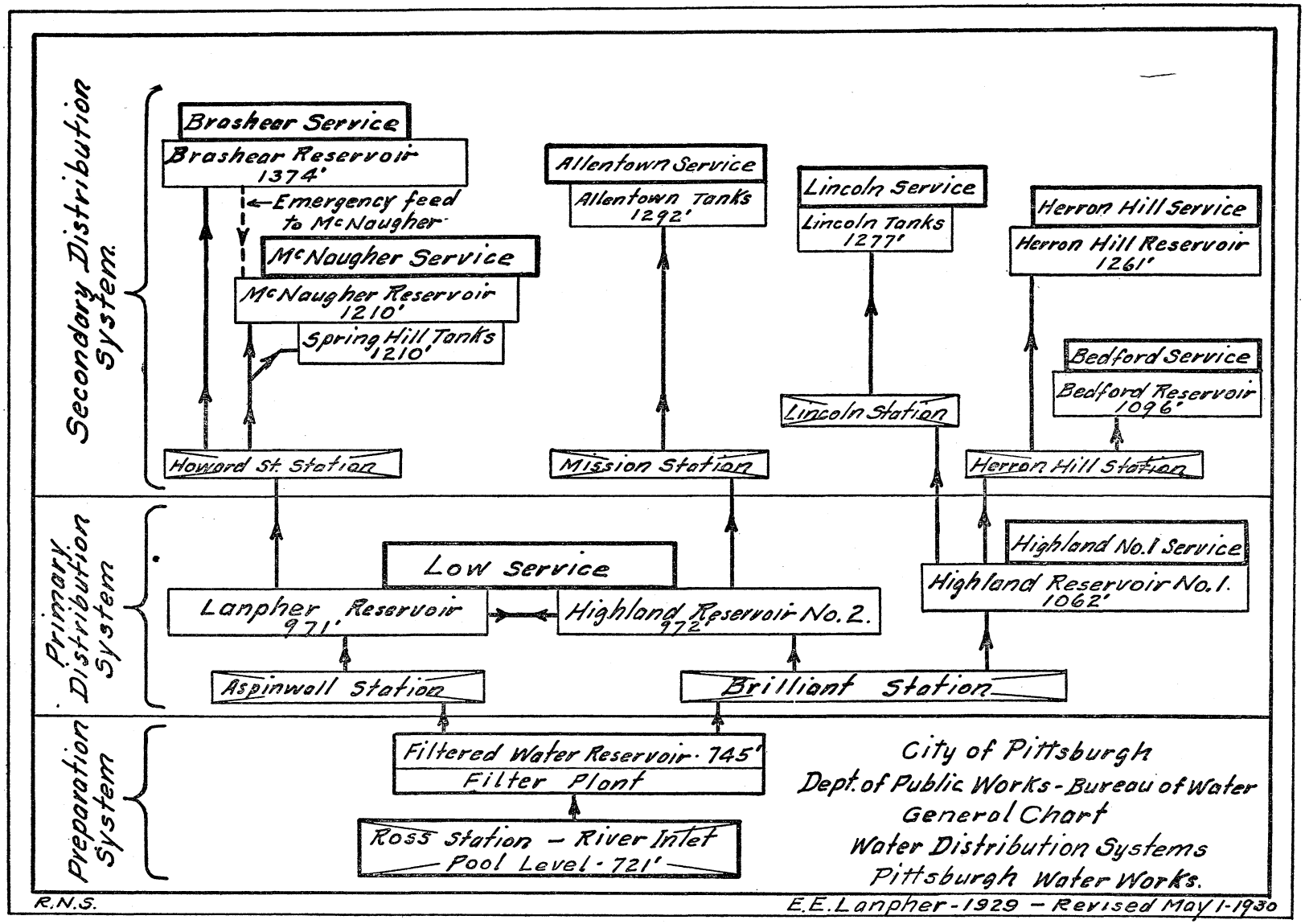
(b) A map of the Water Distribution Systems.

(c) A General Chart of the Water Distribution Systems.

In the following description, the abbreviation "M.G." is used for million gallons, and "M.G.D." is used for million gallons daily; also all elevations are given in feet above mean sea level at Sandy Hook (Sandy Hook Datum). The zero of the Pittsburgh Datum is 696.43 feet above the zero of Sandy Hook Datum. Elevations given are correct to the nearest even foot.

RIVER INTAKE

The water supply is obtained from the Allegheny River near Aspinwall and the filter plant at the easterly boundary of the City, and about seven (7) miles from the junction of the Allegheny and Monongahela Rivers. Here the water enters the system through two concrete intakes controlled by large sluice gates, and passes through suction trunks at either end of Ross Pumping Station to the pumps of that station. Both suction trunks are of concrete,—one is 124 inches in diameter, the other (installed in 1928) is composed of two parallel conduits 84 inches in diameter.



General Chart of Water Distribution Systems

RAW WATER PUMPING STATION

Ross Station is the low lift pumping station which delivers all of the raw river water to the adjacent Filter Plant. It is equipped with two 100 M.G.D. and one 50 M.G.D. steam turbine driven centrifugal pumps, also one 50 M.G.D. and one 35 M.G.D. centrifugal pumps driven by vertical steam engines. The steam plant consists of two 600 h.p. sterling type boilers of 400 lbs. steam pressure, with 6 smaller boilers used only as reserve equipment. This station, during the past two years, has been thoroughly re-equipped, and is an excellent example of a high duty pumping station.

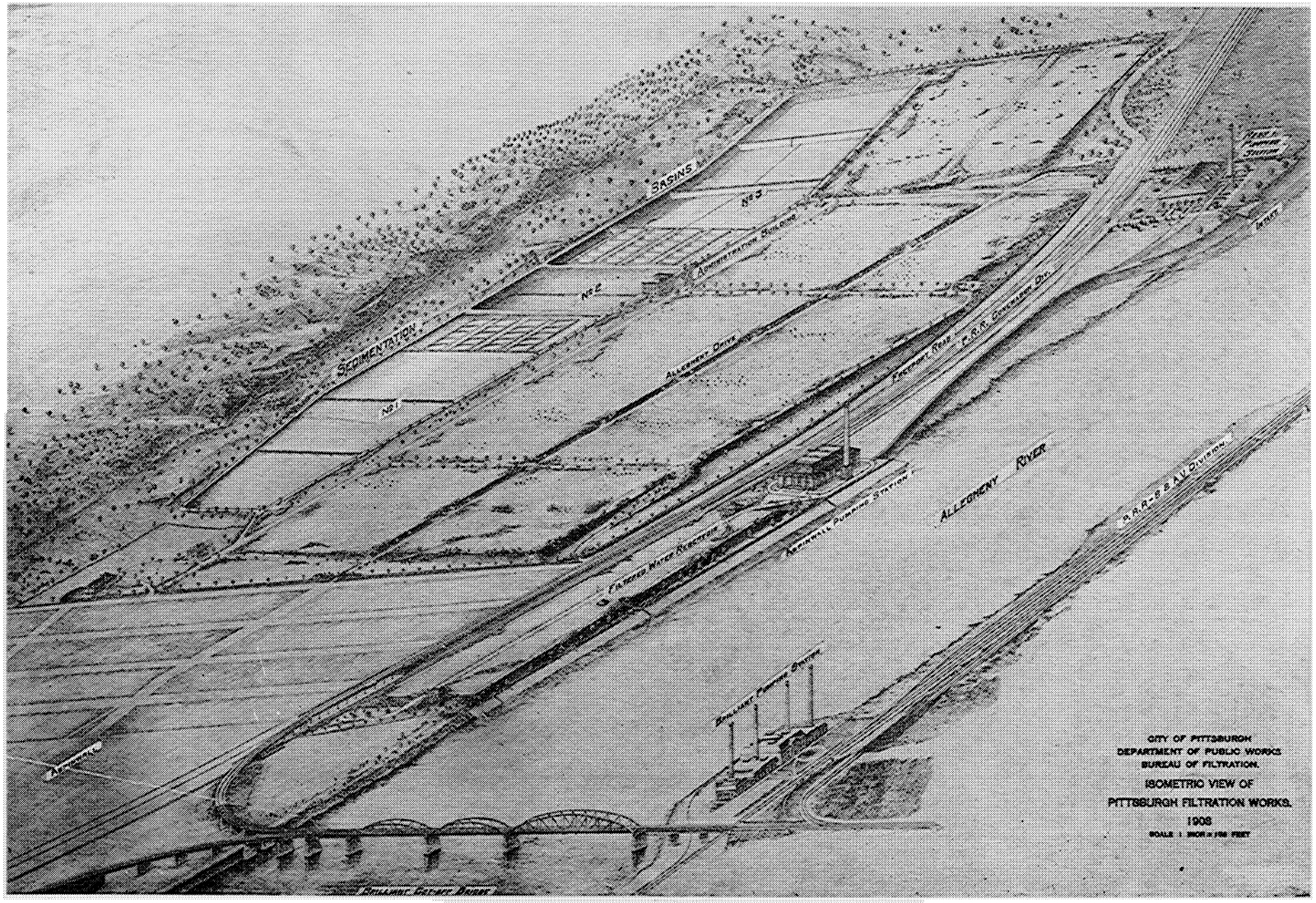
FILTER PLANT

The water pumped at Ross Station passes through a 96-inch diameter, steel, concrete incased couduit, about 2,000 feet in length, to the receiving basin of the Filter Plant. The water elevation in the basin is 47.5 feet above the river pool level. The receiving basin is the middle and smaller one of three sedimentation basins; has an area of about three (3) acres, and contains about 12 M.G. A large part of the heavy suspended matter is deposited as the water passes through this basin. The water leaves the receiving basin through eight (8) 48-inch outlets, to enter the rapid filters (sometimes termed "contact baffles," or "Reislers") located in the sedimentation basin adjacent to the receiving basin.

Both of the sedimentation basins are equipped with twenty-four (24) reinforced concrete, rapid filter units, each being a rectangular compartment approximately 60 feet by 40 feet in area, and containing six (6) vertical feet of gravel. A large amount of the remaining suspended matter is removed from the water in its passage through the rapid sand filters, and the water loses still more of this matter in its course through the large sedimentation basins after having passed through the rapid filters.

Each of the two large sedimentation basins has an area of about twelve (12) acres, a capacity of 54 M.G., and a depth of 15 feet. The water passes through the sedimentation basins at the ends farthest removed from the central receiving basin, into a concrete conduit 96 inches in diameter (known as the settled water conduit), which is the source of supply of the slow sand filters.

There are fifty-six (56) slow sand filters arranged in five (5) groups. The filters of each group are ranged on either side of an operating gallery, an underground work room 31 feet wide and about 1,000 feet long, and which contains the valves, piping, entrance doors to individual filters, regulating and measuring devices, sand washing machinery, and all other equipment necessary for the operation of the filters.



Isometric View of Pittsburgh Filtration Works

Each filter is an underground, concrete room, or compartment, one (1) acre in area and twelve (12) feet in clear height from floor to roof. The roof is of groined arch construction, supported by square concrete piers spaced fifteen feet center to center. Upon the floor of each filter are open jointed tile pipe lines for the purpose of collecting the filtered water and conveying it to filtered water pipes located in the adjacent gallery. Around and over these tile collecting pipes is the filtering medium consisting of one foot of gravel and about three feet of graded sand. The filtration process consists of filling a filter with water to a depth of about six feet above the sand, and of feeding water downward through the sand and gravel to the collecting pipes located on the floor of the filter. These filters are operated at varying rates, the maximum being about 3 M.G.D. per filter. The filters and galleries are covered with about three feet of soil as a protection against frost, and for reasons of general appearance.

The water from the slow sand filters is collected in filtered water pipes in each gallery and passes to the filtered water conduit, a concrete conduit 124 inches in diameter, which leads to the filtered water reservoir. As the water enters the filtered water reservoir, a slight admixture of liquid chlorine is made as an additional precaution in producing a safe drinking water.

The Filtered Water Reservoir stores about 50 M.G. of water prepared for consumption. This reservoir is built of concrete and, like the filters, it is covered and has a groined arch roof.

During the course of the water from the river intake through the filter plant, or from its raw and highly contaminated stage to its filtered and highly sanitary stage, continuous bacteriological and chemical analyses are made by the laboratory force stationed in the Administration Building, and this Filtration Division also retains responsibility for the sanitary character of the water after filtration, when it has been turned over to the Mechanical Division for pumpage, and to the Distribution Division to be served to consumers. For this purpose, continuous analyses are made of water samples taken from the several reservoirs, and from each of the distribution service districts.

PRIMARY DISTRIBUTION SYSTEMS

There are two primary service systems for the distribution of water:—

Low Service—With its Highland No. 2 Reservoir supplied from Brilliant Station, and its *Cabbage Hill Reservoir supplied from Aspinwall Station; and

Highland No. 1 Service—With its Highland No. 1 Reservoir supplied from Brilliant Station.

***Renamed "LANPHER RESERVOIR" by Resolution of Council, April 4, 1930.**

Before describing the primary service systems, the following description of the major units of these systems is given:—

ASPINWALL STATION—a primary pumping station, located on the northerly bank of the Allegheny River at the Filter Plant, completed in 1914, contains four (4) 20 M.G.D. vertical triplex pumping engines and six (6) boilers. It obtains water from the filtered water reservoir through a 60-inch suction main, and delivers it to *Cabbage Hill Reservoir of the Low Service System.

*CABBAGE HILL RESERVOIR—a primary reservoir, located in Shaler Township, about one-half mile north of Etna, completed in 1914, at an elevation of 971 feet. The capacity is 151 M.G., the depth of water 40 feet, while the supply is obtained from Aspinwall Station through a 60-inch steel rising main.

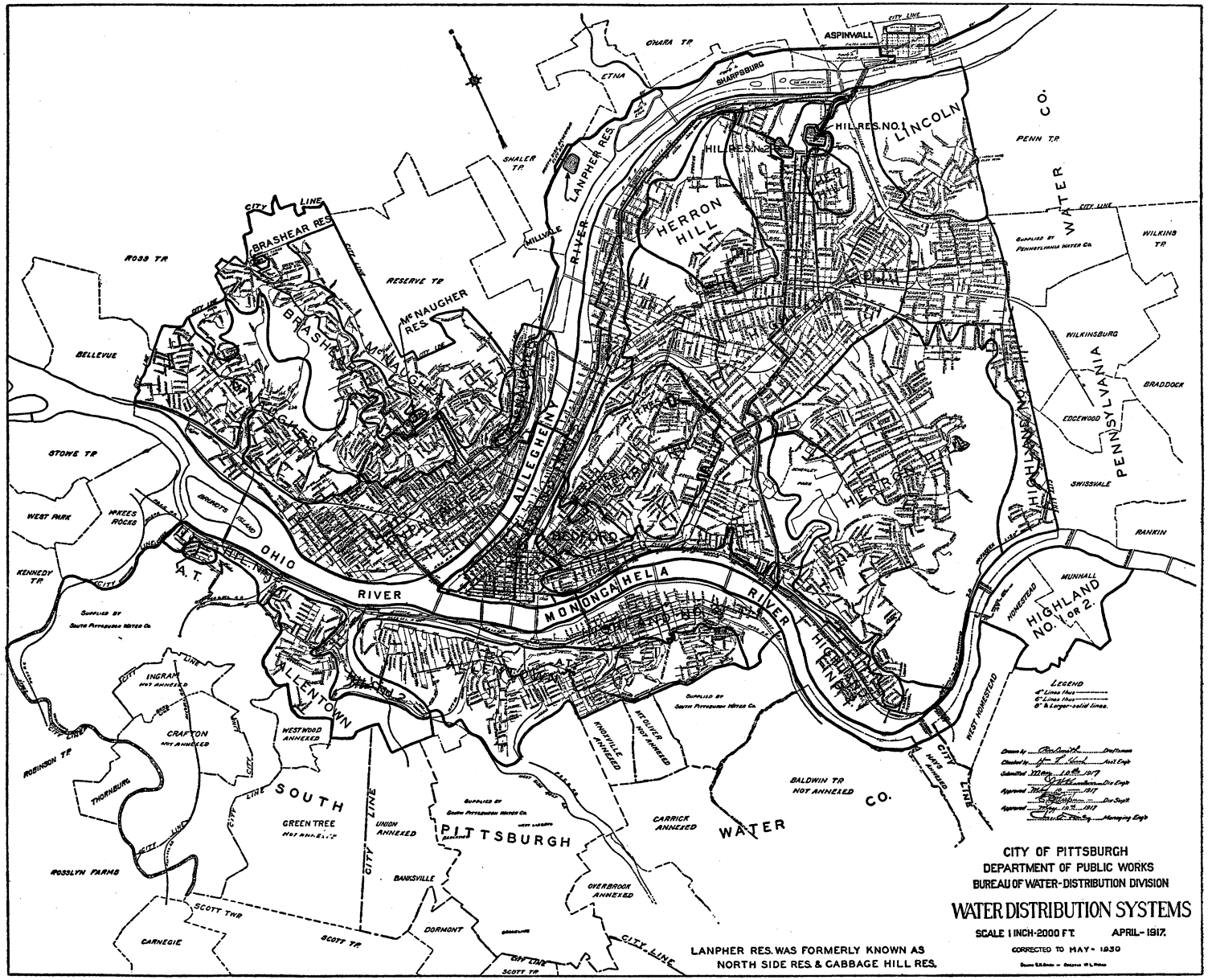
BRILLIANT STATION—a primary pumping station, located on the southerly bank of the Allegheny River, opposite Aspinwall, completed in 1879, contains four (4) 12 M.G.D., four (4) 15 M.G.D., and one (1) 8 M.G.D. vertical triplex pumping engines, and seven (7) boilers. Its supply is obtained from the filtered water reservoir through two (2) 72-inch steel suction mains laid under and across the Allegheny River, and water delivery is made to Highland Reservoir No. 2 of the Low Service System, and to Highland Reservoir No. 1 of the Highland No. 1 Service.

HIGHLAND RESERVOIR No. 2—a primary reservoir of the Low Service System, located in Highland Park at the head of Negley Avenue, completed in 1903, relined in 1927, at an elevation of 972 feet. The capacity is 126 M.G.D., the depth of water is 30 feet, while the supply is obtained from Brilliant Station through a 48-inch steel rising main.

HIGHLAND RESERVOIR No. 1—a primary reservoir of the Highland No. 1 System, located in Highland Park, at the head of Highland Avenue, completed in 1879, at an elevation of 1066 feet. The capacity is 117 M.G., the depth of water 22 feet, while the supply is obtained from Brilliant Station through two (2) 48-inch steel rising mains.

THE LOW SERVICE SYSTEM, through Aspinwall and Brilliant Stations, *Cabbage Hill and Highland No. 2 Reservoirs (elevation 971 and 972 feet respectively), supplies the manufacturing and mercantile districts on both sides of the three rivers, from the low river elevation of 696 feet to about 900 feet, containing a population of about 170,000. The major feeder mains of the system are a 60-inch steel main from *Cabbage Hill Reservoir to the heart of the lower North Side; a 50-inch steel main, changing to one 42-inch steel and one 36-inch cast iron main, leading from Highland Reservoir No. 2, along the Allegheny to the Point District, and a 50-inch

***Renamed "LANPHER RESERVOIR" by Resolution of Council, April 4, 1930.**



Service Map of Water Distribution Systems

steel main leading from the same reservoir, across the Central City and under the Monongahela River at South 34th Street, to the low section of the South Side. It should be noted that the portions of the sytem lying on opposite sides of the rivers are cross-connected at 26th Street, the Manchester Bridge, and the South 10th Street Bridge; also that the two reservoirs supplying the district being practically at the same elevation and cross-connected, act as one reservoir, and that either reservoir could, in case of necessity, supply the entire low service district.

THE HIGHLAND No. 1 SERVICE, through Brilliant Station and Highland Reservoir No. 1 (elevation 1066 feet), supplies a large residential, mercantile and manufacturing district of the Central City comprising East Liberty valley, Homewood, Shadyside, Bloomfield, Oakland and Soho, between approximate elevations 900 feet and 1020 feet, and containing a population of about 180,000. One (1) 36-inch and four (4) 30-inch cast iron feeder mains radiate from Highland Reservoir No. 1 to all parts of the district.

SECONDARY DISTRIBUTION SYSTEMS

There are six (6) secondary distribution systems;—systems to which water is re-pumped from one of the primary distribution systems to higher elevations. The four secondary pumping stations, the four secondary reservoirs, and three tank sets are described with the systems in which they serve.

HERRON HILL SERVICE—through Herron Hill Station, taking its supply from Highland No. 1 primary service, and pumping to Herron Hill Reservoir (elevation 1261 feet), supplies a residential territory of the Central City located on four separated hills:—Herron Hill, Squirrel Hill, Garfield Hill and Heberton Hill, between approximate elevations of 1000 and 1230 feet, containing a population of about 100,000.

HERRON HILL STATION—a secondary pumping station located at Center Avenue and Dithridge Street, rebuilt in 1897, contains two (2) 5 M.G.D. and two (2) 6 M.G.D. vertical triplex pumping engines, and two (2) gas-fired boilers. This station delivers water to Herron Hill and to Bedford Reservoirs.

HERRON HILL RESERVOIR—a secondary reservoir, located on Herron Hill in the University district, completed in 1880, and relined in 1921. Its capacity is 11.5 M.G., depth of water 23 feet, and its supply is received from Herron Hill Station.

BEDFORD SERVICE, through Herron Hill Station and Bedford Reservoir (elevation 1094 feet), supplies a congested residential and small mercantile district adjacent to the Point district of the Central City between approximate elevations 920 and 1030 feet, containing a population of about 22,000.

Bedford Reservoir—a secondary reservoir, located on Bedford Avenue at Ledlie Street, completed in 1850. Its capacity 2.7 M.G., depth of water 9 feet, and its supply is received from Herron Hill Station.

Lincoln Service, through Lincoln Station, taking its supply from Highland No. 1 primary service, and pumping to Lincoln Tank (elevation 1279 feet), supplies a small residential section, known as the Lincoln district, in the northeasterly portion of the Central City, between approximate elevations of 1000 feet and 1250 feet, containing a population of about 6,000.

Lincoln Station—a small secondary pumping station, located at Park Avenue and Dearborn Street, completed in 1895, contains two (2) 1.1 M.G.D. electrically driven centrifugal pumps.

Lincoln Tank—is a secondary tank of 200,000 gallons capacity, located at the eastern boundary of the City.

Allentown Service, through Mission Station, taking its supply from the Low Service System, and pumping to Allentown Tanks (elevation 1294 feet), supplies the high residential section of the South Side, between approximate elevations of 900 feet and 1260 feet, containing a population of about 55,000.

Mission Station, a secondary pumping station, located on Mission Street, near South 18th Street, completed in 1912, contains two (2) 7 M.G.D. vertical triplex pumping engines and two (2) boilers.

Allentown Tanks, three (3) secondary tanks, located in Grandview Park, completed in 1895, have a combined capacity of 2.5 M.G.

McNaugher Service—through Howard Station, taking its supply from the Low Service System, and pumping to McNaugher Reservoir (elevation 1211 feet), and to Spring Hill Tanks at the same approximate elevation, supplies a residential district of the North Side between approximate elevations of 900 feet and 1240 feet, containing a population of about 63,000.

Howard Station, a secondary pumping station, located at Howard and Elmira Streets, re-equipped in 1928, contains two (2) 9 M.G.D., and four (4) 3 M.G.D. electrically driven centrifugal pumps. This station supplies water to McNaugher Reservoir, Spring Hill Tanks, and to Brashear Reservoir.

McNaugher Reservoir is a secondary reservoir located at Lafayette and Biggs Avenues, completed in 1928, consists of two (2) circular concrete units of 5.5 M.G. total capacity.

Spring Hill Tanks, two (2) secondary tanks, located on Erk Way, completed in January, 1929, have a combined capacity of 1 M.G., and are cross-connected with McNaugher Reservoir.

BRASHEAR SERVICE—through Howard Station, pumping to Brashear Reservoir (elevation 1374 feet), supplies the high residential district of the North Side between approximate elevations of 1240 feet and 1380 feet, containing a population of about 6,000. This is the highest service in the City.

BRASHEAR RESERVOIR, a secondary reservoir, located on Montana Avenue at the northerly boundary of the City, being placed in service as this paper is written in February, 1929, is a concrete "T" wall type, containing 11 M.G., at 25 feet depth of water.

Brashear Reservoir, McNaugher Reservoir, and the new Spring Hill Tanks, supply the district recently served by Greentree, Lafayette, Montgomery, and old Spring Hill Tanks, all of which have been abandoned. Greentree Pumping Station is also being abandoned, its work having been taken over at Howard Station.

The complex character of the water distribution scheme of the Pittsburgh Water Works is exemplified by tracing through the system, the water in the fountain pool at the Highland Avenue entrance to Highland Park. From the Allegheny River, it passes through the river intake to Ross Station, where it is pumped to the sedimentation basin of the Filter Plant. After filtration, it crosses under the Allegheny River to Brilliant Station, where it is pumped to Highland Reservoir No. 1. From this reservoir, the water reaches Herron Hill Station by way of Euclid, Friendship, Millvale and Center Avenues, and is pumped to Herron Hill Reservoir. From there, it returns to the Highland District, by way of Bloomfield Bridge, Garfield Hill, Stanton Avenue, Negley Avenue, Hampton Street and Highland Avenue, and finally to the fountain within a few feet of Highland Reservoir No. 1.

The following short table of Plant Data shows additional information most often requested by students.

PLANT DATA, 1928

Average Water Pumpage, Primary Stations	**116.2 M.G.D.**
Storage Capacity, Filter Plant Reservoir	**170.0 M.G.**
Storage Capacity, Distribution Reservoirs	**428.0 M.G.**
Total Length of Rising Mains (8″ to 96″ diameter)	**20.3 miles**
Total Length of Distribution Mains (4″ to 66″ diameter)	**822.0 miles**
Number of Fire Hydrants	**7,583**
Number of Gate Valves	**19,203**
Number of Water Services	**106,746**
Number of Water Meters	**45,699**
Average Delivery Pressure	**78 lbs.**

This paper prepared in February, 1929, by E. E. Lanpher, Managing Engineer of the Bureau of Water, of the City of Pittsburgh, Pennsylvania.

For information relating to the history of the Pittsburgh Water Works, reference

is made to "A Century of the Pittsburgh Water Works" by the same author, contained in the Proceedings of the Engineers' Society of Western Pennsylvania, Vol. 44, No. 10.

Also for information relating to the effects of filtration on typhoid fever rates, reference is made to "Statistics of Typhoid Fever in Pittsburgh" by C. F. Drake, Superintendent, Filtration Division, Bureau of Water, City of Pittsburgh, published in the same "Proceedings", same volume and number.

A CENTURY OF THE PITTSBURGH WATERWORKS*

By E. E. LANPHER†

Descriptions of portions of the waterworks of the City of Pittsburgh have on several occasions, been presented to this Society. However, there has been presented no general description of the plant, and the occasion of the centennial anniversary of the completion of a waterworks system in the central portion of Pittsburgh is an appropriate time to present some of the history, and a description of the present water plant.

Tables of plant and operation costs, services rendered and results obtained are purposely omitted, as they belong to the realm of municipal reports.

Historically and topographically, the waterworks is separated by the Monongahela, Allegheny and Ohio rivers into three parts—the central city or "peninsular" Pittsburgh, the North Side (formerly Allegheny), and the South Side.

THE CENTRAL CITY

The first known attempt to obtain a public water-supply is recorded in the following enactment of the Borough of Pittsburgh, when that municipality contained about 1600 persons.

"Be it ordained by the Burgesses, Freeholders and other inhabitants, housekeepers of the Borough of Pittsburgh, in town meeting duly assembled, at the Court House, the 9th day of August, 1802, that the Burgesses are hereby authorized and empowered to have wells sunk and pumps erected in such parts of this Borough as they think most advisable, beginning with Market Street. And it is further ordained that where individuals have, at their own expense, sunk wells and erected pumps in the streets, in useful and necessary parts of the Borough, that a compensation be made to them in case of their assigning them for public use. The whole expense to be defrayed by a general tax on the Borough.

ISAAC CRAIG, *Chief Burgess.*
DAVID EVANS, *Burgess.*

The estimate of expense accompanying this ordinance was $497.96, and it is certain that at least $170 was collected, and that Walter Christy, Borough Clerk, called for proposals for four public wells on Market Street, which were to be dug to a depth of not less than 47 feet, and for the pumps to equip the wells.

In December 1813, George Evans served notice that he was ready to pump water sufficiently high, by steam power, to run to any part of the town and to supply consumers at three cents a barrel. Again, in January 1818, William B. Foster and William Hamilton petitioned for permission to supply water, but there is no record that either of these two projects materialized.

In 1824, the first definite steps were taken to obtain a general waterworks system. On February 24, Council finally passed an ordinance providing for a loan of $50,000 to construct the necessary works. Supervision was placed in a water committee composed of Messrs. Fairman, Magee, Denny, Carson and Hays. The Pittsburgh and Exchange banks advanced funds on the loan, and the committee

***Presented Engineers' Society of Western Penna.—May 1, 1928.**
†Managing Engineer, Bureau of Water of the City of Pittsburgh, Pa.

purchased an engine-house site at the corner of Duquesne Way and Cecil Alley for $1425; also a lot 240 feet square on Grant Street (the present Court House site) for $3800, upon which to construct a reservoir.

An additional loan of $40,000 was raised in 1826, and contracts were let in December of that year for a steam pumping-engine and a reservoir. It was specified that this pumping-engine was to be able to raise 60,000 gallons in 12 hours to a reservoir of 1,000,000 gallons capacity, at an elevation of 80 feet above the town.

The plant was turned over for operation in September 1828. So much difficulty (mainly breakage of pump and pipes) was experienced that little water was delivered to consumers until 1829; in fact, it appears that the first water revenue accounted for was $3086 in 1829. The water consumption for the first three years did not exceed an average of 40,000 gallons a day, and the pumping-engine was operated about 21 hours a week.

By 1832, the water consumption had materially increased, making it necessary to purchase a second pumping-engine. The plant at this time was termed to be "in good working order" and represented an investment of $111,086.52.

During the 10 years following the opening of the plant, the city had expanded to the hill district east of Grant Street; also complaints were registered in regard to the contamination of the river water near the intake of the Cecil Alley pumping station. This resulted, in 1838, in Council instructing the Water Committee to construct a larger pumping plant at a point "above the City," and a larger and higher reservoir. Mr. R. Moor, described as a mechanical and hydraulic engineer, was engaged to supervise the work. At this time, the city purchased a pumping-station site at Eleventh and Etna streets, and a reservoir site at Prospect and Elm streets (the Washington Park site). The enlarged plant was placed in operation July 4, 1844. It consisted of the pumping station on Eleventh Street, generally called the "lower works," equipped with two steam-driven pumps known as "Samson" and "Hercules," of a combined capacity of 9,000,000 gallons a day, each with a cylinder diameter of 18½ inches and a 12-foot stroke, pumping to the Prospect Street reservoir, known as the "lower basin," at an elevation (floor level) of 160 feet above the river. The "lower basin" had a capacity of about 7,500,000 gallons. The Cecil Alley plant and the Grant Street reservoir were abandoned at this time.

It should be noted that 9,000,000 gallons a day of pumping equipment was installed at a time when the water consumption was 1,500,000 gallons a day; that it was 20 years before additional pumping equipment was installed at the "lower works," and that "Samson" and "Hercules" functioned almost continuously until 1884—a period of 40 years.

In 1847, filtration of the water-supply was first recommended. It required a lapse of 60 years for filtration to become a reality.

In 1848, just 20 years after the completion of the first plant, the continued progress of the city toward the eastern hill section forced the building of a reservoir at Erin Street and Bedford Avenue, and a small station at the "lower basin" to pump to it. This reservoir, at an elevation of 398 feet, with a capacity of 2,700,000 gallons, was known as the "upper basin," while its pumping station was known as the "upper works." This station began operation in 1850 and continued until 1893.

In 1853, after 25 years of development, the average daily pumpage was 2,805,568 gallons; the population about 56,000; the plant valuation about $500,000, and the plant consisted of one primary and one secondary station, two small reservoirs and about 24 miles of pipe. The annexation, in 1867, of 14 wards and about 35,000 people, following the rapid growth of the old city, brought on a general shortage of the water-supply. Additional pumping units were installed, and a small temporary

pumping station was erected at Forty-fifth Street and the Allegheny River in 1870. Its three small pumps delivered an average of less than 1,000,000 gallons a day directly into the distribution system until 1880.

While the matter had been under discussion for about five years, it was 1871 before the Water Committee finally recommended the construction of a pumping station above Negley's Run, the construction of a low reservoir on Brilliant Hill (now Lake Carnegie), and a high-service reservoir at the head of Highland Avenue. It was a year later before authorization to proceed was obtained, and 1879 before any of this new plant was operated. While the work at Brilliant station and Highland reservoir was in progress, there was authorized the construction of a reservoir on Herron Hill and a secondary station to supply it at Dithridge Street, near the present Bigelow Boulevard.

In 1878, after 50 years of plant operation, the pumpage had increased to over 15,000,000 gallons a day, the population to about 106,000, the consumers to about 8000, and the plant valuation to about $2,000,000, exclusive of work under construction. The plant consisted of two primary pumping stations and one secondary station, two small reservoirs, and 105 miles of pipe-lines; also two pumping stations and three reservoirs under construction.

Brilliant Hill reservoir, although practically completed, was never used as a portion of the water-works system. It is now used as a park lake.

The first attempt, February 18, 1879, to supply water from Highland reservoir, failed, due to unconnected discharge pipes and to pipe breakage. Two days later a more successful attempt was made Water was first turned into a small section, the resulting pipe breakage repaired, then extended into an enlarged district. This procedure was continued until March 5, when the water from Highland reservoir finally reached the "Point" section of the city. About four years were required to correct the major faults at Brilliant station and Highland reservoir.

The Herron Hill reservoir, and the original Herron Hill pumping station, started in 1878, were completed early in 1880, and the first water from this system was supplied to consumers on June 26 of that year. The one pump installed (with a capacity of 1,500,000 gallons a day) was transferred from the "upper works". The capacity of Herron Hill reservoir is 12,000,000 gallons, and its elevation is 563 feet, Pittsburgh datum. The daily pumpage to this reservoir during the first year of its operation was less than 900,000 gallons.

The Forty-fifth Street station was closed February 24, 1879, following the opening of Highland reservoir. Except for continuous pipe-line extensions to meet the need of a rapidly extending city, there were no major plant developments from 1880 to 1890.

Three isolated high hills next received attention. In 1890 and 1891, a small secondary pumping station was erected at Evaline Street, pumping to a single tank at an elevation of 512 feet. This station and tank continued to supply the Garfield and Heberton Hill sections until 1914.

Again in 1895, a similar small pumping station and tank were installed to supply the Lincoln section. This Lincoln station was built at Park Avenue and Dearborne Street, while the tank was located near the eastern boundry line of the city at an elevation of 583 feet.

In 1897, a contract was awarded for the construction of Highland reservoir No. 2—the lower reservoir in Highland Park—at an elevation of 277 feet, with a capacity of 126,000,000 gallons. This reservoir, installed for the service of the low-lying sections along both rivers, for which the abandoned Brilliant Hill reservoir had been built, was finally completed, after many trials, in 1903.

The rapid development of the Squirrel Hill section forced the building of a new and larger Herron Hill pumping station at the corner of Center Avenue and Dithridge Street. This station was completed, and the old station abandoned in 1897.

In the latter part of the nineteenth century the contamination of the Allegheny River had reached such a stage that serious consideration of water purification became a matter of necessity. One of the first moves in this attempt to better the character of the water-supply was a combined meeting of the Engineers' Society of Western Pennsylvania, the Chamber of Commerce, the Allegheny County Medical Society, and the Iron City Microscopical Society, whose proceedings were published in 1894.

The citizens ranged themselves into three major groups—those in favor of the filtration of the existing supply; those who favored bringing water from distant uncontaminated sources; and those satisfied with existing conditions. Finally, by resolution of June 10, 1896, Councils provided for the appointment of a Filtration Committee composed of the Mayor, the Presidents of Select and Common Councils, and eight representative citizens. Their report was submitted in January, 1899, and recommended the installation of a slow-sand filtration plant and the water-meter system. The issuing of the first of the so-called "filtration bonds" was approved by the people at an election held September 19, 1899. On the northern bank of the Allegheny River, east of Aspinwall and nearly opposite Brilliant station, the Pittsburgh filtration plant was started in 1905, after four years of intense argument, and after various designs, and redesigns. The first filtered water was delivered December 18, 1907. Additional filtered water was delivered to "peninsular" Pittsburgh as rapidly as individual filters could be completed, and on October 3, 1908, its entire supply was filtered.

The South Side received its first filtered water on February 4, 1909, and the North Side on March 29, 1914.

The filtration plant, as first constructed, consisted of a low-lift pumping station, known as Ross station, equipped with four centrifugal pumps each with a capacity of 35,000,000 gallons a day, a receiving basin, two sedimentation basins, 46 covered slow-sand filters, a filtered-water basin, and the necessary conduits and piping. There were later added to this plant 10 filters to meet the requirements of the North Side, and a contact baffle, or Reisler, pre-filtration system. This work was done in 1912 and 1913.

Due to the consolidation of Pittsburgh and Allegheny December 6, 1907, and to the purchase by the city of the water plant of the Monongahela Water Company in 1908, the three waterworks were merged at that time into a greater city waterworks.

NORTH SIDE

In 1847, Allegheny made its first definite steps to obtain a public waterworks. In that year a committee, consisting of Messrs. Riddle, Painter, Lothrop, Warner, and Alexander, was appointed and within two months reported that it had purchased seven acres of ground on Troy Hill, then in Reserve Township, for a reservoir site, and a lot of ground on Bank Lane, now River Avenue, for a pumping-station site. Council immediately approved the purchase, issuing the necessary bonds in payment, and further issuing $100,000 in bonds with which to construct a waterworks. River Avenue pumping station and Troy Hill reservoir were first operated in 1849, and the cost of the complete waterworks to January 1, 1850, was $265,985.23. The original pumping-engines served in this station until a larger unit, a Lowry, was completed in 1874. This Lowry pumping-engine, together with two Allis pumping-engines installed in 1884, and two Wilson-Snyder pumping-engines installed in 1888, were in service at the time of the consolidation of the two cities in 1907.

In 1871 and 1872, a pumping station containing one small pump was built at the Troy Hill reservoir to supply the adjacent high territory.

The growth of the city into the northern hills made necessary the building of Howard Street pumping station, drawing its supply from the mains of the River Avenue system and pumping to a single tank on Nunnery Hill at an elevation of 502 feet. This work was completed in 1882, and a new engine was added in 1885, a new tank on Spring Hill in 1886, and another on Nunnery Hill in 1888.

Allegheny decided in the early 'nineties to go far outside the city limits to obtain a purer supply of water. Montrose pumping station, located on the Allegheny River near Hoboken, about nine miles from the center of the city, was constructed in 1896, and continued to supply the city until 1914, when, after the consolidation, Aspinwall pumping station took its place. The only other major plant development of the Allegheny waterworks prior to its consolidation with the Pittsburgh waterworks was the installation of Greentree station and tanks in 1904. This small station, located on Broadway, took its supply from the Lafayette system, and pumped to two small tanks at an elevation of 690 feet—the highest point within the present city of Pittsburgh, and located on Montana Hill, at the extreme northerly boundary of Allegheny.

SOUTH SIDE

The Monongahela Water Company served that portion of the city south of the Monongahela and Ohio rivers, as it existed prior to recent annexations. Its charter was dated 1855; however, it was 1865 before active work was started on its water plant. At this time a pumping station on the Monongahela River at South Twenty-ninth Street, and Birmingham reservoir at the head of South Thirtieth Street, were put in service. In 1875, a small pumping station was constructed at Birmingham reservoir for the supply of the hill section. The first Allentown tank was installed in this system in 1895, and two additional tanks were built in 1904. These tanks are in Grandview Park, and at an elevation of 598 feet.

This Monongahela water plant was purchased by the city in 1908. With the exception of Allentown tanks, and the distribution mains, very little of the Monongahela Water Company plant, as purchased, is now in existence.

GREATER PITTSBURGH

With the consolidation of Pittsburgh and Allegheny in 1907, and the purchase of the Monongahela Water Company in 1908, the city faced the necessity of extending its filtered-water service to include the enlarged territory, and of consolidating three water-works, separated by rivers, into one general system.

River Avenue station on the North Side was closed at once, and the supply from Montrose station was chlorinated, beginning in 1911.

On the South Side, soon after the purchase of the plant, water for the low-lying district was fed directly from Highland reservoir No. 2, and the South Twenty-ninth Street station, relieved of this service, took over the work of pumping water to the Allentown tanks, formerly done by Hill station. At this time Hill station and Birmingham reservoir were abandoned. Mission station, on Mission Street near South Eighteenth Street, was started in 1909 and placed in service November 12, 1912. This good example of a secondary pumping station replaced the antiquated South Twenty-ninth Street station, which was abandoned.

The building of Aspinwall station on filtration plant property, for the general supply of the North Side, was started in 1911, and water was first delivered from this station March 28, 1914. In this same system, *Cabbage Hill, or North Side reservoir, was started in 1912, and completed in September

1914. This reservoir, with a capacity of 155,000,000 gallons, at an elevation identical with that of Highland reservoir No. 2, is located in Shaler Township, between the boroughs of Millvale and Etna. The opening of *Cabbage Hill reservoir marked the passing of Troy Hill reservoir and Troy Hill pumping station. While Montrose station is held intact, it has not operated since 1915. Garfield station and tanks finally gave up their duties in 1912, in favor of Herron Hill reservoir.

During the years of the World War and the subsequent period of reconstruction no important changes were made in the water plant. In 1926, provision was made for a large amount of work, most of which is uncompleted. It comprises a large number of pipe-line projects, particularly rising mains; the rehabilitation of Ross and Brilliant stations; the electrification of Howard and Herron Hill stations; the relining of Highland reservoir No. 2; and the building of two reservoirs in the high district of the North Side to replace the Montgomery, Lafayette, and Greentree tanks.

In 1828, one pump, its engine operated by steam from one boiler, served, through about 1½ miles of pipe and one reservoir, a city of about 10,000 people with raw river water at a maximum water pressure of about 34 pounds. The waterworks served a territory of about one-half of a square mile in extent. Now, at the end of a century of successful operation, the Pittsburgh waterworks serves 37 square miles of territory, a population of 590,000, with a daily average of 118,076,000 gallons of filtered water at an average pressure of 79 pounds. Its plant valuation on a used and useful historical basis is about $34,500,000, and its reproduction valuation is about $65,000,000.

Listing only the major items, its plant consists of a slow-sand filtration plant with a capacity of 168,000,000 gallons a day; a low-lift pumping station equipped with five pumps of a combined capacity of 255,000,000 gallons a day; two primary pumping stations equipped with 13 pumps of a combined capacity of 196,000,000 gallons a day; four secondary and one tertiary pumping stations equipped with 16 pumps of a combined capacity of 69,000,000 gallons a day; a filtered water reservoir, storing 50,000,000 gallons; five reservoirs and 12 tanks, storing in the distribution system 413,000,000 gallons; 13.65 miles of rising mains, eight inches to 96 inches in diameter; 812.28 miles of distribution mains, four inches to 66 inches in diameter; 18,993 distribution valves; 7483 fire hydrants; 105,382 water services; and 44,475 water meters.

***Renamed "LANPHER RESERVOIR" by Resolution of Council, April 4, 1930.**

STATISTICS OF TYPHOID FEVER IN PITTSBURGH*

By C. F. DRAKE†

The article by James Otis Handy in the PROCEEDINGS of the Engineers' Society of Western Pennsylvania, April 1927, admirably covers the early history of efforts to establish water purification in Pittsburgh. It would seem, however, that one additional fact should have been included in Mr. Handy's paper. On October 25, 1847, James H. Laning, of Cincinnati, appeared before Pittsburgh Common Council, proposing filtration of the public water-supply of Pittsburgh.

The present paper will be confined to vital statistics, showing the incidence of typhoid fever in Pittsburgh during the past 55 years, so far as statistics are available.

In 1873, the typhoid fever death rate of Pittsburgh was 143.6 per 100,000 inhabitants. The population was 133,000, and the typhoid deaths were 191.

In 1907, the typhoid fever death rate of Pittsburgh, including Allegheny, was 121.1 per 100,000 inhabitants. The combined population was 535,330, and the total typhoid deaths were 648. Excluding Allegheny, the rate was 125.2 per 100,000 inhabitants.

In 1927, the typhoid fever death rate was 1.8 per 100,000 inhabitants. The population was 665,500, and the total typhoid deaths were 12.

These rates include the deaths of non-inhabitants in hospitals.

In 1900, there were 3341 typhoid cases in Pittsburgh proper and South Side. This gives a case rate of 1038.8 per 100,000 inhabitants.

In 1907, there were 5652 typhoid fever cases in Pittsburgh, including Allegheny. With a combined population of 535,330, the typhoid case rate in 1907 was 1055.9 per 100,000 inhabitants. Excluding Allegheny, the rate was 1119.2 per 100,000 inhabitants.

In 1927, there were 78 typhoid fever cases in Pittsburgh. With a population of 665,500, the typhoid case rate in 1927 was 11.7 per 100,000 inhabitants. Non-inhabitants in hospitals are included. The resident typhoid case rate in 1927 was 8.3 per 100,000 inhabitants, with 55 resident typhoid cases. While the typhoid death rate, including non-inhabitants in hospitals, was 1.8 per 100,000 inhabitants in 1927, the resident typhoid death rate, excluding non-inhabitants in hospitals, was only 1.5 per 100,000 inhabitants.

Table I shows the resident and non-resident deaths from various causes, in Pittsburgh, during 1926. This table shows that only 52.9 per cent. of the typhoid deaths reported in Pittsburgh, in 1926, were those of actual residents of the city. The table further shows that from 80 to 100 per cent. of the deaths from many other causes were those of residents of Pittsburgh.

***Presented Engineers' Society of Western Penna.—May 1, 1928, as an amplification of the preceding paper. (Data brought to Jan. 1, 1930 by the author).**

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TABLE I

RELATION OF RESIDENT TO TOTAL DEATHS FROM VARIOUS CAUSES

1926	*Resident deaths*	*Non-residents in hospitals*	*Total deaths*	*Per cent.*
Typhoid fever	9	8	17	52.9
Cerebro-spinal fever	9	5	14	64.3
Violence	573	204	777	73.7
Scarlet fever	13	4	17	76.5
Tuberculosis, all forms	416	86	502	80.0
Erysipelas	13	3	16	81.2
Cancer, malignant tumor	566	131	697	81.2
Diabetes mellitus	96	19	115	83.5
All causes	7507	1436	8943	83.9
Nephritis, acute and chronic	488	83	571	85.5
Lobar pneumonia	732	109	841	87.0
Diphtheria	52	7	59	88.1
Organic heart diseases	1035	134	1169	88.5
Pulmonary tuberculosis	350	44	394	88.8
Broncho-pneumonia	372	42	414	89.9
Apoplexy	481	39	520	92.5
Diarrhea, under two years	222	17	239	92.9
Whooping-cough	106	7	113	93.8
Diarrhea, over two years	26	1	27	96.3
Influenza	215	7	222	96.8
Measles	25	0	25	100.0

Table II shows typhoid death rates per 100,000 inhabitants, from 1900 to 1927, in Pittsburgh; in Pennsylvania; in the United States Registration Area; and in 56 large American cities not including Pittsburgh.

Beginning with 1908, the North Side (formerly Allegheny) is included. Earlier figures are for Pittsburgh, including the South Side.

In Pittsburgh, in 1873, typhoid fever caused 5.43 per cent. of the deaths from all causes; in 1907, the figures were 6.84 per cent., and in 1927, 0.13 per cent. The figures for 1907 do not include Allegheny.

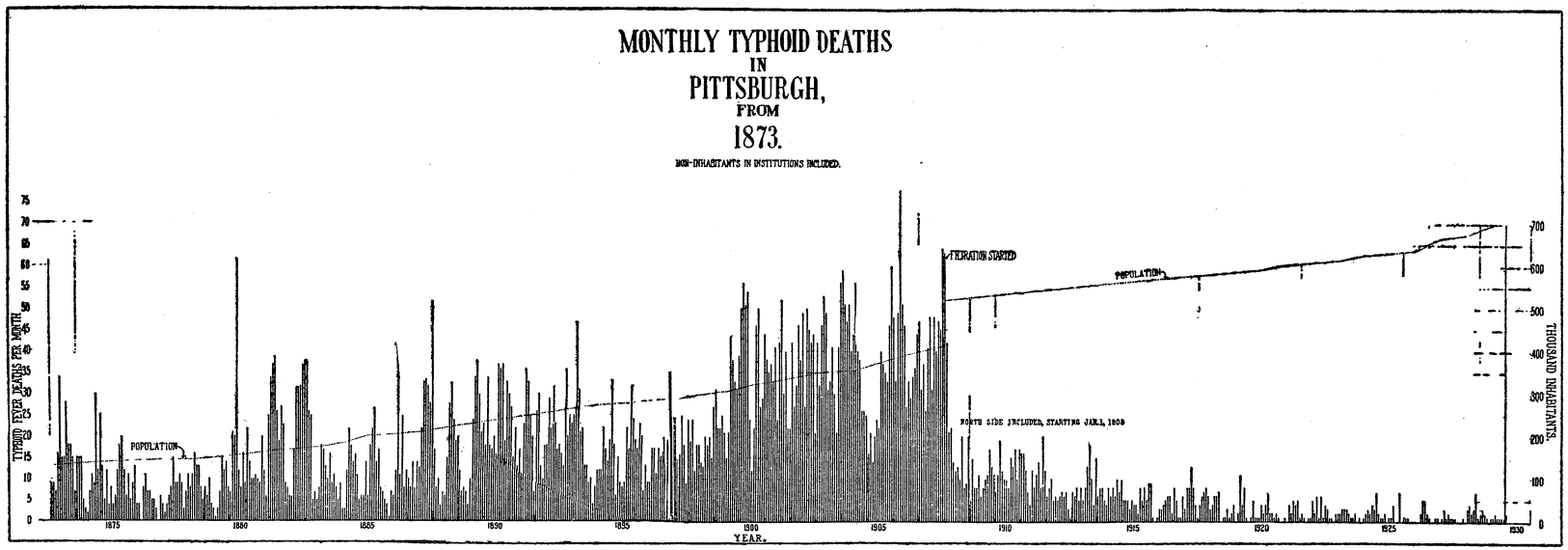
TABLE II

TYPHOID DEATH RATES PER 100,000 INHABITANTS

Year	Pittsburgh Resident	Pittsburgh Total	Pennsylvania	U.S. Registration Area	56 large American cities
1900	120	144.6		35.9	28.37
1901	102	125.3		32.5	30.00
1902	109	133.8		34.4	32.89
1903	108	134.2		34.2	35.45
1904	122	142.1		31.7	30.97
1905	89	98.8		27.8	27.06
1906	110	130.3	56.5	31.4	29.18
1907	106.6	125.2	50.3	29.3	30.88
1908	42.6	48.7	34.3	24.4	22.19
1909	17.4	24.6	22.7	21.2	17.61
1910	21.7	27.8	24.6	23.5	19.38
1911	20.0	25.9	22.0	21.0	15.42
1912	8.1	12.8	16.6	16.5	12.45
1913	10.5	19.6	18.3	17.9	12.60
1914	8.4	15.4	13.2	15.5	10.26
1915	6.6	10.5	12.6	12.4	9.67
1916	5.5	8.6	13.9	13.3	7.59
1917	7.7	11.5	10.7	13.5	6.53
1918	6.2	10.0	10.9	12.6	6.15
1919	3.9	6.3	7.1	9.2	3.81
1920	2.7	5.2	5.7	7.8	3.48
1921	3.0	4.1	7.4	9.0	3.68
1922	3.3	4.9	4.7	7.5	3.12
1923	2.1	3.7	4.9	6.8	3.09
1924	2.6	4.2	3.9	6.7	3.05
1925	1.3	3.0	4.8	8.0	3.45
1926	1.4	2.7	3.7	6.5	2.80
1927	1.5	1.8	2.7	5.5	
1928	2.1	3.3	2.0	4.9	
1929	0.6	2.3			

Table III shows the total typhoid fever deaths, by months, from 1873 through 1928, in Pittsburgh, including non-residents in hospitals.

Table IV shows the total typhoid fever cases, by months, from 1888 through 1927, in Pittsburgh, with non-residents in hospitals included.



Monthly Typhoid Deaths in Pittsburgh From 1873 to 1929

TABLE III

DEATHS FROM TYPHOID FEVER, INCLUDING NON-RESIDENTS IN INSTITUTIONS

Year	*Population*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Total*	*Per 100,000*
1873	133,000	9	9	7	16	34	15	15	28	18	18	15	7	191	143.6
1874	137,000	15	15	15	5	3	2	7	11	9	30	12	25	149	108.8
1875	140,000	13	5	12	4	8	4	6	12	18	20	12	6	120	86.4
1876	142,000	11	5	9	13	4	4	0	8	11	7	7	5	84	59.2
1877	145,000	5	3	0	6	4	2	4	6	8	15	9	9	71	49.0
1878	145,000	11	9	3	7	11	8	11	16	13	13	8	5	115	79.3
1879	150,000	8	6	10	4	3	1	3	7	15	12	14	8	91	60.7
1880	156,381	7	21	20	62	12	8	16	9	22	14	10	10	211	134.9
1881	165,000	11	10	9	20	12	6	25	34	37	39	26	19	248	150.3
1882	170,000	27	23	9	8	6	6	17	33	32	32	37	38	268	157.7
1883	175,000	38	26	25	5	7	5	8	18	17	13	10	16	188	107.4
1884	185,000	9	11	8	5	9	3	3	12	22	18	14	16	130	70.3
1885	202,559	11	5	6	6	14	6	18	22	27	14	17	8	154	76.0
1886	205,000	7	5	4	1	7	6	12	42	11	25	8	12	140	68.3
1887	210,000	10	8	14	8	14	13	22	33	35	32	28	52	269	128.1
1888	220,000	17	8	10	4	7	6	15	28	33	24	19	20	191	86.8
1889	230,000	12	7	8	7	4	10	24	34	38	30	21	23	218	94.8
1890	238,617	18	34	18	17	20	16	37	36	37	19	33	30	315	132.0
1891	247,000	27	15	22	13	17	11	23	36	33	25	20	7	249	100.8
1892	255,000	26	30	13	10	18	18	29	22	32	23	17	18	256	100.4
1893	265,000	16	13	36	20	25	23	25	47	31	21	22	13	292	110.6
1894	272,000	13	9	10	4	8	12	12	22	22	17	14	19	152	55.9
1895	275,000	34	18	6	15	9	8	9	22	17	32	24	19	213	77.4
1896	282,500	17	23	20	7	13	9	9	17	17	11	17	15	175	61.9
1897	287,500	16	15	12	16	13	10	10	16	25	18	9	24	184	64.0
1898	298,772	19	24	12	18	18	14	13	20	18	20	15	27	218	72.9
1899	306,115	31	22	22	25	21	15	21	44	38	33	31	39	342	111.7
1900	321,616	50	56	51	54	24	12	22	46	50	27	29	44	465	144.6
1901	332,000	38	35	37	33	41	24	42	52	30	40	22	22	416	125.3
1902	346,000	42	27	32	46	38	49	27	50	45	42	44	21	463	133.8
1903	354,000	42	32	46	53	49	31	33	41	30	21	41	56	475	134.2
1904	354,000	59	51	47	51	40	44	56	40	38	26	26	25	503	142.1
1905	372,500	16	21	14	20	24	22	40	37	35	33	46	60	368	98.8
1906	390,000	48	33	49	78	51	46	27	33	29	34	36	44	508	130.3
1907*	403,330	47	31	37	26	41	48	31	48	40	47	45	64	505	125.2
1908†	521,187	63	42	21	22	14	12	13	10	20	8	9	20	254	48.7
1909	528,286	5	15	8	8	11	6	8	10	11	17	13	11	130	24.6
1910	533,905	7	11	19	12	10	10	8	15	13	17	10	17	149	27.8
1911	539,602	16	16	12	7	4	12	8	11	14	8	20	12	140	25.9
1912	545,299	6	8	10	5	6	5	6	7	6	7	3	1	70	12.8
1913	550,996	7	6	8	5	8	5	8	13	19	10	4	15	108	19.6

TABLE III—(*Continued*)

Year	*Population*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Total*	*Per 100,000*
1914	556,693	6	8	8	5	4	8	6	8	6	10	7	10	86	15.4
1915	562,390	5	5	5	3	5	4	4	2	8	5	8	5	59	10.5
1916	568,087	9	9	1	0	1	3	3	4	5	6	6	2	49	8.6
1917	573,784	8	5	1	1	6	3	8	8	13	8	4	1	66	11.5
1918	579,481	4	6	7	8	6	3	4	6	6	7	0	1	58	10.0
1919	585,178	1	3	1	2	4	0	2	11	4	8	1	0	37	6.3
1920	591,033	1	5	1	1	1	4	2	4	7	2	2	1	31	5.2
1921	602,452	2	1	0	0	1	0	4	2	5	4	5	1	25	4.1
1922	607,902	2	1	0	1	1	5	2	6	1	6	1	4	30	4.9
1923	613,442	3	1	1	0	2	2	2	3	3	3	2	1	23	3.7
1924	625,919	1	2	0	1	0	1	2	3	2	4	3	7	26	4.2
1925	631,563	2	1	1	2	0	1	1	4	0	0	7	0	19	3.0
1926	637,000	1	1	1	0	0	0	0	0	2	5	5	2	17	2.7
1927	665,500	1‡	0	0	1	1	0	1	3	1	2	1	1	12	1.8
1928	673,800	1	0	0	0	1	0	3	4	2	3	7	1	22	3.3

*First filter started, December 11, 1907. All filtered water to "Peninsular" Pittsburgh in October, 1908. Filtered water to South Side in February, 1909. Filtered water to North Side in March, 1914.

†Including North Side typhoid statistics, starting January 1908.

‡A resident of Sharpsburg died in a Pittsburgh hospital in December, 1926. We included this death in 1926, but Pittsburgh Department of Public Health included it in January, 1927, thus recording two deaths in that month.

TABLE IV

TYPHOID FEVER CASES, INCLUDING NON-RESIDENTS IN INSTITUTIONS

First Filter started December 11, 1907. North Side included, starting 1908.

Year	*Population*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Total*	*Per 100,000*
1888	220,000	139	52	23	19	26	31	110	199	165	119	59	85	1027	466.8
1889	230,000	33	34	63	34	35	49	154	238	203	133	100	135	1211	526.5
1890	238,617	86	157	86	73	85	74	163	190	191	147	170	139	1561	654.3
1891	247,000	171	82	78	45	36	69	78	169	146	146	56	73	1149	465.2
1892	255,000	123	104	78	59	121	87	101	188	161	144	93	112	1371	537.6
1893	264,000	151	54	219	171	193	153	238	419	312	255	160	73	2398	908.3
1894	272,000	95	63	51	62	47	34	81	201	150	205	98	145	1232	452.9
1895	275,000	227	116	66	107	94	50	123	228	222	232	148	124	1737	631.6
1896	282,500	123	120	82	56	74	59	93	213	159	109	131	130	1349	477.5
1897	287,500	99	64	78	71	70	65	100	178	237	130	103	213	1408	489.7
1898	298,772	180	196	99	161	111	124	175	233	209	101	127	202	1918	641.9
1899	306,115	160	76	118	197	143	92	210	362	266	218	211	320	2373	775.2
1900	321,616	383	303	306	213	144	80	291	539	284	257	191	250	3341	1038.8
1901	332,000	243	205	154	252	262	243	416	572	349	320	177	219	3412	1027.7
1902	346,000	380	130	212	233	339	334	301	467	334	204	229	201	3364	972.3

TABLE IV—*Continued*)

Year	*Population*	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Total*	*Per 100,000*
1903	354,000	274	147	304	392	313	175	349	355	275	217	301	547	3649	1030.8
1904	354,000	406	380	227	207	217	193	348	328	237	201	176	180	3100	875.7
1905	372,500	183	126	98	111	176	234	325	342	287	297	382	407	2969	796.8
1906	390,000	328	306	429	820	394	328	420	506	506	675	455	563	5730	1469.2
1907	403,330	567	298	165	199	312	508	332	397	332	440	511	453	4514	1119.2
1908	521,187	434	201	118	134	113	142	119	164	127	96	96	89	1833	351.6
1909	528,286	89	98	82	51	65	52	69	94	99	93	87	76	955	180.7
1910	533,905	43	49	59	65	62	51	83	117	197	117	71	84	998	186.9
1911	539,602	86	54	65	42	51	48	30	81	84	74	85	86	768	142.3
1912	545,299	37	23	32	18	35	30	38	64	38	67	26	23	431	79.0
1913	550,996	27	20	24	38	32	47	64	99	109	53	36	38	587	106.5
1914	556,693	27	27	20	19	20	18	44	51	57	42	37	25	387	69.5
1915	562,390	52	37	14	10	18	20	10	28	53	51	25	45	363	64.5
1916	568,087	25	15	14	5	18	22	35	46	41	15	14	25	274	48.2
1917	573,784	13	16	13	17	28	17	29	59	57	31	14	8	302	52.6
1918	579,481	11	22	16	17	10	10	19	26	41	20	3	5	200	34.5
1919	585,178	6	5	3	3	4	5	17	20	20	23	6	7	119	19.6
1920	591,033	7	5	3	9	4	12	9	13	19	8	6	10	105	17.8
1921	602,452	4	2	5	3	7	5	33	81	113	31	11	7	302*	50.1
1922	607,902	4	2	2	5	6	15	27	24	27	31	6	8	157	25.8
1923	613,442	7	3	0	7	4	15	18	11	20	15	7	3	110	17.9
1924	625,919	10	7	3	3	4	4	14	10	14	11	7	21	108	17.3
1925	631,563	15	2	5	4	6	4	11	14	16	12	13	4	106	16.8
1926	637,000	5	2	3	3	6	2	2	6	28	22	13	6	98	15.4
1927	665,000	3	2	5	2	7	0	12	19	16	5	3	4	78	11.7

*Epidemic Four Mile Run district, due to spring water and privies.

Table V shows the resident typhoid deaths in Pittsburgh, including South Side and North Side, by years from 1907 through 1929.

TABLE V

RESIDENT TYPHOID DEATHS IN PITTSBURGH

Includes all typhoid deaths except those of non-residents brought to hospitals in Pittsburgh after contracting typhoid

Year	*"Peninsula"*	*South Side*	*North Side*	*Not Stated*	*Total*
1907	373	57	143	0	573
1908	128	33	60	1	222
1909	36	15	41	0	92
1910	43	10	63	0	116
1911	33	13	61	1	108
1912	17	12	15	0	44
1913	27	15	15	1	58

TABLE V—(*Continued*)

Year	*"Peninsula"*	*South Side*	*North Side*	*Not Stated*	*Total*
1914	22	7	18	0	47
1915	21	3	13	0	37
1916	16	9	5	1	31
1917	21	5	17	1	44
1918	18	5	13	0	36
1919	10	3	10	0	23
1920	7	6	3	0	16
1921	13	0	5	0	18
1922	12	2	6	0	20
1923	7	2	4	0	13
1924	7	6	3	0	16
1925	6	0	2	0	8
1926	7	2	0	0	9
1927	6	2	2	0	10
1928	12	2	0	0	14
1929	2	1	1	0	4

Table VI shows the resident typhoid cases in Pittsburgh, including South Side and North Side, from 1907 through 1927.

Weekly health reports of the United States Public Health Service show that there were 3879 typhoid cases reported, in 1927, by 57 large American cities with a total population of approximately 29,000,000. This is at the rate of 13.4 per 100,000 inhabitants.

Table VII shows that Pittsburgh (excluding South Side and North Side) with a population of approximately 290,000 reported 3877 resident typhoid cases in 1907, or 1377 per 100,000 inhabitants. In 1927, Pittsburgh had 55 resident typhoid cases, or 8.3 per 100,000 inhabitants—much below the average of 57 large American cities.

Very few American cities of over 100,000 population record entire absence of typhoid fever deaths in any single calendar year; yet the South Side, with a population of approximately 136,000, had no resident typhoid fever death from November 10, 1924, to October 3, 1926—a period of approximately 23 consecutive months—and the North Side, with a population of approximately 146,000 in 1925, had no resident typhoid fever death from March 12, 1925 to September 25, 1927—a period of approximately 30 consecutive months. Thus far in 1928 there has not been any resident typhoid death in Pittsburgh. The North Side had one resident typhoid case during the first four months of 1928.

TABLE VI

RESIDENT TYPHOID CASES IN PITTSBURGH

Includes all typhoid cases except those of non-residents brought to hospitals in Pittsburgh after contracting typhoid

Year	*"Peninsula"*	*South Side*	*North Side*	*Not Stated*	*Total*
1907	3877	406	850	0	5133
1908	1082	270	363	8	1723
1909	326	131	297	1	755
1910	295	97	435	4	831
1911	196	76	373	1	646
1912	145	81	108	1	335
1913	245	106	108	1	460
1914	148	62	66	1	277
1915	146	50	63	3	262
1916	135	42	41	1	219
1917	111	39	111*	1	262
1918	97	24	26	0	147
1919	55	14	23	0	92
1920	46	18	12	0	76
1921	191†	39‡	22	0	252
1922	55	26	31	0	112
1923	57	10	14	0	81
1924	55	15	12	0	82
1925	44	13	12	0	69
1926	38	9	12	0	59
1927	33	15	7	0	55

*Contamination by open cross connection.
†Due largely to sanitary conditions in Four Mile Run.
‡Due to spring water, Arlington Avenue.

TABLE VII

TYPHOID DEATHS IN PITTSBURGH AND ALLEGHENY, INCLUDING NON-RESIDENTS IN INSTITUTIONS

Year	*Allegheny*	*Pittsburgh*	*Total*	*Population*	*Per 100,000*
1900	121	465	586	452,000	129.7
1901	135	416	551	459,000	119.3
1902	149	463	612	466,000	129.6
1903	146	475	621	474,000	128.3
1904	169	503	672	481,000	138.6
1905	182	368	550	491,000	109.2
1906	198	508	706	500,000	135.5
1907	143	505	648	511,000	121.1

TABLE VII—(*Continued*)

Year	*Allegheny*	*Pittsburgh*	*Total*	*Population*	*Per 100,000*
1908			254	520,000	48.7
1909			130	527,000	24.6
1910			149	534,000	27.8
1911			140	542,000	25.9
1912			70	549,000	12.8
1913			108	551,000	19.6
1914			86	557,000	15.4
1915			59	562,000	10.5
1916			49	568,000	8.6
1917			66	574,000	11.5
1918			58	579,000	10.0
1919			37	585,000	6.3
1920			31	591,000	5.2
1921			25	602,000	4.1
1922			30	608,000	4.9
1923			23	613,000	3.7
1924			26	626,000	4.2
1925			19	632,000	3.0
1926			17	637,000	2.7
1927			12	666,500	1.8
1928			22	673,800	3.3
1929			16	694,250	2.3

The question has been asked as to the reduction of typhoid fever in Pittsburgh being due to filtration, to coagulation, or to chlorination.

We use no coagulant in treating the water at Aspinwall. We have never used any, although we have had river turbidities as high as 5600 parts per million. During times of very turbid river water there is a removal of approximately 2½ pounds of mud a day for every consumer of water in Pittsburgh. At times of acid river water, soda-ash is used to neutralize before filtration.

In general, we use about one pound of liquid chlorin per million gallons of water treated after filtration. Practically all progressive water purification plants in this country now use liquid chlorin or hypochlorite to protect public health to the highest known degree. As the chlorin content of the Allegheny River is in the vicinity of 17 parts per million, the introduction of one part in eight million, in the form of liquid chlorin, is chemically of little consequence. Chicago, with lake turbidities frequently ranging as high as 100 parts per million, is said to apply approximately six pounds of chlorin per million gallons of water treated.

There are no figures available to show the relative efficiency of filtration or chlorination in reducing typhoid in Pittsburgh. With a turbidity as high as that developed in the Allegheny River, however, it would be unwise to attempt to produce a safe drinking water by chlorination alone during the entire year. Our results show that filtration causes a very marked reduction of bacteria before the chlorin is actually applied to the water.

Unless we go into an involved discussion of bacterial counts, that is about as well as I can answer the question.

To:
CHARLES H. KLINE, *Mayor*,
EDWARD G. LANG, *Director of Public Works*.

RESUME OF CONSTRUCTION WORK

done by

THE BUREAU OF WATER—DEPARTMENT OF PUBLIC WORKS

January 1, 1926, to August 1, 1929

FILTRATION PLANT:—

Baffle Walls Renewal. The upper sections of a portion of the baffle walls of the sedimentation basins have been renewed under two contracts; and

Sand Handling Pipes in the galleries have been largely renewed by the City force.

These two projects represent an outlay of.....$ 46,064.00

ROSS PUMPING STATION:—

Partial rehabilitation of this station has been accomplished under 21 contracts, 23 projects, the expenditures totalling.....$ 928,939.00

The major items included are:—

A new *Suction Intake* (constructed under emergency conditions at a cost of $387,465.) to supplement the single existing suction intake.

One *100* and one *50 million gallon* per day *steam turbine driven centrifugal pumps.*

Two *600 h.p. boilers* (one completed), and work incidental —stokers, preheaters, draft fans, feed water pumps, water treatment plant and piping.

One *250 kilowatt turbo generator.*

Coal storage bins, bunkers, elevating and conveying machinery.

The equipment of this station, which was in a precarious condition in 1926, is now in excellent condition, and this station is now considered to be one of the very best low lift pumping stations in the world. The station building will be placed in first class condition by the end of this year.

ASPINWALL PUMPING STATION:—

This station is in good condition. The installation of *Soot Blowers*, the replacement of a *Pump Chamber*, and a small amount of work on rising mains have been accomplished under 2 contracts, and by City force, totalling.....$ 18,243.00

BRILLIANT PUMPING STATION:—

This station and equipment was and is in a worn out and antiquated condition, and must be replaced. Designs for a new station are partially completed. A *water softening plant* and *two boilers* have been installed to serve during the reconstruction of the plant; also a large valve has been installed;—total cost.....$ 46,161.00

THE REHABILITATION OF HIGH PRESSURE SYSTEMS OF THE NORTH SIDE

Howard Pumping Station
Brashear Reservoir
McNaugher Reservoir
Spring Hill Tanks
North Side Rising Mains

The three high pressure systems of the North Side in 1926, relied upon antiquated pumps, boilers that had been condemned, and four sets of worn out tanks storing only 1¾ million gallons of water. Briefly, the pumping station has been completely electrified, the old tanks have been replaced by two reservoirs, and one pair of tanks of adequate capacity, and the necessary pipe lines have been installed under 15 contracts and by City force, the cost aggregating.....$1,019,513.00

HOWARD STATION was converted from a steam to an electric drive. Two 9 million gallon and four 3 million gallon per day, motor driven pumps were installed at a cost of $124,041. The building is now being placed in good condition.

BRASHEAR RESERVOIR, capacity 10½ million gallons, a concrete structure at the head of Montana Avenue, was placed in service in January 1929, at a cost of $319,212.

McNAUGHER RESERVOIR, capacity 5½ million gallons, composed of two circular concrete underground tanks at the head of Lafayette Avenue, replaced old Montgomery and Lafayette tanks in 1928, at a cost of $191,705.

SPRING HILL TANKS, capacity 1 million gallons, replaced two old tanks of the same name in 1928,—cost $30,328.

NORTH SIDE RISING MAINS, includes the rising main from Howard Station to Brashear Reservoir, and several small mains required to place the new reservoirs in service. The pipe lengths included under this item were:—

2195 ft. of 30″ pipe; 10,080 ft. of 24″; 5910 ft. of 12″ pipe; 7020 ft. of 8″ pipe; 570 ft. of 6″ pipe laid; also 3200 ft. of 6″ and 8″ pipe line purchased at a total cost of $354,227.

HERRON HILL STATION

Design for an *electirc station* under way, cost to date.....$ 2,536.00

MISSION—ALLENTOWN RISING MAINS

A *Supplementary Rising Main*, composed of 7952 feet of 30″ pipe, 105 feet of 20″ pipe, and 193 feet of 6″ pipe, was installed in 1928 from Mission Station to Allentown Tanks, at a total cost of....$ 140,831.00

SAFETY GUARDS AND MISCELLANEOUS EQUIPMENT

Safety Guards at several stations, and *miscellaneous equipment* were installed at a cost of.....$ 3,920.00

HIGHLAND RESERVOIR No. 1

A portion of the *embankment* at this reservoir has been *regraded*, *new concrete steps*, *watch house* and *inlet chamber* have been constructed under 3 contracts, and by City force,—total cost.....$ 41,069.00

HIGHLAND RESERVOIR No. 2

Complete *Relining* of this reservoir with concrete slabs and gunite concrete to the extent of about 16 acres, and the building of about 3400 lineal feet of concrete *curb fence* have been accomplished,—total cost,..... $ 231,735.00

BEDFORD RESERVOIR

The *Relining* of the upper section of this reservoir, and the construction of a new *watch house* are practically completed,—cost to date,..... $ 16,472.00

APPLICATION MAINS

These are extensions of 2″, 4″, 6″, 8″ and 12″ mains to provide service in expanding residential sections, in new plans of lots, and in built up areas not already supplied. The work installed embraces 440 projects, a length of 18.3 miles of pipe lines. This work is done very largely by City force. Aggregate cost..... $ 254,981.00

STREET IMPROVEMENT MAINS

Included herein is the pipe line work incident to street improvements, and includes the laying, relaying, raising, lowering, moving of water pipes, valves, hydrants and other appurtenances to provide water supply, and to adjust water structures along the new or improved street. This work has included 381 projects involving 14.6 miles of pipes of sizes from 4″ to 24″ in diameter. Aggregate cost..... $ 347,517.00

SYSTEM IMPROVEMENT MAINS

Under this heading are grouped major pipe line projects required to supplement existing single or inadequate feeder mains, and to provide water supply in areas not previously served. There is included the laying of 111 feet of 4″ pipe; 8851 feet of 6″ pipe; 7587 feet of 8″ pipe; 15,935 feet of 12″ pipe; 20,964 feet of 20″ pipe and 2670 feet of 24″ pipe;—in a total of 8 projects and 5 contracts. Aggregate cost,..... $ 412,127.00

The major projects included are:—

NINE MILE RUN FEEDER MAIN. A 20″ main from Braddock and Penn Avenue to Second Avenue in the Hazelwood District (over 19,000 feet of 20″ pipe line).

PLEASANT AND WITTMAN HILL MAINS,—over 13,500 feet of 6″ and 8″ mains installed to develop these two sparsely settled districts of the West End.

NEVILLE–AYLESBORO FEEDER MAINS—over 13,000 feet of 12″ and 20″ mains to reinforce existing supplies in the Bellefield and Squirrel Hill districts.

BAUM BOULEVARD MAINS—over 4300 feet of 12″ mains laid in the Baum Boulevard district of East Liberty to reinforce the water supply, and provide adequate fire protection.

HOMESTEAD MAIN RELAY—about 2700 feet of 24″ main relaid to safeguard the water supply

GRAND TOTAL EXPENDED TO AUGUST 1, 1929	$3,510,108.00

Respectfully submitted,

E. E. LANPHER,
Managing Engineer

August 12, 1929

RESOLUTION

No. 93

Whereas, The City of Pittsburgh owns a reservoir in Shaler Township known as "Cabbage Hill Reservoir", and sometimes referred to as "North Side Reservoir", which latter is misleading, due to the location of City owned reservoirs on the North Side; and

Whereas, The City is desirous of perpetuating the Memory of the late Erwin E. Lanpher, who served it for twenty-six years, and who was Division Superintendent during construction of said reservoir in 1912-14; Therefore, be it

Resolved, That Cabbage Hill Reservoir of the City of Pittsburgh, situated in Shaler Township, is hereby renamed "LANPHER RESERVOIR", and the records of the City and its Bureau of Water shall be changed accordingly.

In Council, April 3, 1930, read and adopted.

JOHN S. HERRON
President of Council

Attest: ROBT. CLARK
Clerk of Council

Mayor's office: April 4, 1930
Approved: CHARLES H. KLINE,
Mayor

Attest: F. L. SWANEY
Mayor's Secretary

Recorded in Resolution Book, Vol. 7, Page 496, 8th day of April, 1930.